CHAPTER-WISE MARKS DISTRIBUTION

S. No.	Chapter	2018		2019		2020	2021			2022		2023	Average
		J	D	J	D	D	Jan	July	D	J	D	J	
1	Ratio & Proportion	1	2	1	1	3	3	3	3	2	1	-	1.81
2	Indices	1	1	2	2	1	1	1	4	2	1	3	1.72
3	Logarithm	2	1	2	2	2	1	1	2	2	2	2	1.72
4	Linear Equation	2	-	1	1	0	0	-	1	2	3	2	1.09
5	Quadratic Equation	3	2	1	3	4	3	4	2	1	2	2	2.45
6	Inequalities	1	1	3	1	1	1	1	2	1	1	2	1.36
7	Mathematics of Finance - Simple Interest	1	3	4	5	1	3	2	1	3	1	1	2.27
8	Mathematics of Finance - Compound Interest	2	11	3	7	6	7	5	4	3	8	5	5.54
9	Mathematics of Finance - Annuity	3	-	3	1	4	4	7	1	8	5	8	4.00
10	Permutations and Combinations	2	4	4	4	4	6	4	4	7	4	4	4.27
11	Sequence & Series	4	4	4	4	3	3	3	3	4	2	3	3.36
12	Sets, Function and Relation	3	4	5	2	4	3	4	3	3	3	5	3.54
13	*Calculus (Limit & Continuity)												
14	Differential Calculus	1	2	2	3	2	1	3	3	1	3	3	2.18
15	Integration	3	2	3	3	3	1	1	1	2	3	1	2.09
16	Number Series, Coding & Decoding	3	5	4	5	4	5	5	5	5	6	5	4.72
17	Direction Tests	6	5	4	6	4	3	4	8	5	5	4	4.90
18	Seating Arrangement	5	3	4	2	5	4	4	3	4	2	4	3.63
19	Blood Relations	4	4	4	4	3	4	4	5	5	7	7	4.63
20	Description of Data	4	7	5	4	7	10	8	5	8	4	5	6.09
21	Central Tendency	5	7	5	7	11	4	4	10	6	8	8	6.81
22	Measures of Dispersion	2	4	8	8	1	5	7	1	5	8	6	5.00
23	Probability	7	6	5	3	4	6	6	4	6	7	5	5.36

S. No.	Chapter	2018		2019		2020	2021			2022		2023	Average
		J	D	J	D	D	Jan	July	D	J	D	J	
24	Probability (Theoretical) Distribution	6	5	4	7	7	4	5	8	5	4	6	5.54
25	*Sampling Theory of Estimation												
26	Correlation	8	1	4	3	3	2	1	1	4	2	2	2.81
27	Regression Analysis	5	5	2	2	-	3	4	3	1	3	3	2.81
28	Index Numbers	8	3	4	3	3	3	4	5	5	5	4	4.27

Note : J: June; D : December

***Chapter 13 & Chapter 25 are newly added Chapters in Syllabus.**

CHAPTER-WISE COMPARISON WITH STUDY MATERIAL

No.	Name of Chapter	Study Material Chapter
1	Ratio & Proportion	1
2	Indices	1
3	Logarithm	1
4	Linear Equation	2
5	Quadratic Equation	2
6	Inequalities	3
7	Mathematics of Finance - Simple Interest	4
8	Mathematics of Finance - Compound Interest	4
9	Mathematics of Finance - Annuity	4
10	Permutations and Combinations	5
11	Sequence & Series	6
12	Sets, Function and Relation	7
13	Calculus (Limit & Continuity)	7
14	Differential Calculus	8
15	Integration	8
16	Number Series, Coding & Decoding	9
17	Direction Tests	10
18	Seating Arrangement	11
19	Blood Relations	12
20	Description of Data	13
21	Central Tendency	14
22	Measures of Dispersion	14
23	Probability	15
24	Probability (Theoretical) Distribution	16
25	Sampling Theory of Estimation	

No.	Name of Chapter	Study Material Chapter
26	Correlation	17
27	Regression Analysis	17
28	Index Numbers	18

Contents

20 CHAPTER DESCRIPTION OF DATA

PAST EXAM QUESTIONS WITH SOLUTIONS (MEMORY BASED)

Q.1. Cost of sugar in a month under the heads raw materials, labour, direct production and others were 12, 20, 35 and 23 units respectively, What is the difference between the central angles for the largest and smallest components of the cost of sugar?

(*a*) 72° (*b*) 48°
(*c*) 56° (*d*) 92°

[Aug. 2007, June 2012]

Solution : (*d*)

Total cost of sugar = (12 + 20 + 35 + 23) units = 90 units

Value of Largest component = 35 units

Value of Smallest component = 12 units

Difference between their central angles $= \frac{35-12}{90} \times 360^0 = 92^0$

Q.2. Arrange the dimensions of Bar diagram, Cube diagram, Pie diagram in sequence.

(*a*) 1,2,3 (*b*) 2,1,3
(*c*) 2,3,2 (*d*) 3,2,1

[Dec. 2009, June 2011]

Solution : (*c*)

Bar diagram : - has length and breadth, so two dimensional.

Cube diagram: - has length, breadth and height and hence it is three-dimensional.

Pie-diagram : Its area can be obtained. Hence two-dimensional

Therefore, if we arrange it in sequence we get

Pie-diagram; Bar, diagram and Cube-diagram *i.e.* 2,3,2.

Q.3. Nationality of a person is:

(*a*) Discrete variable
(*b*) An attribution
(*c*) Continuous variable
(*d*) None

[Dec. 2009]

Solution : (*b*)

Q.4. If we plot less than and more than type cumulative frequency distribution then the graph plotted is–

(*a*) Histogram
(*b*) Frequency curve
(*c*) Ogive
(*d*) None of these

[Dec. 2009]

Solution : (*c*)

Q.5. The primary rules that should be observed in classification

(*i*) As far as possible the class should be of equal width
(*ii*) The classes should be exhaustive
(*iii*) The classes should be unambiguously defined

Then which of the following is correct:

(*a*) Only (*i*) and (*ii*)
(*b*) Only (*ii*) and (*iii*)
(*c*) Only (*i*) and (*iii*)
(*d*) all (*i*), (*ii*) and (*iii*)

[June 2010]

Solution : (*b*)

Q.6. Using Ogive curve, we can determine:

(*a*) Median
(*b*) Quartile
(*c*) Both (*a*) and (*b*)
(*d*) None

[June 2010]

Solution : (*c*)

Q.7. With the help of Histogram one can find:

(*a*) Mean (*b*) Median
(*c*) Mode (*d*) First Quartile

[June 2010]

Solution : (*c*) Histogram is used to find Mode.

Q.8. Mode can be obtained from

(*a*) Frequency polygon
(*b*) Histogram
(*c*) Ogive
(*d*) All of the above

[Dec. 2010]

Solution : (*b*) Mode can be obtained from Histogram

Q.9. The most appropriate diagram to represent the data relating to the monthly expenditure on different items by a family is

(*a*) Histogram
(*b*) Pie-diagram
(*c*) Frequency polygon
(*d*) Line graph

[Dec. 2010]

Solution : (*b*) Pie diagram

Q.10. The data obtained by the internet are

(*a*) Primary data
(*b*) Secondary data
(*c*) Both (*a*) and (*b*)
(*d*) None of these

[Dec. 2010]

Solution : (*b*) Secondary data

Q.11. The Statistical measure computed from the sample observations alone have been termed as

(*a*) estimate (*b*) Parameter
(*c*) Statistic (*d*) Attribute

[Dec. 2010]

Solution : (*c*) Statistic

Q.12. When the two curves of Ogive intersect the point of intersection provides:

(*a*) First Quartile
(*b*) Second Quartile
(*c*) Third Quartile
(*d*) Mode

[June 2011]

Solution : (*b*)

Q.13. Frequency Density can be framed as:

(*a*) Class frequency to the cumulative frequency
(*b*) Class frequency to the total frequency
(*c*) Class frequency to the class length
(*d*) Class length to the class frequency

[June 2011]

Solution : (*c*) Frequency Density (F.D) = Class frequency/Class Length

Q.14. The Chronological classification of data are classified on the basis of:

(*a*) Attributes (*b*) Area
(*c*) Time (*d*) Class Interval

[June 2011]

Solution : (*c*)

Q.15. Arrange the following dimension wise : Pie-diagram, bar-digram and cubic diagram.

(*a*) 1,2,3 (*b*) 3,1,2
(*c*) 3,2,1 (*d*) 2,2,3

[June 2011]

Solution : (*d*)

Q.16. The frequency of class 20-30 in the following data is

Class	0-10	10-20	20-30	30-40	40-50
Cumulative Frequency	5	13	28	34	38

(*a*) 5 (*b*) 28 (*c*) 15 (*d*) 13

[Dec. 2011]

Solution : (*c*)

Frequency of class interval 20 – 30
= c.f. of 20 – 30
– c.f. of 10 – 20
= 28 – 13 = 15

Here the frequency of class " 20 - 30 " = 15

Q.17. The Graphical representation by which median is calculated is called

(*a*) Ogive Curve
(*b*) Frequency Curve

(c) Line diagram
(d) Histogram

[Dec. 2011]

Solution : (a) The median is calculated by Ogive Curve

Q.18. Which of the following is not a two dimensional diagram?

(a) Square diagram
(b) Line diagram
(c) Rectangular diagram
(d) Pie-chart

[Dec. 2011]

Solution : (b) Line diagram is not two dimensional diagram because it has only length.

Q.19. From which graphical representation , we can calculate partition values ?

(a) Lorenz curve
(b) Ogive curve
(c) Histogram
(d) None of the above

[Dec. 2012]

Solution : (b) We can calculate Partition values with the help of Ogive Curve.

Q.20. The data given below refers to the marks gained by a group of students:

Marks	Below 10	Below 20	Below 30	Below 40	Below 50
No. of students	15	38	65	84	100

Then the No. of students getting marks more than 30 would be _____.

(a) 50 (b) 53 (c) 35 (d) 62

[June 2012]

Solution : (c) It is cumulative frequency data.

The No. of students getting marks more than 30 = 100 - 65 = 35

Q.21. Cost of sugar in a month under the heads raw materials, labour, direct production and others were 12, 20, 35 & 23 units respectively. The difference between their central angles for the largest & smallest components of the cost of Sugar is

(a) 92^0 (b) 72^0 (c) 48^0 (d) 56^0

[June 2012]

Solution : (a) Total = 90

Angle difference = $\frac{35-12}{90}\times 360^0 = 92^0$.

Q.22. What is a exclusive series ?

(a) In which both upper and lower limit are not included in class frequency.
(b) In which lower limit is not included in class frequency.
(c) In which upper limit is not included in class frequency
(d) None of the above

[Dec. 2012]

Solution : (c) In exclusive series,upper limit is not included in class frequency.

Q.23. A pie diagram used to represent the following data_____

Source	Customers	Excise Tax	Income Tax	Wealth Tax
Revenue in Millions	120	180	240	180

The central angles corresponding to Income Tax and Wealth Tax are

(a) 90^0,120^0 (b) 120^0,90^0 (c) 60^0,120^0 (d) 90^0,60^0.

[June 2013]

Solution : (b) is correct

Total Revenue = 720

Central Angle for Income-tax = $\frac{240}{720}\times 360^0 = 120^0$

Central Angle for Wealth Tax = $\frac{180}{720}\times 360^0 = 90^0$

Q.24. The pair of averages whose value can be determined graphically?

(a) Mean & Median (b) Mode & Mean
(c) Mode & Median (d) None of the above

[Dec. 2013]

Solution : (c) is correct.

Q.25. The difference between upper limit and lower limit of a class is called:

(a) Class Interval (b) Class Boundaries
(c) Mid-value (d) Frequency

[Dec. 2013]

Solution : (a) Length of class- Interval

Q.26. If the class intervals are 10 - 14, 15 - 19, 20 - 24,..... Then the first class boundaries are:

(a) 9.5 - 14.5 (b) 10 - 15 (c) 9 - 15 (d) 10.5 - 15.5

[Dec. 2013]

Solution : (a) is correct

Since, D = 1 $\therefore LCB = l_1 - \frac{D}{2} = 10 - \frac{1}{2} = 9.5$; UCB = $l_2 + \frac{D}{2} = 14 + \frac{1}{2} = 14.5$

Q.27. The following data related to the marks of group of students

Marks	No. of students
More than 70%	7
More than 60%	18
More than 50%	40
More than 40%	60
More than 30%	75
More than 20%	100

How many students have got marks less than 50%?

(a) 60 (b) 82 (c) 40 (d) 53

[June 2014]

Solution : (a) is correct.

No .of students scoring marks less than 50% = 100 - No. of students scoring more than 50%

= 100 - 40 = 60

Q.28. To draw Histogram the frequency distribution should be

(a) Inclusive type
(b) Exclusive type
(c) Inclusive and Exclusive type
(d) None

[June 2014]

Solution : (b) is correct

Q.29. "The less than Ogive" is a:

(a) U-shaped curve
(b) J-shaped curve
(c) S- shaped curve
(d) Bell-shaped curve

[June 2014]

Solution : (b) is correct.

Q.30. There were 200 employees in an office in which 150 were married. Total male employees were 160 out of which 120 were married. What was the number of female unmarried employees?

(a) 30 (b) 10
(c) 40 (d) 50

[June 2014]

Solution : (b) is correct.

	Male	Female	Total
Married	120	30	150
Unmarried	40	10	50
Total	160	40	200

Unmarried Female = 10

Q.31. The most appropriate diagram to represent 5 year plan outlay of India in different economic sectors is

(a) Pie diagram
(b) Histogram
(c) Line diagram
(d) Frequency polygon

[Dec. 2014]

Solution : (a) is correct

Q.32. For construction of Histogram the class intervals of frequency distribution is

(a) Equal
(b) Unequal
(c) Either Equal or Unequal
(d) None

[Dec. 2014]

Solution : (a) is correct

Q.33. 100 persons are divided into number of male/female and employed/un-employed it refers to

(a) Cardinal Data
(b) Ordinal Data
(c) Spatial Data
(d) Temporal Data

[Dec. 2014]

Solution : (b) is correct

Q.34. The number of observations between 150 and 200 based on the following data is:

Value	More than 100	More than 150	More than 200	More than 250
No. of observations	70	63	28	05

(a) 46 (b) 35 (c) 28 (d) 23

[June 2015]

Solution : (b) is correct

No. of observation b/w 150 and 200 = 63-28=35.

Q.35. Number of accidents 0 1 2 3 4 5 6 7
Frequency 12 9 11 13 8 9 6 3

In how many cases 4 or more accidents occur ?

(a) 32 (b) 41 (c) 26 (d) 18

[June 2015]

Solution : (c) is correct

No. of 4 or more accidents = 8+ 9 + 6+ 3 = 26

Q.36. The curve obtained by joining the points, whose X-coordinates are the upper limits of the class-intervals and Y-coordinates are the corresponding cumulative frequencies is called

(a) Ogive
(b) Histogram
(c) Frequency Polygon
(d) Frequency Curve

[June 2015]

Solution : (a)

Q.37. Histogram is used for the presentation of the following type of series:

(a) Time series
(b) Continuous frequency series
(c) Discrete series
(d) Individual series

[June 2015]

Solution : (b)

Q.38. The perpendicular line drawn from the intersection of two Ogives which touches at ___ point in X-axis.

(a) Median
(b) Mode
(c) Third quartile
(d) First quartile

[June 2015]

Solution : (a)

Q.39. Which is most common diagrammatic representation for grouped frequency distribution.

(a) Histogram
(b) Ogive
(c) Both (a) & (b)
(d) None of these

[June 2015]

Solution : (a) is correct.

Q.40. Classification is of _____ kinds:

(a) One (b) two
(c) three (d) Four

[June 2015]

Solution : (d) is correct.

Q.41. Quartiles can be found through which graph?

(a) Ogive
(b) Histogram
(c) Frequency polygon
(d) Frequency curve

[June 2015]

Solution : (a) is correct.

Q.42. The chart that user Logarithm of the variable is known as:

(a) Line chart
(b) Ratio chart
(c) Multiple line chart
(d) Component line chart

[June 2015]

Solution : (b) is correct.

Q.43. Find the number of observations between 250 and 300 from the following data:

Value	More than 200	More than 250	More than 300	More than 350
No. of obs.	56	38	15	0

(a) 56 (b) 23 (c) 15 (d) 8

[June 2015]

Solution : (b) is correct.

No. of observations = 38 - 15 = 23

Q.44. Data collected on religion from the census reports are

(a) Primary data
(b) Secondary data
(c) Sample data
(d) (a) or (b)

[June 2016]

Solution : (b) is correct.

Q.45. Different modes of presentations of data are _____

(a) Textual
(b) Tabular
(c) Both (a) & (b)
(d) None

[Dec. 2016]

Solution : (c) is correct

Q.46. For construction of Histogram the class intervals of frequency distribution is

(a) Equal
(b) Unequal
(c) Either Equal or Unequal
(d) None

[Dec. 2016]

Solution : (a) is correct.

Q.47. In _____ method(s) information can be gathered by the researcher himself by contacting the interviewee

(a) Personal Interview
(b) Telephone Interview
(c) Both (a) & (b)
(d) Indirect oral

[Dec. 2016]

Solution : (c) is correct.

Q.48. Profits made by XYZ Bank in different years refers to _____

(a) Attribute
(b) Discrete variable
(c) Continuous variable
(d) None

[Dec. 2016]

Solution : (c) is correct because Blue Chips company's profit always increases.

Q.49. The intersection of point of less than Ogive and more than Ogive gives

(a) Mean
(b) Mode
(c) Median
(d) None

[June 2017]

Solution : (c)

Q.50. Which of the following diagram is appropriate to represent the various heads in total cost ?

(a) Bar graph
(b) Pie chart
(c) Multiple line chart
(d) Scatter plot

[June 2017]

Solution : (b)

Q.51. Frequency density corresponding to a class interval is the ratio of ____

(a) Class frequency to the class length
(b) Class frequency to the total frequency
(c) Class length to the class frequency
(d) Class frequency to the cumulative frequency

[June 2017]

Solution : (a)

Q.52. Stub of a table is the :

(a) Right part of the table describing the columns
(b) Left part to the table describing the columns
(c) Right part of the table describing the row
(d) Left part of the table describing the rows

[Dec. 2017]

Solution : (d)

Q.53. Pie diagram is used for :

(a) Comparing different components and their relation to the total
(b) Representing quantitative data in circle
(c) Representing qualitative data in a circle
(d) Either (b) or (c)

[June 2018]

Solution : (a)

Q.54. Find the number of observation between 250-300 from the following data:

Value	More than 200	More than 250	More than 300	More than 500
No. of observation	56	38	15	0

(a) 38 (b) 23 (c) 15 (d) None of these

[June 2018]

Solution : (b)

No. of obs. = 38 - 15 = 23

Q.55. The graphical representation of median can be found by using :

(a) Frequency polygon
(b) Histogram
(c) Ogives
(d) Frequency curve

[June 2018]

Solution : (c)

Q.56. Frequency density is used in the construction of

(a) Histogram
(b) Ogive
(c) Frequency polygon
(d) None when the classes are of unequal width

[May 2018]

Solution : (a)

Q.57. Divided Bar Chart is considered for

(a) Comparing different components of a variable
(b) The relation of different components to the table
(c) (a) or (b)
(d) (a) and (b) *[May 2018]*

Solution : (d)

Q.58. The following frequency distribution

X :	12	17	24	36	45
Y :	2	5	3	8	9

is classified as:

(a) Discrete distribution (b) Continuous distribution
(c) Cumulative frequency distribution (d) None of the above

[Nov. 2018]

Solution : (a)

Q.59. Histogram is useful to determine graphically the value of

(a) Arithmetic mean
(b) Mode
(c) Median
(d) None

[Nov. 2018]

Solution : (b)

Q.60. Data are said to be _____ if the investigator himself is responsible for the collection of the data.

(a) Primary data
(b) Secondary Data
(c) Mixed of primary and secondary data
(d) None

[Nov. 2018]

Solution : (a)

Q.61. A suitable graph for representing the portioning of total into sub parts in Statistics is

(a) A pictograph (b) A Pie Chart
(c) An Ogive (d) Histogram

[Nov. 2018]

Solution : (b)

Q.62. The number of times a particular items occurs in a class interval is called its

(a) Mean
(b) Cumulative frequency
(c) Frequency
(d) None of the above

[Nov. 2018]

Solution : (c)

Q.63. An Ogive is a graphical representation of

(a) Cumulative frequency distribution of
(b) Ungrouped data
(c) A frequency distribution
(d) None of the above

[Nov. 2018]

Solution : (a)

Q.64.

Class	0–10	10–20	20–30	30–40	40–50
Frequency	4	6	20	8	3

For the class 20-30, cumulative frequency is

(a) 26 (b) 10 (c) 41 (d) 30

[Nov. 2018]

Solution : (d) $\because$ cf = 4 + 6 + 20 = 30

Q.65. Which of the following graph is suitable for cumulative frequency distribution?

(a) 'O' give (b) Histogram (c) G.M (d) A.M

[June 2019]

Solution : (a)

Q.66. Histogram can be shown as

(a) Ellipse (b) Rectangle
(c) Hyperbola (d) Circle

[June 2019]

Solution : (b)

Q.67. _____ Series is continuous

(a) Open ended
(b) Exclusive
(c) Close ended
(d) Unequal call intervals

[June 2019]

Solution : (b)

Q.68. Ogive graph is used for finding

(a) Mean
(b) Mode
(c) Median
(d) None

[June 2019]

Solution : (c)

Q.69. Histogram is used for finding

(a) Mode (b) Mean
(c) First quartile (d) None

[June 2019]

Solution : (a)

Q.70. Histogram is used for presentation of the following type of series.

(a) Time Services
(b) Continuous Frequency Series
(c) Discrete Series
(d) Individual Series

[Dec. 2019]

Solution : (b)

Q.71. The graphical representation of cumulative frequency distribution is called-

(a) Histogram
(b) Pie Chart
(c) Frequency Polygon
(d) Ogive *[Dec. 2019]*

Solution : (d)

Q.72.

No. of Accidents	0	1	2	3	4	5	6	7
Frequency	36	27	33	29	24	27	18	9

In how many cases 4 or more accidents occur ?

(a) 96 (b) 133 (c) 78 (d) 54

[Dec. 2019]

Solution : (c)

No. of cases in which 4 or more accidents occur

= 24 + 27 + 18 + 9 = 78

Q.73. The difference between upper limit and lower limit of a class is called:

(a) Class interval
(b) Class boundaries
(c) Mid-value
(d) Frequency

[Dec. 2019]

Solution : (a)

Q.74. The average of salaries in a factory is ₹ 47,000. The statement that the average salary ₹ 47,000 is.....

(a) Descriptive statics
(b) Inferential
(c) Detailed
(d) Undetailed

[Dec. 2020]

Solution : (a)

Descriptive Statistics - Descriptive Statistics is the term given to the analysis of data that helps to describe position using a number of statistics, including the mode, Median and Mean. Inferential Statistics - Using sample data to make an inference or draw a conclusion of the population.

Q.75. Statistics cannot deal with ..... data.

(a) Quantitative
(b) Qualitative
(c) Textual
(d) Attribute

[Dec. 2020]

Solution : (c)

Q.76. Sweetness of a sweet dish is.....

(a) Attribute
(b) Discrete Variable
(c) Continuous Variable
(d) Variable

[Dec. 2020]

Solution : (a)

Q.77. Census reports are used as a source of..... data.

(a) Secondary (b) Primary
(c) Organize (d) Confidential

[Dec. 2020]

Solution : (a)

Q.78. Types of cumulative frequencies are.....

(a) 1 (b) 2
(c) 3 (d) 4

[Dec. 2020]

Solution : (b)

Q.79. You are an Auditor of a firm and the firm earns a profit ₹ 67,000 you stated to them that the annual profit is ₹ 67,000. This is .....type of statistics.

(a) Descriptive (b) Detailed
(c) Non-detailed (d) Inferential

[Dec. 2020]

Solution : (a)

Q.80. The.....are used usually when we wants to examine the relationship between two variables.

(a) Bar Graph (b) Pie Chart
(c) Line Chart (d) Scatter Plot

[Dec. 2020]

Solution : (d)

Q.81. A bar chart is drawn for

(a) Continuous data
(b) Nominal data
(c) Time series data
(d) Comparing different components

[Jan. 2021]

Solution : (d) A bar chart (may be vertical or horizontal) shows comparison of different components.

Q.82. A tabular presentation can be used for

(a) Continuous series data
(b) Nominal data
(c) Time series data for longer period
(d) Primary data

[Jan. 2021]

Solution : (b) Tabular presentation (Tabulation) is normally used for Nominal Data.

Q.83. A variable with qualitative characteristic is known as

(a) Quality Variable
(b) An attribute
(c) A discrete variable
(d) A continuous variable

[Jan. 2021]

Solution : (b) is correct

Q.84. The accuracy and consistency of data can be verified by

(a) Scrutiny
(b) Internal Checking
(c) External Checking
(d) Double Checking

[Jan. 2021]

Solution : (a) is correct

Q.85. From a histogram one cannot compute the approximate value of

(a) Mode
(b) Standard deviation
(c) Median
(d) Mean

[Jan. 2021]

Solution : (b) With the help of histogram approximate value of standard deviation cannot be obtained.

Q.86. The left part of a table providing the description of rows is called.

(a) Caption (b) Box - head
(c) Stub (d) Body

[Jan. 2021]

Solution : (c) is correct.

Q.87. Mode can be obtained from _____

(a) Frequency polygon
(b) Histogram
(c) O give
(d) All of the above

[Jan. 2021]

Solution : (b) is correct.

Q.88. Most of the Commonly used distributions provide a.

(a) Bell - Shaped
(b) U Shaped
(c) J - Shaped Curve
(d) Mixed Curve

[Jan. 2021]

Solution : (a) is correct.

Q.89. Which of the following is suitable for the graphical representation of a Cumulative frequency distribution ?

(a) Frequency polygon
(b) Histogram
(c) O give
(d) Pie chart

[Jan. 2021]

Solution : (c) is correct.

Q.90. Sweetness of sweet dish is.

(a) An Attribute
(b) A discrete variable
(c) A continuous variable
(d) A variable

[Jan. 2021]

Solution : (a) is correct.

because sweetness is the nature of sweets.

Q.91. There were 200 employees in an office in which 150 were married. Total male employees were 160 out of which 120 were married. What was the number of female unmarried employees?

(a) 30 (b) 40 (c) 50 (d) 10

[July 2021]

Solution : (d) is correct

Tabulation

	Male	Female	Total
Married	120	150 – 120 = 30	150
Unmarried	40	50 – 40 = 10	50
Total	160	40	200

Q.92. Data collected on religion from the census reports are

(a) Primary data
(b) Unclassified data
(c) Sample data
(d) Secondary data

[July 2021]

Solution : (d) is correct.

Census Report → Primary Data.

Data on Religion from Census = Secondary Data.

Q.93. Which of the following diagram is the most appropriate to represents various heads in total cost?

(a) Pie chart (b) Bar graph
(c) Multiple line chart (d) Scatter plot

[July 2021]

Solution : (a) is correct

Q.94. In a graphical representation of data, the largest numerical value is 4 the smallest numerical value is 25. If classes desired are 4 then which class interval is

(a) 45 (b) 5 (c) 20 (d) 7.5

[July 2021]

Solution : (b) is correct

Given

Smallest observation = 4 = S

Largest observation = 25 = L

No. of Class intervals desired = 4.

Formula

$$\text{No. of CIs} = \frac{\text{Range}}{i}$$

$$\therefore \quad \text{(length of the C.I.)} = i = \frac{L-S}{\text{No. of CIs}} = \frac{25-4}{4}$$

$$= 5.25 \cong 5.$$

Q.95. In graphical representation of data, ideographs are also called as

(a) Picto-graphs (b) Asymmetry graphs
(c) Symmetry graphs (d) Pictograms

[July 2021]

Solution : (d) is correct.

Q.96. ____ means separating items according to similar characteristics grouping them into various classes.

(a) Classification (b) Editing (c) Separation (d) Tabulation

[July 2021]

Solution : (a) is correct.

Q.97. Frequency density of a class interval is the ratio of _____

(a) Class frequency to the total frequency
(b) Class length to class frequency
(c) Class frequency to the cumulative frequency
(d) Frequency of that class interval to the corresponding class length

[July 2021]

Solution : (d)

$$\text{Frequency density} = \frac{\text{Frequency of class-interval}}{\text{Length of that class-interval}}$$

Q.98. A graph that uses vertical bars to represent data is called a

(a) Line graph (b) Scatter plot
(c) Vertical graphs (d) Bar

[July 2021]

Solution : (d) is correct.

Q.99. In a study about the male and female students of Commerce and Science departments of a college in 5 years, the following data's were obtained:

1995	2000
70% female students	75% female students
65% read Commerce	40% read Science
20% of male students read Science	50% of female students read Commerce
3000 total No. of students	3600 total No. of students

After combining 1995 and 2000 if x denotes the ratio of female commerce student to female Science student and y denotes the ratio of male commerce student to male Science student, then

(a) $x = y$ (b) $x > y$ (c) $x < y$ (d) $x \geq y$

[Dec. 2021]

Solution : (c)

	1995			2000		
	M.	F.	Total	M.	F.	Total
Commerce	10%	55%	65%	10%	50%	60%
Science	20%	15%	35%	15%	25%	40%
Total	30%	70%	100%	25%	75%	100%
		Total	=3000		Total	=3600

Total Female Commerce Students in 1995 & 2000 together

$$= 3000 \times \frac{55}{100} + 3600 \times \frac{50}{100} = 1650 + 1800 = 3450$$

$$\text{Female Science Students} = 3000 \times \frac{15}{100} + 3600 \times \frac{25}{100} = 450 + 900 = 1350$$

$$\therefore x = \frac{3450}{1350} = 2.555$$

Total Male Commerce Students

$$= 3000 \times \frac{10}{100} + 3600 \times \frac{10}{100}$$

$$= 300 + 360 = 660$$

Total Male Science Students

$$= 3000 \times \frac{20}{100} + 3600 \times \frac{15}{100}$$

$$= 600 + 540 = 1140$$

$$Y = \frac{660}{1140} = 0.5785$$

Clearly $x < y$

C Correct.

Q.100. A National Institute arrange its students data in accordance with different States. This arrangement of data is known as

(a) Temporal Data
(b) Geographical Data
(c) Ordinal Data
(d) Cardinal Data *[Dec. 2021]*

Solution : (b)

Data arrange region wise are known as Geographical Data Example:– Arrangement of students States wise are Geographical Data

Q.101. A student marks in five subjects S_1, S_2, S_3, S_4 and S_5 are 86, 79, 90, 88 and 89. If we need to draw a Pie chart to represent these marks, then what will be the Central angle for S_3?

(a) 103.2° (b) 75°
(c) 105.6° (d) 94.8°

[Dec. 2021]

Solution : (b)

$$\text{Central Angle for } S_3 = \frac{S_3}{\text{Total}} \times 360°$$

$$= \frac{90}{86+79+90+88+89} \times 360°$$

$$= 75°$$

(b) is correct.

Q.102. The following data relate to the marks of a group of students:

Marks :	Below 10	Below 20	Below 30	Below 40	Below 50
No. of students:	15	38	65	84	100

How many students got marks more than 30?

(a) 65 (b) 50 (c) 35 (d) 43

[Dec. 2021]

Solution : (c)

No. of Students getting Marks more than 30

= 100–65 = 35

Q.103. The following data relate to the marks of 48 students in Statistics:

56	10	54	38	21	43	12	22
48	51	39	26	12	17	36	19
48	36	15	33	30	62	57	17
5	17	45	46	43	55	57	38
43	28	32	35	54	27	17	16
11	43	45	2	16	46	28	45

What are the frequency densities for the class intervals 30-39, 40-49, 50-59?

(*a*) 0.20, 0.50, 0.90 (*b*) 0.70, 0.90, 1.10

(*c*) 0.1875, 0.1667, 0.2083 (*d*) 0.90, 1.00, 0.80

[Dec. 2021]

Solution : (*d*)

Class Interval	Frequency	Frequency = f/i Density
30 – 39	9	$\frac{9}{10} = 0.9$
40 – 49	11	$\frac{11}{10} = 1.1$.
50 – 59	7	$\frac{7}{10} = 0.7$

Here Length of the class interval

$= i = l_2 - l_1 + D = 39 - 30 + 1 = 10$

Where D = Lower Limit of a class interval-upper limit of just pre-class interval.

Maximum matching value in option D

Q.104. Multiple axis line chart is considered when

(*a*) There is more than one time series

(*b*) The units of the variables are different.

(*c*) In any case

(*d*) If there are more than one time series and unit of variables are different.

[Dec. 2021]

Solution : (*d*)

Q.105. Sweetness of a sweet dish is

(*a*) An attribute

(*b*) A discrete variable

(*c*) A continuous variable

(*d*) A variable

[June 2022]

Solution : (*a*) is correct

Sweatness is the nature of Sweat.

So it is an Attribute

Q.106. Median of a distribution can be obtained from

(*a*) Frequency polygon

(*b*) Histogram

(*c*) Less than type ogives

(*d*) Pie chart

[June 2022]

Solution : (*c*) is correct

Ogive Curve/Cumulative Frequency Curve is suitable for any Partion Value (*i.e.* Median; Quartiles etc.)

Q.107. We get —by plotting cumulative frequency against the respective class boundary.

(*a*) Histogram (*b*) Polygon

(*c*) Pie chart (*d*) Ogives

[June 2022]

Solution : (*d*) is correct

Ogive curves are plotted by using cumulative frequencies and Class - Boundaries.

Q.108. Types of research data are

(*a*) Organised data and unorganized data

(*b*) Qualitative data and quantitative data

(*c*) Processed data and unprocessed data

(*d*) Discrete data and continuous data

[June 2022]

Solution : (*b*) is correct

Q.109. The collected information on which of the following characteristic do not form data?

(*a*) The number of files audited are 'less than 6'. 'between 5 and 10' and 'more than 9'

(*b*) The number of files audited are 'very less'. ' moderate' and 'very large'

(*c*) The number of files audits in a file

(*d*) The number of auditors who audited a file

[June 2022]

Solution : (*b*) is correct

Q.110. Histograms are drawn only when

(*a*) Frequencies in various class intervals are equal

(*b*) Class intervals are equal

(*c*) Class intervals are unequal

(*d*) For less than type cumulative frequencies

[June 2022]

Solution : (*b*) is correct

Histogram is drawn taking length of class-intervals equal.

Q.111. Which one of the following is not a mode of presentation of data?

(*a*) Textual presentation

(*b*) Tabular presentation

(*c*) External presentation

(*d*) Diagrammatic representation

[June 2022]

Solution : (*c*) is correct

Q.112. Which one of the following is a continuous variable?

(*a*) The quantum of days to get a cure from illness

(*b*) The quantum of oxygen cylinders used to treat a patient

(*c*) The quantum of drug injected in to a patient

(*d*) The quantum of tablets prescribe to a patient

[June 2022]

Solution : (*c*) is correct

Illness gradually up or down.

Q.113. Which one of the following is a source of primary data?

(*a*) Government records

(*b*) Research Articles

(*c*) Journals

(*d*) Questionnaire filled by enumerators

[Dec. 2022]

Solution: (*d*)

Q.114. Which is the left part of the table providing the description of the rows?

(*a*) Caption (*b*) Box head

(*c*) Stub (*d*) Body

[Dec. 2022]

Solution: (*c*)

Q.115. The suitable formula for computing the number of class intervals is :

(*a*) 3.322 logN

(*b*) 0.322 logN

(*c*) 1+3.322 logN

(*d*) 1–3.322 logN

[Dec. 2022]

Solution : (*c*) is correct

H.A. Sturges provides a formula for determining the approximation number of classes

K = 1 + 3.322 logN

Where K = Number of classes

and logN = log of the total number of observations.

Q.116. Ogive for more than type and less than type distributions intersect at

(*a*) Mean (*b*) Median

(*c*) Mode (*d*) Origin

[Dec. 2022]

Solution: (*b*) is correct.

The perpendicular drawn from the point of intersection of less than and more than ogive curve cut X-axis at median.

Q.117. The shareholding pattern of ABC Ltd. is as follows:

Share-holders	Pro-moter	FII	DII	Govt.	Public
No. of shares in Millions	120	25	20	20	15

What is the difference between central angles (in degree) for shares held by Promoters and Public in pie chart?

(*a*) 216 (*b*) 189

(*c*) 180 (*d*) 99

[June 2022]

Solution :

Total = 120 + 25 + 20 + 20 + 15

= 200

Difference between the Central Angle of Promoters and Public in Pie Chart

$= \left(\frac{120-15}{200}\right) \times 360^o$

$= 189^o$

(*b*) is correct.

Q.118. What does an Ogive curve represent?

(*a*) The cumulative frequency and class boundary

(*b*) The frequency and class boundary

(*c*) The frequency and cumulative frequency

(*d*) The Frequency and Class Interval

[June 2022]

Solution :

(*a*) Ogive Curve (Cumulative frequency curve) represent cumulative frequency & Class boundary.

Q.119. The following is the data related to the daily income of 86 persons:

Income in ₹	500-999	1000-1499	1500-1999	2000-2499
No. of persons	15	28	36	7

What is the percentage of persons earning at least ₹ 1,500 per day?

(*a*) 50% (*b*) 45%

(*c*) 40% (*d*) 60%

[June 2022]

Solution : Total persons

= 15 + 28 + 36 + 7

= 86

No. of persons earning more than ₹ 1,500 per day

= 36 + 7 = 43

∴ Percentage of persons earning more than ₹ 1,500

$= \frac{43}{86} \times 100 = 50\%$

∴ (*a*) is correct.

Q.120. For tabulation, 'caption' is:

(*a*) The upper part of the table

(*b*) The lower part of the table

(*c*) The main part of the table

(*d*) The upper part of a table that describes the rows and sub-rows

[June 2022]

Solution : ∴ (*a*) is correct.

Q.121. The modes of presentation of data are:

(*a*) Textual, Diagrammatic and Internal presentation

(*b*) Tabular, Textual and Internal Presentation

(*c*) Textual, Tabular and Diagrammatic presentation

(*d*) Tabular, Diagrammatic and Internal Presentation

[June 2022]

Solution : (*c*) is correct.

21 CHAPTER CENTRAL TENDENCY

PAST EXAM QUESTIONS WITH SOLUTIONS (MEMORY BASED)

Q.1. The harmonic mean of 1, 1/2, 1/3.....1/n is

(*a*) 1/(n + 1) (*b*) 2/(n + 1)

(*c*) (n + 1)/2 (*d*) 1/(n - 1)

[June 2010]

Solution : (*b*) $H = \frac{n}{\sum\left(\frac{1}{x_1}\right)}$

$= \frac{n}{1+2+3+.....+n}$

$= \frac{n}{\frac{n}{2}(n+1)} = \frac{2}{(n+1)}$

Tricks : GBC

Q.2. The mean weight of 15 students is 110 kg. The mean weight of 5 of them is 100 kg. and that of another five students is 125 kg., then the mean weight of the remaining students is:

(*a*) 120 (*b*) 105

(*c*) 115 (*d*) None of these

[June 2010]

Solution : (*b*) Total weight of remaining 5 students

$= 15\times110 - 5\times100 - 5\times125 = 525$

∴ Mean weight of remaining 5 students $= \frac{525}{5} = 105$

Q.3. In a class of 11 students, 3 students were failed in a test. 8 students who passed secured 10,11, 20, 15, 12, 14, 26 and 24 marks respectively. What will be the median marks of the students:

(*a*) 12 (*b*) 15

(*c*) 13 (*d*) 13.5

[June 2010]

Solution : (*a*) Let x_1, x_2, x_3 be the marks of fail 3 students. Arranging marks in ascending order ; we get x_1, x_2, x_3, 10, 11, 12, 14, 15, 20, 24, 26 Median = Middle obs. = 12

Q.4. A lady travel at a speed of 20 km/h and returned at quicker speed. If her average speed of the whole journey is 24 km/h, find the speed of return journey (in km/h)

(*a*) 25 (*b*) 30

(*c*) 35 (*d*) 38

[Dec. 2010]

Solution : (*b*) **TRICKS** : Av. Speed = $\frac{2\times20x}{x+20} = 24$

Where x = Retuning Speed

24x + 480 = 40x

16x = 480

x = 30 km/hr.

Q.5. Let the mean of the variable 'x' be 50, then the mean of u = 10+5x will be:

(*a*) 250 (*b*) 260

(*c*) 265 (*d*) 273

[Dec. 2010]

Solution : (*b*) u = 10 + 5x

Since mean changes w.r.t the change of Origin & Scale

∴ New Mean of u = 10 + 5 × 50 = 260

Q.6. If the difference between mean and mode is 63, then the difference between Mean and Median will be_____

(*a*) 63

(*b*) 31.5

(*c*) 21

(*d*) None of the above

[June 2011]

Solution : (*c*) Given : Mode - Mean = 63

Since ; Empirical Relationship is

(Mode - Mean) = 3(Median - Mean)

∴ Median - Mean = $\frac{63}{3} = 21$

Q.7. If the Arithmetic mean between two numbers is 64 and the Geometric mean between them is 16. The Harmonic Mean between them is_____.

(*a*) 64 (*b*) 4

(*c*) 16 (*d*) 40

[June 2011]

Solution : (*b*) Given : A.M = A = 64

G.M. = G = 16; H.M = ?

We know, $(G.M.)^2 = A.M. \times H.M.$

$(16)^2 = 64 \times H.M.$

∴ HM = $\frac{256}{64} = 4$

Q.8. The average of 5 quantities is 6 and the average of 3 is 8. What is the average of the remaining two?

(*a*) 4 (*b*) 5

(*c*) 3 (*d*) 3.5

[June 2011]

Solution : (*c*)

Sum of Remaining two Nos. = 5 × 6 - 3 × 8 = 6

∴ Av. of Remaining two = $\frac{6}{2} = 3$

Q.9. The median of following numbers, which are given in ascending order is 25. Find the Value of X if data is 11, 13, 15, 19, (x + 2), (x + 4), 30, 35, 39, 46

(*a*) 22 (*b*) 20

(*c*) 15 (*d*) 30

[Dec. 2011]

Solution : (*a*)

Numbers are in Ascending Order ; N = 10 (Even)

Median = Av. of Middle two obs.

$25 = \frac{1}{2}[(x+2)+(x+4)]$

50 = 2x + 6 ;

2x = 50 - 6

x = 22

Tricks :- GBC.

Q.10. The average age of a group of 10 students was 20 years. The average age are increased by two years when two new students joined the group. What is the average age of two new students who joined the group ?

(*a*) 22 years (*b*) 30 years

(*c*) 44 years (*d*) 32 years

[Dec. 2011]

Solution : (*d*)

Sum of age of two boys

= (10+2) × (20 + 2) - 10 × 20

= 264 - 200 = 64

Average Age of two boys = $\frac{64}{2} = 32$

Q.11. Geometric Mean of three observations 40, 50 and X is 10. The value of X is

(*a*) 2

(*b*) 4

(*c*) 1/2

(*d*) None of the above

[June 2010]

Solution : (*c*) **Tricks:** Product of obs. = $(GM)^3$

$(10)^3 = 40.50.X$

1,000 = 40.50.X

$X = \frac{10}{20} = \frac{1}{2}$

Q.12. The mean of first three terms is 14 and mean of next two terms is 18. The mean of all five terms is:

(*a*) 14.5 (*b*) 15

(*c*) 14 (*d*) 15.6

[June 2010]

Solution : (*d*) Formula

$\sum X = N.\bar{X}$

Sum of 1st 3 Numbers = 3 × 14 = 42

Sum of next 2 Numbers = 2 × 18 = 36

Sum of all these 5 Numbers = 42 + 36 = 78

Av. of these 5 Numbers = $\frac{78}{5} = 15.6$

Tricks : Combined Mean

$= \frac{3\times14+2\times18}{3+2} = 15.6$

Q.13. The mean salary of a group of 50 persons is ₹ 5,850. Later on it is discovered that the salary of one employee has been wrongly taken as ₹ 8,000 instead of ₹ 7,800. The corrected mean salary is

(*a*) ₹ 5,854

(*b*) ₹ 5,846

(*c*) ₹ 5,650

(*d*) None of the above

[Dec. 2012]

Solution : (*b*) Correct mean

$= \frac{\text{Correct}\sum x}{N}$

$\bar{x} = \frac{N.\bar{X} - \text{wrong obs.} + \text{correct obs.}}{N}$

$= \bar{x} = \frac{50\times5,850 - 8000 + 7800}{50}$

$= 5846$

TRICKS : Do with Calculator mentally

Q.14. If the mode of a data is 18 and mean is 24 then median is_____

(*a*) 18 (*b*) 24
(*c*) 22 (*d*) 21

[Dec. 2012]

Solution : (*c*) Mode = 18 ; Mean = 24

Mode = 3 Median - 2 Mean

18 = 3 Median - 2 × 24

18 = 3 Median - 48

18 + 48 = 3 Median

Median = $\frac{66}{3}$ =22

Q.15. For data on frequency distribution of weights :

70, 73, 49, 57, 56, 44, 56, 71, 65, 62, 60, 50, 55, 49, 63 and 45

If we assume class length as 5, the number of class intervals would be

(*a*) 5 (*b*) 6
(*c*) 7 (*d*) 8

[Dec. 2012]

Solution : (*b*) L = Largest obs. = 73

S = Smallest obs. = 44

Range = L - S = 73 - 44 = 29

Length = i = 5

No. of Class -Intervals = $\frac{\text{Range}}{\text{i}}$

$= \frac{29}{5} = 5.8 = 6$

Q.16. The point of intersection of the "less then" and "more then" Ogives correspond to

(*a*) Mean (*b*) Mode
(*c*) Median (*d*) 10th percentile

[Dec. 2012]

Solution : (*c*) Median

Q.17. A man travels from Agra to Gwalior at an average speed of 30 km per hour and back at an average speed of 60 km per hour. What is his average speed?

(*a*) 38 km per hour
(*b*) 40 km per hour
(*c*) 45 km per hour
(*d*) 35 km per hour

[Dec. 2012]

Solution : (*b*); **Tricks :** Average speed = $\frac{2xy}{x+y}$

Given x = 30 km/h & y = 60 km/h

Average speed = $\frac{2\times30\times60}{30+60}$

$= \frac{2\times30\times60}{90} = 40$ km per hour

Q.18. Which of the following measures of central tendency cannot be shown by graphical method?

(*a*) Mean (*b*) Median
(*c*) Mode (*d*) Quartiles

[June 2013]

Solution : (*a*) Mean Cannot be Shown with Graphical Method.

Q.19. GM of 8,4,2 is_____

(*a*) 4 (*b*) 2
(*c*) 8 (*d*) None

[June 2013]

Solution : (*a*) is correct

$G = (8.4.2)^{1/3} = (2^3.2^2.2)^{1/3}$

$= (2^6)^{1/3} = 2^2 = 4$

Tricks : Go by choices

Q.20. The average age of 15 students is 15 years. Out of these the average age of 5 students is 14 years and that of other 9 students is 16 years, then the age of 15th student is_____

(*a*) 11 years (*b*) 14 years
(*c*) 15 years (*d*) None of these

[June 2013]

Solution : (*a*) is correct

Age of 15th student = 15 × 15 - 5 × 14 - 9 × 16 = 11 years

Q.21. Which of the following statement is true?

(*a*) Median is based on all observations
(*b*) The Mode is the mid value
(*c*) The Median is the 2nd Quartile
(*d*) The Mode is the 5th decile

[June 2014]

Solution : (*c*) is correct

Median M = Q_2

Q.22. For two numbers A.M. = 10 and G.M. = 8; the H.M. ....?

(*a*) 9 (*b*) 8.9
(*c*) 6.4 (*d*) None

[Dec. 2014]

Solution : (*c*) is correct

$\because AH = G^2 \Rightarrow H = \frac{G^2}{A}$

$= H = \frac{8^2}{10} = 6.4$

Q.23. The 3rd decile for the values 15, 10, 20, 25, 18, 11, 9, 12 is

(*a*) 13 (*b*) 10.7 (*c*) 11 (*d*) 11.5

[Dec. 2014]

Solution : (*b*) is correct

Arranging in Ascending order

9, 10, 11, 12, 15, 18, 20, 25

N=8 $\therefore D_3 = 3\left(\frac{N+1}{10}\right)^{th} obs. = 3\left(\frac{8+1}{10}\right) = 2.7^{th} obs.$

$=2^{nd}$ obs.$+0.7(3^{rd}-2^{nd}$obs.)

=10+0.7(11-10)

=10.7

Q.24. The A.M. of square of first '2n' natural number is

(*a*) $\frac{1}{6}(2n+1)(4n-1)$

(*b*) $\frac{1}{6}(2n-1)(4n-1)$

(*c*) $\frac{1}{6}(2n-1)(4n+1)$

(*d*) $\frac{1}{6}(2n+1)(4n+1)$

[Dec. 2014]

Solution : (*d*) is correct

Formula : $S_n = \frac{n(n+1)(n+1)}{6}$

$S_{2n} = \frac{2n(2n+1)(2\times2n+1)}{6}$

$= \frac{2n(2n+1)(4n+1)}{6}$

A.M. = $\frac{S_{2n}}{2n} = \frac{2n(2n+1)(4n+1)}{6\times2n}$

$= \frac{1}{6}(2n+1)(4n+1)$

Tricks : GBC

Q.25. A Random variables x follows uniform distribution in the interval [-3,7]. Then the mean of distribution is

(*a*) 2 (*b*) 4
(*c*) 5 (*d*) 6

[Dec. 2014]

Solution : (*a*) is correct

Note:- Random variable has uniform distribution *i.e.*

Here, Arithmetic Mean is applied

$\therefore$ Mean = $\frac{-3+7}{2} = 2$

Q.26. If the Harmonic mean of two numbers is 4 and Arithmetic mean (A) and Geometric mean (G) satisfy the equation $2A+G^2 = 27$ then the two numbers are

(*a*) (1,3) (*b*) (9,5)
(*c*) (6,3) (*d*) (12,7)

[June 2015]

Solution : Tricks : (*a*) Go by choices

For option (*c*); H = $\frac{2ab}{a+b} = \frac{2\times6\times3}{6+3} = 4$

= H (true)

A = $\frac{6+3}{2} = 4.5$

G = $\sqrt{ab} = \sqrt{6\times3} = \sqrt{18}$

It satisfies $2A + G^2 = 27$

$\therefore$ (*c*) is correct

Q.27. There were 50 students in a class. 10 failed whose average marks were 2.5. The total marks of class were 281. Find the average marks of students who passed?

(*a*) 6.4 (*b*) 25
(*c*) 256 (*d*) 86

[Dec. 2015]

Solution : (*a*) is correct.

Average Marks of students who passed

$= \frac{281-10\times2.5}{50-10} = 6.4$

Q.28. If the mean of two numbers is 30 and Geometric Mean is 24 then what will be those two numbers ?

(*a*) 36 and 24 (*b*) 30 and 30
(*c*) 48 and 12 (*d*) None of these

[June 2016]

Solution : (*c*) is correct.

Tricks: Go by choices

(*c*) Arithmetic Mean = $\frac{48+12}{2} = 30$

Geometric Mean = $\sqrt{48\times12} = 24$

It satisfies all conditions.

Q.29. The G.M. of observations 40, 50 and *x* is 10, then find the value of *x* ?

(*a*) 4 (*b*) 5
(*c*) 2 (*d*) $\frac{1}{2}$

[Dec. 2016]

Solution : (*d*) is correct.

Tricks : Product of observations = (GM) No. of obs.

$40\times50\times x = 10^3$

So, $x = \frac{1}{2}$

Q.30. If the mean of data is 55.6 and the mode is 46, then the median is _____

(*a*) 50.4 (*b*) 40.7
(*c*) 52.4 (*d*) None

[Dec. 2016]

Solution : (*c*) is correct.

Since, Mode = 3Median - 2 Mean

46 = 3Median - 2×55.6

So, Median = (46 + 111.2)/3 = 52.4

Q.31. _____ is used for ordering the size of designed cloths.

(*a*) Mean (*b*) Median
(*c*) Mode (*d*) None

[Dec. 2016]

Solution : (*c*) is correct.

Q.32. The mean of 10 observations is 14.4. Out of these mean of 4 observations is 16.5, then find the mean of remaining observations?

(*a*) 13.6 (*b*) 13
(*c*) 13.8 (*d*) 12

[Dec. 2016]

Solution : (*b*) is correct.

No. of remaining observations = 10 - 4 = 6

Sum of these 6 observations = 14.4 ×10 - 4×16.5

= 78

Their mean = 78/6 = 13

Q.33. The mean of 6, 4, 1, 5, 6, 10 and 3 is 5. If each number is added with 2, then the new mean is _____

(*a*) 7 (*b*) 5
(*c*) 6 (*d*) 10

[Dec. 2016]

Solution : (*a*) is correct.

Q.34. Which of the following is correct ?

(*a*) 3(Mean - Median) = Mean - Mode
(*b*) Mean - Median = 3(Mean - Mode)
(*c*) Mean - Median = 2(Mean - Mode)
(*d*) Mean - Mode = 2(Mean - Median)

[June 2017]

Solution : (*a*) is correct

Q.35. A person purchases 5 rupees worth of eggs from 10 different markets. You are to find average No. of eggs per rupee for all the markets taken together. What is the suitable form of average in this case?

(a) AM (b) GM
(c) HM (d) None

[June 2017]

Solution : (c) is correct.

Q.36. GM = 6, AM = 6.5 then HM =

(a) $\frac{6^2}{6.5}$ (b) $\frac{6}{6.5}$

(c) $\frac{6.5}{6}$ (d) None

[June 2017]

Solution : Formula ; $G^2 = A.H.$

$\Rightarrow \quad 6^2 = (6.5)H.$

or $H = \frac{6^2}{6.5}$

$\therefore$ (a) is correct.

Q.37. A company's past 10 years average earnings was ₹40 crores. For obtaining the same average earnings for 11 years including these 10 years how much earning (in ₹) must be made by the company in the 11th year ?

(a) 40 crores

(b) $\frac{40\times10}{11}$ crores

(c) More than 40 crores

(d) None

[June 2017]

Solution : Earning in 11^{th} year

$= 11 \times 40 - 10 \times 40 = ₹\ 40$ crores

(a) is correct.

Q.38. The rates of returns from three different shares are 100%, 200% and 400% respectively, the average rate of return will be _____

(a) 350% (b) 233.33%
(c) 200% (d) 300%

[June 2017]

Solution : (c) is correct.

$Gm = (100\times200\times400)^{1/3}$

$= 200\%$

Q.39. Mean of 7, 9, 12, x, 4, 11 & 5 is 9. Find the missing observation :

(a) 13 (b) 15
(c) 12 (d) None of these

[Dec. 2017]

Solution :

$x = 7\times9-7-9-12-4-11-5$

$= 15.$

Q.40. If all the frequencies are equal then which will doesn't exist :

(a) Mean (b) Median
(c) Mode (d) None of these

[Dec. 2017]

Solution : (c)

Q.41. _____ is the reciprocal of the AM of reciprocal of observation :

(a) HM (b) GM
(c) Both (d) None of these

[Dec. 2017]

Solution : (a)

Q.42. Mean of n observation is $\bar{x}$, if first observation is increased by 1, 2nd observation is by 2 and so on, then new mean is _____

(a) $\bar{x}+n.n$ (b) $\bar{x}+\frac{n+1}{2}$ (c) $\bar{x}+\frac{n}{2}$ (d) $\bar{x}+n$

[June 2018]

Solution : (b)

$$\text{New Mean} = \frac{n\bar{x}+(1+2+3+.....+n)}{n}$$

$$= \bar{X}+\frac{n(n+1)}{2n} = \bar{X}+\frac{(n+1)}{2}$$

Q.43. GM. of 4, 8, 16, 32 and 64 is _____ :

(a) 8 (b) 16
(c) 32 (d) 64

[June 2018]

Solution : (b)

Tricks : 4, 8, 16, 32, 64 are in G.P.

$\therefore$ GM = Middle observation = 16.

Q.44. Which of the following results hold for a set of distinct positive observations?

(a) $AM \geq GM \geq HM$
(b) $HM \geq GM \geq AM$
(c) $AM > GM > HM$
(d) $GM > AM > HM$

[June 2018]

Solution : (c)

Q.45. For a moderately skewed distribution, which of the following relationship holds?

(a) Mean - Mode = 3 (Mean - Median)
(b) Median - Mode = 3 (Mean - Median)
(c) Mean - Median = 3 (Mean - Mode)
(d) Mean - Median = 3 (Median - Mode)

[June 2018]

Solution : (a)

Q.46. If the variables X and Z are so related that $Z = aX + b$ for each $X = x_i$, where a and b are constant, then $\bar{Z} = a\bar{X} + b$

(a) True (b) False
(c) Both (d) None

[May 2018]

Solution : (a)

Q.47. Relation between mean, median and mode is

(a) Mean - mode = 2 (mean - median)
(b) mean - median = 3 (mean - mode)
(c) mean - median = 2 (mean - mode)
(d) mean - mode = 3 (mean - median)

[May 2018]

Solution : (d)

Q.48. If each item is reduced by 15 , A.M is

(a) reduced by 15 (b) Increased by 15
(c) reduced by 10 (d) None

[May 2018]

Solution : (a)

If each observation is reduced by 15 then new A.M. also reduced by 15, because A.M. changes with the shifting of origin.

Q.49. For 889, 999, 391, 384, 390, 480, 485, 760, 111, 240 Rank of median is

(a) 2.75 (b) 5.5
(c) 8.25 (d) None

[May 2018]

Solution : (b)

Here No. of observation (N) = 10

$$\text{Rank of Median } (m_e) = \left(\frac{N+1}{2}\right)^{th} \text{observation}$$

$$= \left(\frac{10+1}{2}\right)^{th} \text{term} = 5.5^{th} \text{term}$$

Rank of median $(m_e) = 5.5$

Q.50. The average of a series of overlapping averages, each of which is based on a certain number of item within a series is known as

(a) Moving average
(b) Weighted average
(c) Simple average
(d) None

[May 2018]

Solution : (a)

Q.51. If the mean of the following distribution is 6 then the value of P is

X :	2	4	6	10	P + 5
f :	3	2	3	1	2

(a) 7 (b) 5
(c) 11 (d) 8

[Nov. 2018]

Solution : (a)

Tricks : Go by choices

Use Calculator

(a) If $P = 7 \Rightarrow P + 5 = 7 + 5 = 12$

So; mean = press $2\times3 =$; $4\times2 =$; $6\times3 =$; $10\times1 =$; $12\times2 =$ button, then GT button $\div$ 11 = button 6 (True)

So, (a) is correct.

Q.52. If total frequencies of three series are 50,60 and 90 and their means are 12, 15 and 20 respectively, then the mean of their composite series is

(a) 15.5 (b) 16
(c) 14.5 (d) 16.5

[Nov. 2018]

Solution : (d)

Calculator Tricks:-

X_{123} = press $50\times12 =$; $60\times15 =$; $90\times20 =$ button , then GT button, then

$\div(50+60+90=200)$ button

$= 16.5$

Q.53. If in a moderately skewed distribution the values of mode and mean are 32.1 and 35.4 respectively, then the value of the median is

(a) 33.3 (b) 34
(c) 34.3 (d) 33

[Nov. 2018]

Solution : (c)

$M_o = 3M - 2\bar{X}$

or $32.1 = 3M - 2\times35.4$

or $M = \frac{32.1+70.8}{3} = 34.3$

Q.54. The median of the data 5, 6, 7, 7, 8, 9, 10, 11, 11, 12, 15, 18, 18 and 19 is

(a) 10 (b) 10.5
(c) 11.5 (d) 11

[Nov. 2018]

Solution : (b) M_e = Average of middle two observations , if N = even No. of obs.

$$M_e = \frac{10+11}{2} = 10.5$$

Q.55. The means of 20 items of a data is 5 and if each item is multiplied by 3, then the new mean will be

(a) 20 (b) 5
(c) 15 (d) 10

[Nov. 2018]

Solution : (c)

New Mean = $5\times3 = 15$

Q.56. The Geometric mean of 3, 6, 24 and 48 is

(a) 6 (b) 8
(c) 12 (d) 24

[Nov. 2018]

Solution : (c)

$GM = \sqrt[4]{3\times6\times24\times48} = 12$

Q.57. The Algebraic sum of the deviation of a set of values from their arithmetic mean is

(a) >0 (b) =0
(c) <0 (d) None

[Nov. 2018]

Solution : (b)

Q.58. Which one of the following is not a central tendency ?

(a) Mean Deviation
(b) Arithmetic mean
(c) Median
(d) Mode

[Nov. 2018]

Solution : (a)

Q.59. The AM of 15 Observations is 9 and the AM of first 9 Observation is 11 and then AM of remaining Observation is

(*a*) 11 (*b*) 6
(*c*) 5 (*d*) 9

[June 2019]

Solution : (*b*)

Sum of remaining 6 observations =
Sum of 15 observations -
Sum of 9 observations
$= 9\times15 - 11\times9 = 135 - 99 = 36$

Average of 6 observations $= \frac{36}{6} = 6$

Q.60. In a moderately Skewed distribution the values of mean & median are 12 & 8 respectively. The value of mode is

(*a*) 0 (*b*) 12
(*c*) 15 (*d*) 30

[June 2019]

Solution : (*a*)

Mode = 3 Median - 2 Mean
$= 3\times8 - 2\times12 = 24 - 24 = 0$

Q.61. Which of the following is positional average ?

(*a*) Median (*b*) GM
(*c*) HM (*d*) AM

[June 2019]

Solution : (*a*)

Q.62. For a symmetric distribution

(*a*) Mean = Median = Mode
(*b*) Mode = 3 Median - 2 Mean
(*c*) Mode $= \frac{1}{3}$ Median $= \frac{1}{2}$ Mean
(*d*) None

[June 2019]

Solution : (*a*)

(*a*) For a symmetric distribution Mean = Median = Mode

Q.63. For the distribution

X	1	2	3	4	5	6
f	6	9	10	14	12	8

The value of median is

(*a*) 3.5 (*b*) 3 (*c*) 4 (*d*) 5

[June 2019]

Solution : (*c*)

x	1	2	3	4	5	6
f	6	9	10	14	12	8
C.F	6	15	25	39	51	59

N = 59

Median (Me) = The observation having cumulative frequency just equal to or just greater than $\left(\frac{N+1}{2}\right)^{th}$ term $= \left(\frac{59+1}{2}\right)^{th}$ term

= 30th term = 4

Q.64. $\sum_{i=1}^{n}(x-\bar{x}) = ?$

(*a*) 1 (*b*) 0 (*c*) -1 (*d*) None of these

[Dec. 2019]

Solution : (*b*)

The algebraic sum of deviations of all observations from mean is always equal to ZERO.

Q.65. The median of the following frequency distribution is equal to

X :	5	7	9	12	14	17	19	21
Y :	6	5	3	6	5	3	2	4

(*a*) 6 (*b*) 12 (*c*) 13 (*d*) 14

[Dec. 2019]

Solution : (*b*)

Ascending order

X	5	7	9	12	14	17	19	21
Y i.e. "f".	6	5	3	6	5	3	2	4
c.f.	6	11	14	20	25	28	30	34

N = 34

$M_e = \frac{N+1}{2} = \frac{34+1}{2} = 17.5^{th}$ obs.

$= 17^{th}$ obs. + 0.5 (18^{th} obs. - 17^{th} obs.)

= 12 + 0.5 (12 - 12)

= 12

Q.66. Find median from the following data:

Marks	0-10	10-30	30-60	60-80	80-90
No. of students	5	15	30	8	2

(*a*) 8 (*b*) 30 (*c*) 40 (*d*) 45

[Dec. 2019]

Solution : (*c*)

C.I	0-10	10-30	30-60	60-80	80-90
f	5	15	30	8	2
c.f.	5	20	50	58	60

N= $\sum f = 60$.

$\frac{N}{2} = \frac{60}{2} = 30$

∴ Median - Class = The class-interval having cumulative frequency just equal to or greater than $\frac{N}{2} = 30$ is 30 - 60

∴ $f = 30$; $c = 20$; $i = 30$.

$M_e = L + \frac{N/2 - C}{f} \times i$

$= 30 + \frac{30-20}{30} \times 30$

$= 30 + 10 = 40$

Q.67. Find the mode from the following data:

Class:	3-6	6-9	9-12	12-15	15-18	18-21	21-24
Frequency	2	5	10	23	21	12	3

(*a*) 23 (*b*) 13.3 (*c*) 12.6 (*d*) 14.6

[Dec. 2019]

Solution : (*d*)

Clearly model - class = 12-15 because its frequency is highest.

∴ $f_0 = 23$; $f_{-1} = 10$; $f_{+1} = 21$

∴ $\Delta_1 = f_0 - f_{-1} = 23 - 10 = 13$

$\Delta_2 = f_0 - f_{+1} = 23 - 21 = 2$

Formula

$M_0 = L + \frac{\Delta_1}{\Delta_1 + \Delta_2} \times i$

$= 12 + \frac{13}{13+2} \times 3$

$= 12 + \frac{13}{5} = 12 + 2.6$

= 14.6

Q.68. Find the mode of the following distribution?

Class:	0-7	7-14	14-21	21-28	28-35	35-42	42-49
Frequency	19	25	36	72	51	43	28

(*a*) 24.3 (*b*) 25.4 (*c*) 72 (*d*) 21

[Dec. 2019]

Solution : (*b*)

Model - Class = 21 - 28

because its frequency is highest.

So; $f_0 = 72$; $f_{-1} = 36$; $f_{+1} = 51$.

$\Delta_1 = f_0 - f_{-1} = 72 - 36 = 36$

$\Delta_2 = f_0 - f_{+1} = 72 - 51 = 21$.

∴ $M_0 = L + \frac{\Delta_1}{\Delta_1 + \Delta_2} \times i$

$= 21 + \frac{36}{36+21} \times 7$

= 25.4

Q.69. The arithmetic mean of two numbers is 30 and geometric mean is 24 find the two number

(*a*) 12 and 48 (*b*) 14 and 46 (*c*) 10 and 50 (*d*) 16 and 44

[Dec. 2019]

Solution : (*a*)

Trick s: GBC

Let (*a*) 12 ; 48 is correct.

∴ AM $= \frac{12+48}{2} = 30$ (True)

GM $= \sqrt{12\times48} = \sqrt{576} = 24$ (Also True)

So; (*a*) is correct.

Q.70. Sum of the squares of deviations is minimum when deviations are taken from

(a) Mean (b) Median
(c) Mode (d) An arbitrary value

[Dec. 2019]

Solution : (a)

$\because \Sigma(X-\overline{X})^2 \le \Sigma(X-M_e)^2$

Q.71. Given the weights for the numbers 1, 2, 3,.....n are respectively 1^2, 2^2, 3^2,....., n^2. Then weighted HM is.....

(a) $\frac{2n+1}{2}$ (b) $\frac{2n+1}{6}$ (c) $\frac{2n+1}{3}$ (d) $\frac{2n+1}{2}$

[Dec. 2020]

Solution : Tricks for 1st observation HM = 1

(No need of its Weight)

For n = 2 ⇒ For 1st two observation

X	W	W/X
1	$1^2=1$	1
2	$2^2=4$	2
	$\Sigma W = 5$	$\frac{W}{X}=3$

$HW = \frac{\sum W}{\sum(W/X)} = \frac{5}{3}$

Now GBC

(a) $HW = \frac{2n+1}{4} \Rightarrow$ if $n=1 \Rightarrow HW = \frac{2\times1+1}{4} \neq 1$.

∴ (a) is False

(b) $n=1 \Rightarrow HW = \frac{2\times1+1}{6} \neq 1$.

∴ (b) is also False.

(c) for $n=1 \Rightarrow HW = \frac{2\times1+1}{3} = 1$ (True)

for $n=2 \Rightarrow HW = \frac{2\times2+1}{3} = \frac{5}{3}$ (True also)

(c) is correct

Q.72. Which measure is suitable for open - end classification?

(a) Median (b) Mean (c) Mode (d) GM

[Dec. 2020]

Solution : (a) is Correct.

Q.73. 50th percentile is equal to

(a) Median (b) Mode (c) Mean (d) None

[Dec. 2020]

Solution : $P_{50} = Me = Q_2 = D_5$

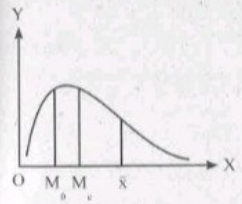
∴ (a) is correct.

Q.74. For a distribution Mean, Median and Mode are 23, 24 and 25.5 respectively, then it is most likely.....skewed distribution

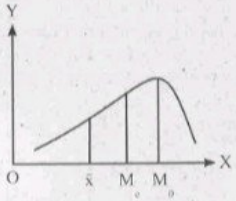
(a) Positively (b) Symmetrical (c) Asymptotically (d) Negatively

[Dec. 2020]

Solution : $\overline{x} = 23$; Me = 24, $M_o = 25.5$



(i) Positively Skewed



(ii) Negatively Skewed

Clearly This is Negatively Skewed.

(d) is correct.

Q.75. If any two numbers are in AP, then GM^2 =.....

(a) AM x HM (b) AM + HM (c) M x Z (d) AM x M

[Dec. 2020]

Solution : (a)

$G^2 = AH$

$\Rightarrow GM^2 = AM \times HM$

= (Arithmetic Mean) (Harmonic Mean)

Q.76. Two values yielded an arithmetic mean of 24 and a harmonic mean of 6. The geometric mean of these values is.....

(a) 8 (b) 12 (c) 14 (d) 16

[Dec. 2020]

Solution : AM = 24

HM = 6

$GM = \sqrt{AM \times HM} = \sqrt{24\times6}$

= 12

(b) is correct

Q.77. The HM of A and B is $\frac{1}{3}$ and HM of C and D is $\frac{1}{5}$. Then HM of A, B, C and D is .....

(a) $\frac{8}{15}$ (b) $\frac{1}{4}$ (c) $\frac{15}{8}$ (d) $\frac{4}{15}$

[Dec. 2020]

Solution : A & B Means two observations ⇒ $N_1 = 2$

(b) $H_1 = \frac{1}{3}$

C &D Means two observations ⇒ $N_2 = 2$

and $H_2 = \frac{1}{5}$

HM of A,B,C &D means combined

HM of A & B and C & D

$= \frac{N_1+N_2}{\frac{N_1}{H_1}+\frac{N_2}{H_2}} = \frac{2+2}{\frac{2}{\frac{1}{3}}+\frac{2}{\frac{1}{5}}} = \frac{4}{2\times3+2\times5} = \frac{4}{16} = \frac{1}{4}$

∴ (b) is correct.

Q.78. Which one of these is least affected by extreme values?

(a) Mean (b) Median
(c) Mode (d) None

[Dec. 2020]

Solution : (c)

AM; GM; HM are more affected by extreme values. Median is not affected by extreme values. Mode is least affected by extreme values.

Q.79. A fire engine rushes to a place of fire accident with a speed of 110 kmph and after the completion of operation returned to the base at a speed of 35 kmph. The average speed per hour in per direction is obtained as ..... of those speeds.

(a) Speed Avg. of (b) HM of
(c) GM of (d) Half of HM of

[Dec. 2020]

Solution : (b)

Up & Down Distances are same. Speeds different.

Average speed = H.M. of those speeds.

$= \frac{1+1}{\frac{1}{110}+\frac{1}{35}} = 53.1$ kmph.

Q.80. Ten matches data is given. Then which of the following cannot be found?

(a) Least Score (b) Highest Score
(c) Best Score (d) Median Score

[Dec. 2020]

Solution : Ten Matches data are given; means Lowest and highest scores are given. Their Median can be obtained. The data has equal frequency, So its Mode cannot be obtained. It means Best Score cannot be obtained.

So, (c) is correct.

Q.81. If the AM and HM of two numbers are 6 and 9 respectively, then GM is.....

(a) 7.35 (b) 8.5
(c) 6.75 (d) None

[Dec. 2020]

Solution : AM=6; HM=9

AM ≥ GM ≥ HM. (Always)

Here AM < HM

Hence data is not perfect.

So, its GM cannot be determined. (d) is correct.

Q.82. From the record on sizes of shoes sold in a shop, one can compute the following to determine the most preferred shoe size.

(a) Mean (b) Median
(c) Mode (d) Range

[Jan. 2021]

Solution : (c) Most preferred shoe size in sale, means most frequent. So, mode is suitable.

Q.83. Which of the following measure does not possess mathematical properties?

(a) Arithmetic mean
(b) Geometric mean

(c) Harmonic mean
(d) Median

[Jan. 2021]

Solution : (d) Median.

Q.84. If $y = 3 + (4.5)x$ and the mode for x-value is 20, then the mode for y-value is

(a) 3.225 (b) 12
(c) 24.5 (d) 93

[Jan. 2021]

Solution : (d) is correct.

$$Y = 3 + (4.5)\,x$$
$$\text{Mode } (Y) = 3 + 4.5 \times \text{Mode } (x)$$
$$= 3 + 4.5 \times 20$$
$$= 3 + 90 = 93$$

Q.85. If there are two groups with n_1 with n_2 observations and H_1 and H_2 are respective harmonic means, then the harmonic mean of combined observation is

(a) $\dfrac{n_1H_1 + n_2H_2}{n_1 + n_2}$

(b) $\dfrac{n_1H_1 + n_2H_2}{H_1 + H_2}$

(c) $\dfrac{n_1 + n_2}{n_1H_1 + n_2H_2}$

(d) $\dfrac{(n_1 + n_2)H_1 + H_2}{n_1H_2 + n_2H_1}$

[Jan. 2021]

Solution : (d) is correct

$$\text{Combined H.M} = \frac{n_1 + n_2}{\frac{n_1}{H_1} + \frac{n_2}{H_2}}$$

$$= \frac{n_1 + n_2}{\left(\frac{n_1H_2 + n_2H_1}{H_1H_2}\right)} = \frac{(n_1 + n_2)(H_1H_2)}{n_1H_2 + n_2H_1}$$

Q.86. Expenditures of a Company (in Million Rupees) per item in various Years

Years	Item of Expenditures				
	Salary	Fuel and Transport	Bonus	Interest on Loans	Taxes
1998	288	98	3.00	23.4	83
1999	342	112	2.52	32.5	108
2000	324	101	3.84	41.6	74
2001	336	133	3.68	36.4	88
2002	420	142	3.96	49.4	98

What is the average amount of interest per year which the company had to pay during this period?

(a) 33.66 (b) 36.66 (c) 31.66 (d) 39.66

[July 2021]

Solution : (b) is correct

Average Amount of interest

$$= \frac{23{\cdot}4 + 32{\cdot}5 + 41{\cdot}6 + 36{\cdot}4 + 49{\cdot}4}{5}$$

$$= 36.66$$

Q.87. There are n numbers. When 50 is subtracted from each of these number the sum of the numbers so obtained is -10. When 46 is subtracted from each of the original n numbers, then the sum of numbers so obtained is 70. What is the mean of the original n numbers?

(a) 56.8 (b) 25.7 (c) 49.5 (d) 53.8

[July 2021]

Solution : (c) is correct.

From 1st condition

$$\bar{X} = 50 + \frac{\sum(X - 50)}{n} = 50 + \frac{10}{n}$$

$$= 50 - \frac{10}{n}$$

From 2nd condition

$$\bar{X} = 46 + \frac{\sum(X - 46)}{n}$$

$$= 46 + \frac{70}{n}$$

From 1st

$$50 - \frac{10}{n} = 46 + \frac{70}{n}$$

or; $$4 = \frac{10}{n} + \frac{70}{n}$$

or $$4 = 80 \quad \Rightarrow \quad n = 20$$

$\therefore$ **mean** $= \bar{X} = 50 - \frac{10}{20} = 49.5$

Q.88. The mean of 'n' observation is 'X'. If K is added to each observation, then the new mean is _____

(a) X (b) XK
(c) X-K (d) X + K

[July 2021]

Solution : (d) is correct

old mean = X

If K is added to each observation

Then new mean = X + K

Q.89. If y = 3 + 1.9 x, and mode of x is 15, then the mode of y is:

(a) 15.9 (b) 27.8
(c) 35.7 (d) 31.5

[July 2021]

Solution : (d) is correct.

$$\text{Mode } (Y) = 3 + 1.9(15)$$
$$= 31.5$$

Q.90. If there are 3 observations 15, 20, 25 then the sum of deviation of the observations from their AM is

(a) 0 (b) 5
(c) −5 (d) 10

[Dec. 2021]

Solution : (a)

Because sum of deviations of obs. from mean is always equal to zero.

$\therefore \Sigma\left(X - \bar{X}\right) = 0$

[Note : No need to solve]

Q.91. If the AM and GM for 10 observations are both 15, then the value of HM is

(a) less than 15
(b) more than 15
(c) 15
(d) cannot be determined

[Dec. 2021]

Solution : (c)

If AM = GM = 15

$\Rightarrow$ AM = GM = HM = 15

Q.92. If average mark for a group of 30 girls is 80, a group of boys is 70 and combined average is 76, then how many are in the boy's group ?

(a) 21 (b) 20
(c) 22 (d) 19

[Dec. 2021]

Solution : (b)

Tricks : Go by choices (GBC)

$$\overline{x_{12}} = \frac{N_1\bar{X}_1 + N_2\bar{X}_2}{N_1 + N_2}$$

$$= \frac{30 \times 80 + 20 \times 70}{30 + 20}$$

Calculator Work

30×80 = button

20×70 = button GT button (Press)

÷ 50 = button

we get 76.

$\therefore$ (b) is correct.

Q.93. If two variables *a* and *b* are related by $c = ab$ then G.M. of *c* is equal to

(a) G.M. of *a* + G.M. of *b*
(b) G.M. of *a* × G.M. of *b*
(c) G.M. of *a* − G.M. of *b*
(d) G.M. of *a* / G.M. of *b*]

[Dec. 2021]

Solution : (b)

GM(C) = GM(ab)

= GM(a). GM(b)

Q.94. For a moderately skewed distribution the median is twice the mean, then the mode is _____ times the median.

(a) 3 (b) 2
(c) 2/3 (d) 3/2

[Dec. 2021]

Solution : (b)

$\because$ Median = $2\bar{X}$

$M_o = 3M - 2\bar{X}$

$= 3 \times 2\bar{X} - 2\bar{X} = 4\bar{X}$

$= 2 \times 2\bar{X}$

= 2 Median

Q.95. The median value of the set of observations 48, 36, 72, 87, 19, 66, 56, 91 is

(a) 53 (b) 87
(c) 61 (d) 19

[Dec. 2021]

Solution : (c)

Arranging in ascending order; we get

19, 36, 48, 56, 66, 72, 87, 91

$$\text{Median} = \frac{56 + 66}{2} = 61$$

Q.96. For a data having odd number of values, the difference between the first and the middle value is equal to the difference between the last and the middle value; similarly, the difference between the second and middle value is equal to that of second last and middle value so on. Therefore, the middle value is equal to

(a) Half of the range
(b) Half of standard deviation
(c) Mode
(d) Mean

[Dec. 2021]

Solution : (d)

Let us assume Nos. as

2, 3, 4, 5, 6 (odd No. of observations)

1st Condition

4–2 = 6–4

2 = 2 (True)

[Difference means Larger value – smaller value]

2nd condition

4–3 = 5–4 (Also True)

Clearly middle observation = 4

= Median or Mean (Here)

Median is not in option.

So Mean is Answer.

Q.97. One hundred participants expressed their opinion on recommending a new product to their friends using the attributes : most unlikely, unlikely, not sure, likely, most likely. The appropriate measure of central tendency that can be used here is

(a) Mean
(b) Mode

(c) Geometric mean
(d) Harmonic mean

[Dec. 2021]

Solution : (b)
Here, Quality is asked.
So mode is suitable

Q.98. Ogive curves cannot be used to determine
(a) Mean (b) Median
(c) Mode (d) Range

[Dec. 2021]

Solution : (d)
Ogive Curves means less than or more than cumulative frequency curve. Here, it is difficult to find Largest or smallest observations So, Range cannot be determined

Q.99. Along a road there are 5 buildings of apartments, marked as 1, 2, 3, 4, 5. Number of people residing in each building is available. A bus stop is to be setup near one of the buildings so that the total distance walked by the residents to the bus stop from their buildings must be kept minimum. One must consider involving _____ to find the position of the bus stop.
(a) Mean (b) Median
(c) Mode (d) Weighted mean

[Dec. 2021]

Solution : (b)

Q.100. Given that mean = 70.20 and mode = 70.50, the median is expected to be
(a) 70.15 (b) 70.20
(c) 7.30 (d) 70.35

[Dec. 2021]

Solution : (c)

$M_o = 3M - 2\bar{X}$

$70.50 = 3M - 2 \times 70.20$

or $3M = 70.50 + 140.40$

$= 210.9$

or $M = \frac{210.9}{3} = 70.30$

Q.101. _____Mean is calculated, when the values in series do not have equal importance.
(a) Arithmetic (b) Harmonic
(c) Geometric (d) Weighted

[June 2022]

Solution : (d)
When observations have not equal importance than weighted Mean is used.

Q.102. A seller of pearls kept the pearls in seven boxes labelled from one to seven. At the end of a day, he found that J labelled box contained J pearls, the average number of pearls per box is
(a) 4 (b) 6.5
(c) 7.5 (d) 8

[June 2022]

Solution : In J^{th} box has of J No. of pearls.
∴ No. of Pearls contained from 1 to 7 boxes are 1, 2, 3, 4, 5, 6, 7
∴ A. M. = Average

$= \frac{1+2+3+4+5+6+7}{7} = 4$

∴ (a) is correct

Q.103. The Mean of 100 students was 45. Later on, it was discovered that the marks of two students were misread as 85 and 54 instead of 58 and 45. Find out the correct mean.
(a) 68 (b) 36 (c) 44.64 (d) 52

[June 2022]

Solution :
Tricks

$\text{Correct Mean} = \left(\frac{\text{N . Incorrect Mean} - \text{Incorrect obs.} + \text{correct obs.}}{\text{N}}\right)$

$= \frac{100 \times 45 - 85 - 54 + 58 + 45}{100}$

$= 44.64$

∴ (c) is correct.

Q.104. Calculate the value of 3rd quartile from the following data 40, 35, 51, 30, 21, 25, 16, 29, 27, 32.
(a) 36.25 (b) 30.25
(c) 25 (d) 35

[June 2022]

Solution : Arranging observations in ascending order, we get
16, 21, 25, 27, 29, 30, 32, 35, 40, 51
Here N = 10

$Q_3 = 3\left(\frac{N+1}{4}\right)^{th}$ observation

$= 3\left(\frac{10+1}{4}\right) = 8.25^{th}$ observation

$= 8^{th}$ obs. $+ 0.25\ (9^{th} - 8^{th}$ obs.)
$= 35 + 0.25\ (40 - 35)$
$= 36.25$
∴ (a) is correct

Q.105. If mean $(\bar{X})$ is = 10 and mode (Z) is = 7, then find out the value of median (M).
(a) 9 (b) 17
(c) 3 (d) 4.33

[Dec. 2022]

Solution: *Given :*
Mean = $\bar{X} = 10$; Mode = $Z = 7$
Formula :
$M_o = 3M_e - 2\bar{X}$
or
$7 = 3M_e - 2 \times 10$
or $3M_e = 27$ ∴ $M_e = 9$
∴ (a) is correct

Q.106. _____ is based on all the observations and _____ is based on the central fifty per cent of the observations.
(a) Mean deviation, Range
(b) Mean deviation, quartile deviation

(c) Range, standard deviation
(d) Quartile deviation, standard deviation

[Dec. 2022]

Solution : (b)

Q.107. The relationship between two variables x and y is given by 4x – 10y = 20. If the median value of the variable x is 10 then what is median value of variable y?
(a) 1.0 (b) 2.0
(c) 3.0 (d) 4.0

[Dec. 2022]

Solution : *Given :*
$4x - 10y = 20$
and Me $(x) = 10$; ∴ Me $(y) = ?$
$\therefore 4 \times 10 - 10$ Me $(y) = 20$
or; $40 - 20 = 10$ Me (y)
or; $20 = 10$ Me (y)
Me $(y) = 2$
∴ (b) is correct.

Q.108. The median of the observations 42, 72, 35, 92, 67, 85, 72, 81, 51, 56 is
(a) 69.5 (b) 72
(c) 64 (d) 61.5

[Dec. 2022]

Solution: Arranging in ascending order ;
We get
35, 42, 51, 56, 67, 72, 72, 81, 85, 92
N = 10 (Even No.)
Median = Me = Average of middle two observations

$= \frac{67+72}{2} = \frac{139}{2} = 69.5$

(a) is correct

Q.109. The mean of 50 observations is 36. If two observations 30 and 42 are to be excluded, than the mean of the remaining observations will be:
(a) 36 (b) 38
(c) 48 (d) 50

[Dec. 2022]

Solution: Mean of rest observations

$= \frac{N\bar{x} - \text{Excluded observation}}{N - \text{No. of observations removed}}$

$= \frac{50 \times 36 - 30 - 42}{50 - 2} = 36$

∴ (a) is correct

Q.110. If Arithmetic Mean and Geometric Mean between two numbers are 5 and 4 respectively, then these numbers are
(a) 2 & 3 (b) 2 & 8
(c) 4 & 6 (d) 1 & 16

[Dec. 2022]

Solution: *Given:* Arithmetic mean = 5
and Geometric mean = 4
Tricks: Go by choices
(b) 2; 8

$A.M = \frac{2+8}{2} = 5$ (True)

and $GM = \sqrt{2 \times 8} = 4$ (Also is True)

∴ (b) is correct

Q.111. If Arithmetic between two numbers is 5 and Geometric mean is 4 then what is the value of Harmonic mean?
(a) 3.2 (b) 3.4
(c) 3.5 (d) 3.6

[Dec. 2022]

Solution: $HM = \frac{G^2}{A}$

$= \frac{4^2}{5}$

$= 3.2$

∴ Option (a) is correct.

Q.112. The average age of 15 students in a class is 9 years. Out of them, the average age of 5 students is 13 years and that of 8 students is 5 years. What is the average of remaining 2 students?
(a) 5 years (b) 9 years
(c) 10 years (d) 15 years

[Dec. 2022]

Solution : Total age = N. $\bar{x} = 15 \times 9 = 135$
Total age of 5 students $= 5 \times 13 = 65$
Total age of 8 students $= 8 \times 5 = 40$
∴ Age of rest 2 students $= 135\text{-}65\text{-}40 = 30$
∴ Av. age of rest 2 students $= 30/2 = 15$
∴ option (d) is correct.

Q.113. A Professor has given assignment to students in a Statistics class. A student Jagan computes the arithmetic mean and standard deviation for a set of 100 observations as 50 and 5 respectively. Later on, Sonali points out to Jagan that he has made a mistake in taking one observation as 100 instead of 50. What would be the correct mean if the wrong observation is corrected?
(a) 50.5 (b) 49.9
(c) 49.5 (d) 50.1

Solution:
Given

$\left.\begin{matrix} N = 100; \bar{X} = 50 \\ S.D. = 5 \end{matrix}\right]$ Incorrect

Incorrect Observation = 100
Correct Observation = 50
∴ Correct Mean

$= \frac{100 \times 50 - 100 + 50}{100}$

$= 49.5$

∴ (c) is correct.

Q.114. Find the mean of the following data:

Class Interval	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	9	13	6	4	6	2	3

(a) 23.7 (b) 35.7 (c) 39.7 (d) 43.7

Solution :

Note :– No need to make this table. Do it directly on Calculator.

Class-Interval	Mid Value (X)	Frequency (f)	fx
10 - 20	15	9	
20 - 30	25	13	
30 - 40	35	6	
40 - 50	45	4	
50 - 60	55	6	
60 - 70	65	2	
70 - 80	75	3	

$\Sigma f = 43$

$$\overline{X} = \frac{\sum fx}{\sum f}$$

Calculator Tricks

Press $15 \times 9 =$ button

$25 \times 13 =$ "

$35 \times 6 =$ "

$45 \times 4 =$ "

$55 \times 6 =$ "

$65 \times 2 =$ "

$70 \times 3 =$ " Then

Press GT button Then ÷ 43 = button; we get 35.697 ≈ 35.7

∴ (*b*) is correct.

Q.115. The Median of the following set of observations 24, 18, 36, 42, 30, 28, 21, 29, 25, 33 is:

(*a*) 26.5 (*b*) 27.5

(*c*) 28.5 (*d*) 29.5

Solution :

Arranging all observations in ascending order; we get

18, 21, 24, 25, 28, 29, 30, 33, 36, 42

Here N = 10 observations (Even)

∴ Median = A.M. of middle two observations

$= \frac{28+29}{2} = 28.5$

(*c*) is correct.

Q.116. Find the mode of the following data:

X	25-30	30-35	35-40	40-45	45-50	50-55
f(*x*)	20	53	42	42	41	43

(*a*) 31.75 (*b*) 30.75

(*c*) 33.75 (*d*) 35.75

Solution :

Here Modal-Class = 30 – 35

(Because highest frequency lie in this Class-Interval)

i = 5

And $f_o = 53$; $f_{-1} = 20$; $f_{+1} = 42$

$\Delta_1 = f_o - f_{-1} = 53 - 20 = 33$

$\Delta_2 = f_o - f_{+1} = 53 - 42 = 11$

$\therefore M_O = L + \frac{\Delta_i}{\Delta_1 + \Delta_2} \times i$

$= 30 + \frac{33}{33+11} \times 5$

$= 33.75$

∴ (*c*) is correct.

Q.117. For a moderately skewed distribution of marks in statistics for a group of 200 students, the mean marks and median marks were found to be 55.60 and 52.40, respectively. What are the modal marks?

(*a*) 54.43 (*b*) 48

(*c*) 53.56 (*d*) 46

Solution : Given

$\overline{X} = 55.60$; $M_e = 52.40$

$M_O = 3M_e - 2\overline{X}$

$= 3 \times 52.40 - 2 \times 55.60$

$= 46$

∴ (*d*) is correct.

Q.118. For a given data set: 5, 10, 3, 6, 4, 8, 9, 3, 15, 2, 9, 4, 19, 11, 4: what is the median?

(*a*) 8 (*b*) 6

(*c*) 4 (*d*) 9

Solution : Arranging in ascending order. We get

2, 3, 3, 4, 4, 4, 5, 6, 8, 9, 9, 10, 11, 15, 19.

N = 15

$\text{Median} = \frac{N+1}{2} = \frac{15+1}{2} = 8\text{th obs.}$

$= 6$

∴ (*b*) is correct.

Q.119. If the mean of two numbers is 30 and geometric mean is 24, then what will be the Harmonic mean of two numbers?

(*a*) 19.2 (*b*) 21.8

(*c*) 22.3 (*d*) 18.4

Solution : Given

A = 30; G = 24

$\therefore H = \frac{G^2}{A} = \frac{24^2}{30} = 19.2$

(*a*) is correct.

Q.120. The Geometric Mean of 3, 7, 11, 15, 24, 28, 30, 0 is:

(*a*) 6 (*b*) 0

(*c*) 9 (*d*) 12

Solution : If at least one observation of the data is Zero(0).

Then Geometric Mean is Not possible.

No option should be the Answer.

But as per formula

$= (3 \times 7 \times 11 \times 15 \times 24 \times 28 \times 30 \times 0)^{1/8}$

$= 0$

∴ (*b*) should be selected.

22 CHAPTER MEASURES OF DISPERSION

PAST EXAM QUESTIONS WITH SOLUTIONS (MEMORY BASED)

Q.1. The variance of data : 3, 4, 5, 8 is

(*a*) 4.5 (*b*) 3.5 (*c*) 5.5 (*d*) 6.5

[Dec. 2010]

Solution : (*b*) X : 3, 4, 5, 8

$\sum X = 20$; $\sum X^2 = 9 + 16 + 25 + 64 = 114$

$\text{variance} = \frac{\sum X^2}{n} - \left(\frac{\sum X}{n}\right)^2$

$= \frac{114}{4} - 25 = 3.5$

Q.2. Given the observations: 4, 9, 11, 14, 37. The Mean deviation about the Median is

(*a*) 11 (*b*) 8.5

(*c*) 7.6 (*d*) 7.45

[Dec. 2010]

Solution : (*c*) 4, 9, 11, 14, 37

Median = Middle obs. = 11

X	$\lvert d\rvert = \lvert x - 11\rvert$
4	7
9	2
11	0
14	3
37	26

$\sum \lvert d\rvert = 38$

Mean deviation about median

$\text{M.D.} = \frac{\sum \lvert d\rvert}{n} = \frac{38}{5} = 7.6$

Q.3. If all observations in a distribution are increased by 6, then the variance of the series will be _____.

(*a*) Increased (*b*) Decreased

(*c*) Unchanged (*d*) None of these

[Dec. 2010]

Solution : (*c*) RULE :- SD does not w.r.t. origin.

So; Variance will also remain unchanged.

Q.4. The standard deviation of the weights (in kg.) of the student of a class of 50 students was calculated to be 4.5 kg. Later on it was found that due to some fault in weighing machine, the weight of each student was under measured by 0.5 kg. The Correct standard deviation of the weight will be:

(*a*) Less than 4.5

(*b*) Greater than 4.5

(*c*) Equal to 4.5

(*d*) Cannot be determined

[Dec. 2011]

Solution : (*c*)

RULE :- S.D remains unaffected due to a change of origin but changes with respect to scale.

So, correct S.D. of 50 students = 4.5

Q.5. For Normal distribution the relation between Quartile Deviation (Q.D.) and Standard Deviation (S.D.) is

(*a*) Q.D > S.D

(*b*) Q.D < SD

(*c*) Q.D = S.D

(*d*) None of the above

[Dec. 2011]

Solution : (*b*) Since; $Q.D = \frac{2}{3}$

$S.D \Rightarrow Q.D < S.D$

Q.6. If standard deviation of first 'n' natural numbers is 2 then the value of 'n' is

(*a*) 10 (*b*) 7

(*c*) 6 (*d*) 5

[June 2010]

Solution : (*b*) S.D. of 1st .n. natural Numbers

$= \sqrt{\frac{n^2-1}{12}}$

$\frac{2}{1} = \sqrt{\frac{n^2-1}{12}}$, OR, $4 = \frac{n^2-1}{12}$

OR, $n^2 - 1 = 48$

OR, $n^2 = 49 \Rightarrow n = 7$

TRICKS : Go by choices.

Q.7. The standard deviation is independent of change of

(*a*) Scale

(*b*) Origin

(*c*) Both origin and scale

(*d*) None of these

[June 2010]

Solution : (*b*)

Q.8. If Standard deviation of X is σ, then Standard deviation of $\frac{ax+b}{c}$, where a, b and c are arbitrary constants, will be

(*a*) σ (*b*) $\frac{a\sigma+b}{c}$

(*c*) $\frac{a}{c}\sigma$ (*d*) $\left|\frac{a}{c}\right|\sigma$

[Dec. 2012]

Solution : (*d*) S.D. of $X = \sigma$

Let $y = \frac{ax+b}{c} = \frac{ax}{c} + \frac{b}{c}$

S.D. of $y = \left|\frac{a}{c}\right|$ S.D. of $x = \left|\frac{a}{c}\right|\sigma$

Q.9. Which of the following measures of dispersion is used for calculating the consistency between two series?

(*a*) Quartile deviation

(*b*) Standard Deviation

(*c*) Coefficient of variation

(*d*) None of them

[Dec. 2012]

Solution : (*c*)

Coefficient of variation (CV) is used for calculating the consistency between two series.

Q.10. $\sum x^2 = 3390, n = 30, \sigma = 7$; **then** $\overline{X} =$ ____

(*a*) 113 (*b*) 210 (*c*) 8 (*d*) None

[June 2013]

Solution : (*c*) is correct

$\because \sigma^2 = \frac{\sum X^2}{N} - (\overline{X})^2$

or $49 = \frac{3390}{30} - (\overline{X})^2$

or $(X)^2 = 113 - 49 = 64$

$\therefore \overline{X} = 8$

Q.11. If the mean of frequency distribution is 100 and coefficient of variation is 45% then standard deviation is_____

(*a*) 45

(*b*) 0.45

(*c*) 0.045

(*d*) None

[June 2013]

Solution : (*a*) is correct

$C.V. = \frac{\sigma}{\overline{X}} \times 100$

or, $45 = \frac{\sigma}{100} \times 100$, $\sigma = 45$

Q.12. If Arithmetic Mean= $\frac{8+4}{2}$ then variance is

(*a*) 2 (*b*) 6

(*c*) 1 (*d*) 4

[Dec. 2013]

Solution : (*d*) is correct

Arithmetic mean $= \frac{8+4}{2}$

$\therefore$ Numbers are 8;4

$\therefore$ SD of 8 & 4 $= \frac{1}{2}|8-4| = 2$

Variance = $SD^2 = 4$

Q.13. Coefficient of mean deviation about mean for the first 9 natural numbers is:

(*a*) $\frac{200}{9}$

(*b*) 80

(*c*) $\frac{400}{9}$

(*d*) 50

[Dec. 2013]

Solution : (*c*) is correct

X	$\lvert X - \overline{X} \rvert$
1	4
2	3
3	2
4	1
5	0
6	1
7	2
8	3
9	4

$\overline{X} = 5$ $\sum |X - \overline{X}| = 20$

$MD = \frac{\sum |X - \overline{X}|}{N} = \frac{20}{9}$

Coefficient of $MD = \frac{MD}{\overline{X}} \times 100$

$= \frac{20 \times 100}{9 \times 5} = \frac{400}{9}$

Q.14. Mean = 5, S.D = 2.6, Median = 5, Q.D = 1.5 then coefficient of Q.D is:

(*a*) 35 (*b*) 39

(*c*) 30 (*d*) 32

[Dec. 2013]

Solution : (*c*) is correct

$\because$ Mean = Median = 5

$\therefore$ Data is symmetrical

$\therefore M = \frac{Q_3 + Q_1}{2} = 5$

$\therefore Q_3 + Q_1 = 10$

Coefficient of $QD = \frac{Q_3 - Q_1}{Q_3 + Q_1} \times 100$

$= \frac{2 \times QD}{Q_3 + Q_1} \times 100 = \frac{2 \times 1.5}{10} \times 100$

$= 30.$

Q.15. The difference between maximum and minimum value of the data is known as:

(*a*) Range (*b*) Size

(*c*) Width (*d*) Class

[Dec. 2013]

Solution : (*a*) Range = L-S.

Q.16. The formula for range of middle 50% items of a series is

(*a*) $Q_3 - Q_1$

(*b*) $Q_3 - Q_2$

(*c*) $Q_2 - Q_1$

(*d*) $\frac{Q_3 - Q_1}{2}$

[June 2014]

Solution : (*a*) is correct

Range of Middle 50% items

= Inter Quartile Range

$= Q_3 - Q_1$

Q.17. What will be the probable value of mean deviation? When $Q_3 = 40$ and $Q_1 = 15$

(*a*) 17.50

(*b*) 18.75

(*c*) 15.00

(*d*) None of the above

[June 2014]

Solution : (*c*) is correct

6QD = 5 MD = 4 SD

or $\frac{6.(Q_3 - Q_1)}{2} = 5MD$

or 3(40 – 15) = 5 MD

or MD = 15.00

Q.18. 1st quartile is 142 Semi-inter Quartile 18. Then median is

(*a*) 151 (*b*) 160

(*c*) 178 (*d*) None

[Dec. 2014]

Solution : (*b*) is correct.

$\therefore Q_1 = 142$

Semi-inter Quartile Range

$= QD = \frac{Q_3 - Q_1}{2} = 18$

$\therefore Q_3 - Q_1 = 36$

$Q_3 - 142 = 36$

$Q_3 = 142 + 36 = 178$

Median

$= M = \frac{Q_3 + Q_1}{2} = \frac{178 + 142}{2} = 160$

(Remember : Here it has assumed as symmetrical)

Q.19. Q.D is

(*a*) 2/3 .SD (*b*) 4/5 SD

(*c*) 5/6S.D (*d*) None

[Dec. 2014]

Solution : (*a*) is correct.

$\therefore$ 6QD = 5 MD = 4 SD

$QD = \frac{4}{6} SD = \frac{2}{3} SD$

Q.20. Co-efficient of QD is equal to_____

(*a*) $\frac{QD}{M} \times 100$ (*b*) $\frac{QD}{x} \times 100$

(*c*) $\frac{QD}{Z} \times 100$ (*d*) None

[June 2015]

Solution : (*a*) is correct.

Co-efficient of $QD = \frac{Q_3 - Q_1}{Q_3 + Q_1} \times 100$

$= \frac{\frac{Q_3 - Q_1}{2}}{\frac{Q_3 + Q_1}{2}} \times 100 = \frac{QD}{M} \times 100$

where $M = \frac{Q_3 + Q_1}{2}$ (Symmetrical)

Q.21. If every observation is increased by 5 then

(*a*) SD increases by 5

(*b*) MD increases by 5

(*c*) QD increases by 5

(*d*) None affected

[June 2015]

Solution : (*d*) is correct.

Rule : The value of QD; MD; SD; RANGE does not change with respect to the change of origin.

Q.22. The SD of X is known to be 10 then the SD of (5θ + 5 x) is

(a) 50 (b) 100
(c) 10 (d) 500

[June 2015]

Solution : SD of (50 + 5x)
= 5 × SD of x
= 5 × 10 = 50

Q.23. Find the range of 6,5,4,3,1, 3,6,10,8.

(a) 6 (b) 3
(c) 9 (d) 10

[Dec. 2015]

Solution : (c) is correct.
Range = L – S = 10 – 1 = 9

Q.24. Find the mean deviation about mean of 4, 5, 6, 8, 3:

(a) 7.2 (b) 5.2
(c) 1.44 (d) 1.70

[Dec. 2015]

Solution : (c) is correct.

X	$\lvert X-\bar{X}\rvert$
3	2.2
4	1.2
5	0.2
6	0.8
8	2.8
$\sum X = 26$	$\sum \lvert X-\bar{X}\rvert = 7.2$

$\bar{X} = \frac{26}{5} = 5.2$

$MD = \frac{\sum|X-\bar{X}|}{N} = \frac{7.2}{5} = 1.44$

Q.25. If V(x) = 23 Find variance of (2x+10:)

(a) 104 (b) 110
(c) 92 (d) 85

[Dec. 2015]

Solution : (c) is correct.

Var.(X) = $\sigma^2 = 23$; $\therefore \sigma = \sqrt{23}$

SD of $(2X+10) = 2.\sigma = 2\sqrt{23}$

Var. $(2X+10) = \left(2\sqrt{23}\right)^2 = 92$

Q.26. The average of 2 numbers is 20 and their standard deviation 5. Find the two numbers?

(a) 15, 25 (b) 30, 40
(c) 10,15 (d) None of these

[Dec. 2015]

Solution : (a) is correct.

Tricks : Go by choices. For option (a)

$AV. = \frac{15+25}{2} = 20$

$SD = \sigma = \frac{1}{2}|25-15| = 5$

It satisfy both conditions which are given in question.

Q.27. If Variance = 125.6, $\bar{X}$ = 40, coefficient of variation =

(a) 28.02 (b) 314
(c) 40.02 (d) None of these

[Dec. 2015]

Solution : (a) is correct.

$\sigma = \sqrt{125.6} = 11.21$

$C.V = \frac{\sigma}{\bar{X}} \times 100 = \frac{11.21}{40} \times 100 = 28.02$

Q.28. If same amount is added to or subtracted from all the values of the individual series then the standard deviation and variance both shall be

(a) Changed (b) Unchanged
(c) Same (d) None of these

[June 2016]

Solution : (b)

Since, SD does not change with respect to the change of origin. So, variance will also remain unchanged.

Q.29. The SD of first n natural numbers is _____

(a) $\sqrt{\frac{n^2-1}{12}}$ (b) $\sqrt{\frac{n(n+1)}{12}}$
(c) $\sqrt{\frac{n(n-1)}{6}}$ (d) None of these

[June 2016]

Solution : (a)

Q.30. If mean and coefficient of variation of the marks of n students is 20 and 80 respectively. What will be variance of them

(a) 256 (b) 16
(c) 25 (d) None of these

[June 2016]

Solution : (a)

Given $\bar{X} = 20$; C.V = 80%

$\therefore C.V. = \frac{\sigma}{\bar{X}} \times 100$

$\therefore 80 = \frac{\sigma}{20} \times 100$

$\therefore \sigma = \frac{80 \times 20}{100} = 16$

Variance $= \sigma^2 = 16^2 = 256$

Q.31. If AM and CV of a random variable X are 10 & 40 respectively, then the variance of $\left(-15+\frac{3x}{2}\right)$:

(a) 64 (b) 81 (c) 49 (d) 36

[June 2017]

Solution : (d) is correct.

Given; $\frac{\sigma}{10} \times 100 = 40$ $\therefore \sigma = 4$

$\therefore$ SD of $\left(-15+\frac{3}{2}x\right) = \frac{3}{2} \times SD(x) = \frac{3}{2} \times 4 = 6$

$\therefore$ Variance of $\left(-15+\frac{3}{2}x\right) = 6^2 = 36$

Q.32. Mean deviation is least when deviations are taken from:

(a) Mean (b) Median
(c) Mode (d) None of these

[Dec. 2017]

Solution : (b)

Q.33. Mean of a series is equal to 100, coefficient of variation is 45% then the S.D. is _____.

(a) 45 (b) 0.45
(c) 4.5 (d) 40.5

[June 2018]

Solution : (a)

$C.V. = \frac{\sigma}{\bar{X}} \times 100$

or $45 = \frac{\sigma}{100} \times 100$

$\sigma = 45$

Q.34. Coefficient of variation is a relative measure of _____ :

(a) Range
(b) Central Tendency
(c) Dispersion
(d) Q.D.

[June 2018]

Solution : (c)

Q.35. $\frac{(Q_3-Q_1)}{(Q_3+Q_1)}$ is known as

(a) Coefficient of Range
(b) Coefficient of Q.D.
(c) Coefficient of S.D.
(d) Coefficient of M.D.

[May 2018]

Solution : (b) Coefficient of Q.D. $= \frac{(Q_3-Q_1)}{(Q_3+Q_1)}$

Q.36. If the S.D. of the 1st n natural Nos. is $\sqrt{30}$, Then the value of n is

(a) 19 (b) 20
(c) 21 (d) None

[May 2018]

Solution : (a) **Tricks** : GBC
For (a)

$S.D = \sqrt{\frac{n^2-1}{12}} = \sqrt{\frac{19^2-1}{12}} = \sqrt{30}$

(true)

Q.37. If two random variables x and y are related by Y = 2 – 3X, then the SD of Y is given by

(a) –3 × SD of X
(b) 3 × SD of X
(c) 9 × SD of X
(d) 2 × SD of X

[May 2018]

Solution : (b)

S.D of y $(\sigma_y) = |b|$ S.D of X (σ_x)
$= |-3| . \sigma_x$
$= 3\sigma_x$

Q.38. If the variance of 5, 7, 9 and 11 is 4, then the coefficient of variation is

(a) 25 (b) 15
(c) 17 (d) 19

[Nov. 2018]

Solution : (a)

$\sigma^2 = 4 \Rightarrow \sigma = 2$

$\bar{X} = (5+7+9+11) \div 4 = 8$

$\therefore C.V = \frac{\sigma}{\bar{X}} \times 100 = \frac{2}{8} \times 100 = 25\%$

Q.39. Standard Deviation for the marks obtained by a student in monthly test in Mathematics (out of 50) as 30, 35, 25, 20, 15 is

(a) 25 (b) 50
(c) $\sqrt{50}$ (d) $\sqrt{30}$

[Nov. 2018]

Solution : (c)

X	X^2
30	900
35	1225
25	625
20	400
15	225
$\sum x$ = 125	$\sum x^2$ = 3375

Tricks : Use Calculator for direct calculation

$6 = \sqrt{\frac{\sum x^2}{N} - \left(\frac{\sum x}{N}\right)^2}$

$= \sqrt{\frac{3375}{5} - \left(\frac{125}{5}\right)^2}$

$= \sqrt{50}$

Q.40. If the standard deviation for the marks obtained by a student in monthly test is 36, then the variance is

(a) 36
(b) 6
(c) 1296
(d) None of the above

[Nov. 2018]

Solution : (c)

$\sigma = 36$

Variance $= \sigma^2 = 36^2 = 1296$.

Q41. Which one of the following is not a Central Tendency?

(a) Mean Deviation
(b) Arithmetic mean
(c) Median
(d) Mode

[Nov. 2018]

Solution : (a)

Q.42. If the range of a set of values is 65 and maximum value in the set is 83, then the minimum value in the set is

(a) 74
(b) 9
(c) 18
(d) None of the above

[Nov. 2018]

Solution : (c)

Range = L – S
65 = 83 – S
$\therefore$ S = 83 – 65 = 18

Q.43. If $\sigma^2 = 100$ and coefficient of variation = 20% then $\bar{X}$ =

(a) 60 (b) 70
(c) 80 (d) 50

[June 2019]

Solution : (*a*) If $\sigma^2 = 100$, So $\sigma = \sqrt{100} = 10$ C.V. $= \frac{S.D}{A.M} \times 100$

$20 = \frac{10}{X} \times 100$

$20X = 1000$; $\overline{X} = 50$

Q.44. If the points of inflexion of a Normal Curve are 40 and 60 respectively, then its mean deviation is

(*a*) 8 (*b*) 45

(*c*) 50 (*d*) 60

[June 2019]

Solution : (*a*)

If the point of inflexion of a Normal Distribution are 40 and 60.

Formula, $\mu - \sigma = 40$ .....(1)

$\mu + \sigma = 60$ .....(2)

Solving eqns. (1) and (2); we get

$\mu = 50$, $\sigma = 10$

Then M.D. $= 0.8.\sigma = 0.8 \times 10 = 8$

Q.45. Standard deviation is ___ times of $\sqrt{MD \times QD}$

(*a*) 2/3 (*b*) 4/5

(*c*) $\sqrt{\frac{15}{8}}$ (*d*) $\sqrt{\frac{8}{15}}$

[June 2019]

Solution : (*c*) We know that,

4 S.D = 5 M.D = 6 Q.D

Let, 4 S.D = 5 M.D = 6 Q.D

LCM of 4,5,6 = 60

S.D = 60/4 = 15

MD = 60/5 = 12

QD = 60/6 = 10

Let SD is x times of $\sqrt{MD \times QD}$

SD = x $\sqrt{MD \times QD}$

$15 = x\sqrt{12 \times 10}$

Squaring on both sides; we get

$225 = x^2 . 12 \times 10$

So, $x = \sqrt{\frac{225}{12 \times 10}} = \sqrt{\frac{15}{8}}$

Q.46. The Q.D of 6 numbers 15, 8, 36, 40, 38, 41 is equal to

(*a*) 12.5 (*b*) 25

(*c*) 13.5 (*d*) 37

[June 2019]

Solution : (*c*) Arranging obs. in Ascending order, we get

8, 15, 36, 38, 40, 41

Here, N = 6

$Q_1 = \left(\frac{N+1}{4}\right)^{th}$ term

$= \left(\frac{6+1}{4}\right)^{th}$ term $= 1.75^{th}$ term

$= 1^{st}$ term + 0.75 (2^{nd} term – 1^{st} term)

$= 8 + 0.75 \times (15 - 8)$

$= 8 + 0.75 \times 7$

$= 8 + 5.25$

$= 13.25$

$Q_3 = 3\left(\frac{N+1}{4}\right)^{th}$ obs.

$= \frac{3(6+1)^{th}}{4}$ term $= 5.25^{th}$ term

$= 5^{th}$ term + 0.25 (6^{th} term – 5^{th} term)

$= 40 + 0.25\,(41 - 40)$

$= 40 + 0.25 \times 1$

$= 40 + 0.25 = 40.25$

$QD = \frac{Q_3 - Q_1}{2}$

$= \frac{40.25 - 13.25}{2} = \frac{27}{2} = 13.5$

Q.47. S.D of first five consecutive natural numbers is

(*a*) $\sqrt{10}$ (*b*) $\sqrt{8}$

(*c*) $\sqrt{3}$ (*d*) $\sqrt{2}$

[June 2019]

Solution : (*d*)

S.D of 1st 'n' Natural No. $= \sqrt{\frac{n^2 - 1}{12}}$

n = 5

S.D $= \sqrt{\frac{5^2 - 1}{12}} = \sqrt{\frac{24}{12}} = \sqrt{2}$

Q.48. If the profit of a company remain same for the last ten months then the S.D. of profits of the company would be:

(*a*) Positive (*b*) Negative

(*c*) Zero (*d*) (a) or (c)

[June 2019]

Solution : (*c*)

If the profits of a company remain same for ten months.

then S.D = 0

(Since shifting of origin S.D is not changed)

Q.49. Coefficient of quartile deviation is 1/4 then Q_3/Q_1 is

(*a*) 5/3 (*b*) 4/3

(*c*) 3/4 (*d*) 3/5

[June 2019]

Solution : (*a*) Coeff. of Q.D $= \frac{1}{4}$

$\frac{Q_3 - Q_1}{Q_3 + Q_1} = \frac{1}{4}$ [cross product]

or ; $4Q_3 - 4Q_1 = Q_3 + Q_1$

or ; $4Q_3 - Q_3 = Q_1 + 4Q_1$

or ; $3Q_3 = 5Q_1$

or; $\frac{Q_3}{Q_1} = \frac{5}{3}$

Q.50. The sum of mean and SD of a series is a + b, if we add 2 to each observation of the series then the sum of mean and SD is

(*a*) a + b + 2 (*b*) 6 – a + b

(*c*) 4 + a – b (*d*) a + b + 4

[June 2019]

Solution : (*a*) If a constant quantity is added to each observation, then value of mean changes but SD remains unchanged.

Since, Mean + S.D = (a + b)

$\Rightarrow$ Let mean = a and SD = b

If we add '2' in each observation New mean = a + 2 and new Sd = b, So new (mean + S.D) = (a + b + 2)

Q.51. What will be the probable value of mean deviation when $Q_3 = 40$ and $Q_1 = 15$?

(*a*) 17.50 (*b*) 18.75

(*c*) 15.00 (*d*) 16.00

[Dec. 2019]

Solution : (*c*)

$Q.D. = \frac{Q_3 - Q_1}{2} = \frac{40 - 15}{2} = 12.5$

Formula

$6.QD = 5.MD$

or; $6 \times 12.5 = 5.MD$

$\therefore MD = \frac{6 \times 12.5}{5} = 15.$

Q.52. Find the mean deviation about mean of 4, 5, 6, 8, 3

(*a*) 5.20 (*b*) 7.20

(*c*) 1.44 (*d*) 2.33

[Dec. 2019]

Solution : (*c*)

X	$\lvert X - \overline{X} \rvert$
4	1.2
5	0.2
6	0.8
8	2.8
3	2.2

$\Sigma X = 26$ $\Sigma \lvert X - \overline{X} \rvert = 7.2$

$\overline{X} = \frac{\Sigma X}{N} = \frac{26}{5} = 5.2$

$MD. = \frac{\Sigma \lvert X - \overline{X} \rvert}{N} = \frac{7.2}{5} = 1.44$

Q.53. The mean and coefficient of variance are 20 and 80. Find the value of variance

(*a*) 16 (*b*) 256

(*c*) 36 (*d*) none

[Dec. 2019]

Solution : (*b*)

$C.V = \frac{\sigma}{\overline{X}} \times 100$

or ; $80 = \frac{\sigma}{20} \times 100 \Rightarrow \sigma = 16$

Variance $= \sigma^2 = 16^2 = 256.$

Q.54. Find SD of 1, 2, 3, 4, 5, 6, 7, 8, 9

(*a*) $\sqrt{\frac{20}{3}}$ (*b*) $\sqrt{\frac{81}{3}}$

(*c*) $\sqrt{\frac{20}{5}}$ (*d*) None of these

[Dec. 2019]

Solution : (*a*)

Formula; S.D of 1st n natural Nos. = $\sqrt{\frac{n^2 - 1}{12}}$

$= \sqrt{\frac{9^2 - 1}{12}} = \sqrt{\frac{80}{12}} = \sqrt{\frac{20}{3}}$

Q.55. The standard deviation for the set of numbers 1,4,5,7,8, is 2.45 nearly. If 10 is added to each number then new standard deviation is

(*a*) 24.45 (*b*) 12.45

(*c*) 2.45 (*d*) 0.245

[Dec. 2019]

Solution : (*c*)

Note:- If a constant quantity is added to each observation then the value of S.D. does not change.

Q.56. If every observation is increased by 5 then:

(*a*) SD increase by 5

(*b*) MD increased by 5

(*c*) QD increases by 5

(*d*) Dispersion Not affected

[Dec. 2019]

Solution : (*d*)

Note:- If every observation is increased by a constant quantity then the value of dispersion does not change.

Q.57. For given distribution the arithmetic mean is 15 and the standard deviation is 9 then the coefficient of variation?

(*a*) $\frac{15}{9} \times 100$ (*b*) $\frac{15}{9}$

(*c*) $\frac{9}{15}$ (*d*) $\frac{9}{15} \times 100$

[Dec. 2019]

Solution : (*d*)

Co-efficient of variation

$= C.V = \frac{\sigma}{\overline{X}} \times 100 = \frac{9}{15} \times 100$

$= 60\ \%$

Q.58. The mean of a distribution is 14 and the standard deviation is 5. What is the value of the coefficient of variation?

(*a*) 60.4% (*b*) 70%

(*c*) 35.7% (*d*) 27.8%

[Dec. 2019]

Solution : (*c*)

$C.V = \frac{\sigma}{\overline{X}} \times 100 = \frac{5}{14} \times 100$

$= 35.7\%$

Q.59. Which of the following measure of dispersion is based on absolute deviations?

(*a*) Range

(*b*) SD

(*c*) Mean Deviation

(*d*) Quartile Deviation

Solution : (*c*)

Q.60. The best statistical measure used for comparing two series is

(*a*) Mean absolute deviation

(*b*) Range

(*c*) Coefficient of variation

(*d*) Standard deviation

[Jan. 2021]

Solution : (*c*) Coefficient of variation (C.V.) (a relative dispersion) is assumed as the best measure for comparing two series.

Q.61. Which of the following measure of dispersion is based on absolute deviations?

(*a*) Range

(*b*) SD

(*c*) Mean Deviation

(*d*) Quartile Deviation

[Dec. 2019]

Solution : (*c*)

Q.62. The relationship between P-series and Q series is given by 2P- 3Q = 10. If the rage of P- Series is 18. What would be the range of Q?

(*a*) 10 (*b*) 15
(*c*) 9 (*d*) 12

[Jan. 2021]

Solution : (*d*) is correct.

Given eqn. is

$$2P - 3Q = 10$$

Tricks 2 Range (P) = 3 Range (Q)

[∴ Range does not change with respect to the change of origin but changes with respect to scale.]

So, $2 \times 18 = 3$ Range (Q)

$$\therefore \quad \text{Range(Q)} = \frac{2\times 18}{3} = 12$$

Q.63. It is given that the mean ($\bar{X}$) is 10 and standard deviation (s.d.) is 3.2. If the observations are increased by 4, then the new mean and standard deviations are:

(*a*) ($\bar{X}$) = 10, s.d. = 7.2
(*b*) ($\bar{X}$) = 10, s.d. = 3.2
(*c*) ($\bar{X}$) = 14, s.d. = 3.2
(*d*) ($\bar{X}$) = 14, s.d. = 7.2

[Jan. 2021]

Solution : (*c*)

Mean	S.D.
10	3.2
(Each observation + 4)	3.2
	No change

= 10 + 4 = 14

(*c*) is correct

Q.64. Which of the following is a relative measure of dispersion?

(*a*) Range
(*b*) Mean deviation
(*c*) Standard deviation
(*d*) Coefficient of quartile deviation

[Jan. 2021]

Solution : (*d*) is correct

Q.65. Find the coefficient of mean deviation about mean for the data: 5, 7, 8, 10, 11, 13, 19

(*a*) 17.28 (*b*) 28.57 (*c*) 32.11 (*d*) 18.56

[Jan. 2021]

Solution : (*c*) is correct

$$\text{Mean} = \bar{X} = \frac{\text{sum of observations}}{\text{No. of observations}}$$

$$= \frac{5+7+8+10+11+13+19}{7}$$

$$= \frac{73}{7} = 10.42 \text{ [Find by calculator]}$$

$$\text{Mean Deviation} = \text{MD} = \frac{\sum|X-\bar{X}|}{N}$$

$$= \frac{[|5-10.42|+|7-10.42|+|8-10.42|+|10-10.42|+|11-10.42|+|13-10.42|+|19-10.42|]}{7}$$

= 3.3457

On Calculator [Minimum Time]

Do as 5-10.42 = [+/−] button Then M + (Press)

[because MD is always positive]

Type another observation 7 = [+/−]

Then M + button (Press)

[Note : No need of typing 10.42 again and again].

Then type 8 = [+/−] M + (Press)
10 = [+/−] M + (Press)
11 = M + (Press)

[Here difference is positive; so never press = [+/−] button]

13 = M + (Press)
19 = M + (Press)

Press MRC button two times at the end. It will give you numerator value.

Divide it by 7; we will get.

$$\text{Coefficient of MD} = \frac{\sum|X-\bar{X}|}{\bar{X}} \times 100$$

$$= \frac{3.3457}{10.42} \times 100$$

$$= 32.108 = 32.11\%$$

[95% Calculations can be made without noting/writing any thing else.]

Q.66. The mean deviation of the numbers 3, 10, 6, 11, 14, 17, 9, 8, 12 about the mean is (correct to one decimal place)

(*a*) 8.7 (*b*) 4.2 (*c*) 3.1 (*d*) 9.8

[July 2021]

Solution : (*c*) is correct.

[Do everything on calculation]

[Note: – Never write in this way in exam. Only type difference on calculator and divide result by 14]

= 3.43 Approx.

Q.72. If the relationship between x and y is given by 2x + 3y = 10 and the range of y is 10, then what is the range of x?

(*a*) 10 (*b*) 18 (*c*) 8 (*d*) 15

[July 2021]

Solution : (*d*) is correct.

Tricks:

2. Range (X) = 3. Range (Y)

[∵ value of Range is always positive.]

or; 2. Range (X) = 3 × 10

$$\text{or Range (X)} = \frac{3\times 10}{2} = 15$$

Q.73. The marks secured by 5 students in a subject are 82, 73, 69, 84, 66. What is the coefficient of Range

(*a*) 0.12 (*b*) 12 (*c*) 120 (*d*) 0.012

[Dec. 2021]

Solution : (*b*)

$$\text{Coefficient of Range} = \frac{84-66}{84+66} \times 100$$

$$= 12$$

Q.74. Which one of the following is not a measure of central tendency?

(*a*) Median (*b*) Range
(*c*) Arithmetic Mean (*d*) Harmonic Mean

[June 2022]

Solution : (*b*) Range is not a measure of central-Tendency.

Q.75. What is mean deviation about mean of the following numbers? 11, 8, 10, 10, 12, 9

(*a*) 2 (*b*) 1 (*c*) 1.5 (*d*) 1.8

[June 2022]

Solution : Mean = $\bar{X} = \frac{11+8+10+10+12+9}{6} = 10$

$$\text{MD}_{\bar{x}} = \delta_{\bar{x}} = \frac{\sum|X-\bar{X}|}{N}$$

$$= \frac{|11-10|+|8-10|+|10-10|+|10-10|+|12-10|+|9-10|}{6}$$

$$= \frac{1+2+0+0+2+1}{6} = \frac{6}{6} = 1$$

∴ (*b*) is correct

Q.76. Following are the ages of 8 employees of a small old age home expressed in 96, 50, 67, 75, 71, 69, 64, 66. Find the range and its coefficient.

(*a*) 46, 31.51 respectively (*b*) 51, 37.67 respectively
(*c*) 43, 29.49 respectively (*d*) 49, 36.42 respectively

[June 2022]

Solution : Smallest observation = S = 50

Largest observation = L = 96

∴ Range = L–S = 96 – 50 = 46

$$\text{Coefficient of Range} = \frac{L-S}{L+S} \times 100$$

$$= \frac{96-50}{96+50} \times 100 = 31.51\%$$

∴ (*a*) is correct

Q.77. Find the standard deviation and coefficient of variation of 1, 6, 5, 9, 8.

(*a*) 2.78 and 40.83 respectively (*b*) 2.45 and 47.93 respectively
(*c*) 2.78 and 47.93 respectively (*d*) 2.87 and 49.37 respectively

[June 2022]

Solution : Observations are x : 1, 5, 6, 8, 9

$\therefore \Sigma x = 1 + 5 + 6 + 8 + 9 = 29$

$\Sigma x^2 = 1^2 + 5^2 + 6^2 + 8^2 + 9^2 = 207$

$$\therefore \sigma = \sqrt{\left(\frac{\Sigma x^2}{N}\right) - \left(\frac{\Sigma x}{N}\right)^2} = \sqrt{\frac{207}{5} - \left(\frac{29}{5}\right)^2}$$

$$= \sqrt{41.4 - (5.8)^2} = 2.78$$

$\bar{X} = \frac{\Sigma x}{N} = \frac{29}{5} = 5.8$

$\therefore$ Coefficient of variation = C.V. $= \frac{\sigma}{\bar{X}} \times 100$

$= \frac{2.78}{5.8} \times 100 = 47.93$

$\therefore$ (*c*) is correct

Q.78. The arithmetic mean and coefficient of variation of data set X are respectively, 10 and 30. The variance of 30 - 2X is

(*a*) 28 (*b*) 32
(*c*) 34 (*d*) 36

[June 2022]

Solution : Given $\bar{X} = 10$; CV =30

$\because$ CV $= \frac{\sigma}{\bar{X}} \times 100 = 30$

or $\frac{\sigma}{10} \times 100 = 30$

$\therefore \sigma_x = 3$

Let $y = 30 - 2x$

$\sigma_y = |-2| . \sigma_x = 2 \times 3 = 6$

Variance (y) $= \sigma_y^2 =$ var. (30–2x)
$= 6^2 = 36$

$\therefore$(*d*) is correct.

Q.79. Which measure of dispersion is base on the absolute deviation only?

(*a*) Range
(*b*) Standard deviation
(*c*) Mean deviation
(*d*) Quartile deviation

[June 2022]

Solution : (*c*) is correct

$\because MD = \frac{\Sigma|x - \bar{x}|}{N}$

Hence only MD is based on absolute deviation.

Q.80. The coefficient of deviation based on 25th and 75th percentiles of 6, 9, 3, 8, 4, 5, 8 and 4 is

(*a*) 50 (*b*) 100/3
(*c*) 30 (*d*) 25

[June 2022]

Solution : Arranging observations in ascending order than we get

3, 4, 4, 5, 6, 8, 8, 9

Here N = 8

$P_{25} = Q_1 = 25 \left(\frac{N+1}{100}\right)^{th}$ observation

$= 25 \left(\frac{8+1}{100}\right) = 2.25^{th}$ obs.

$= 2^{nd}$ obs.+ 0.25 (3^{rd} obs – 2^{nd} obs.)
$= 4 + 0.25 (4–4) = 4$

$P_{75} = Q_3 = 75 \left(\frac{N+1}{100}\right)^{th}$ observation.

$= 75 \left(\frac{8+1}{100}\right) = 6.75^{th}$ obs.

$= 6^{th}$ obs. + 0.75 (7^{th} obs. – 6^{th} obs.)
$= 8 + 0.75 (8 - 8)$
$= 8$

$\therefore$ Coefficient of Deviation

$= \frac{P_{75} - P_{25}}{P_{75} + P_{25}} \times 100 = \frac{8-4}{8+4} \times 100$

$= \frac{100}{3}\%$

$\therefore$ (*b*) is correct

Q.81. If the coefficient of variation and standard deviation are 30 and 12 respectively, then the arithmetic mean of the distribution is:

(*a*) 40 (*b*) 36
(*c*) 25 (*d*) 19

[Dec. 2022]

Solution : *Given:*

CV = 30; σ = 12

$\because$ C.V. $= \frac{\sigma}{\bar{x}} \times 100$

$\therefore \quad \bar{x} = \frac{\sigma}{CV} \times 100 = \frac{12}{30} \times 100$
$= 40$

(*a*) is correct

Q.82. Which one of the following is not a method of measures of dispersion?

(*a*) Standard deviation
(*b*) Mean deviation
(*c*) Range
(*d*) Concurrent deviation method

[Dec. 2022]

Solution : (*d*)

Q.83. Mean deviation is minimum when deviation are taken from:

(*a*) Mean (*b*) Median
(*c*) Mode (*d*) Range

[Dec. 2022]

Solution: (*b*) is correct

$\sum|X - Me| < \sum|X - \bar{X}|$

Dividing by N on both sides;

we get

$\frac{\sum|X - Me|}{N} < \frac{\sum|X - \bar{X}|}{N}$

$\therefore$ MD from median (minimum) < MD from (Maximum)

Q.84. If the first quartile is 56.50 and the third quartile is 77.50, then the coefficient of quartile deviation is:

(*a*) 638.09 (*b*) 15.67
(*c*) 63.80 (*d*) 156.71

[Dec. 2022]

Solution : *Given*

$Q_1 = 56.50$

$Q_3 = 77.50$

Co-efficient of QD

$= \frac{Q_3 - Q_1}{Q_3 + Q_1} \times 100$

$= \frac{77.50 - 56.50}{77.50 + 56.50} \times 100$

$= \frac{21}{134} \times 100 = 15.67$

$\therefore$ (*b*) is correct

Q.85. If the sum of square of the values equals to 3390, Number of observations are 30 and Standard deviation is 7, what is the mean value of the above observations?

(*a*) 14 (*b*) 11
(*c*) 8 (*d*) 5

[Dec. 2022]

Solution : *Given,*

$= \Sigma x^2 = 3390$; N = 30; *SD* = σ = 7

Formula

$\sigma^2 = \frac{\Sigma x^2}{N} - (\bar{x})^2$

or; $7^2 = \frac{3390}{30} - (\bar{x})^2$

or; $49 = 113 - (\bar{x})^2$

or; $(\bar{x})^2 = 113 - 49 = 64$

or; $\bar{x} = \sqrt{64} = 8$

(*c*) is correct

Q.86. If the variance of a random variable '*x*' is 17 then what is variance of y = 2x + 5?

(*a*) 34 (*b*) 39
(*c*) 68 (*d*) 78

[Dec. 2022]

Solution : $\sigma_x = Sd = \sqrt{17}$

$\sigma_y = 2 . \sigma_x = 2\sqrt{17}$

$\therefore$ Ver. (4) $= \sigma_{y_2} = 4 \times 17$
$= 68$

So, (*c*) is correct.

Q.87. If the variance of given data is 12, and their mean value is 40, what is Coefficient of Variation (CV)?

(*a*) 5.66% (*b*) 6.66%
(*c*) 7.50% (*d*) 8.65%

[Dec. 2022]

Solution: $\sigma^2 = 12$

$\sigma = \sqrt{12}$

$\bar{x} = 40$

$\therefore$ CV $= \frac{\sigma}{\bar{x}} \times 100$

$= \frac{\sqrt{12}}{40_2} \times 100^5$

$= 8.66\%$

So, (*d*) is correct.

Q.88. In a given set if all data are of same value then variance would be:

(*a*) 0 (*b*) 1
(*c*) –1 (*d*) 0.5

[Dec. 2022]

Solution: So, S.D. = 0 [$\because$ All observations are same]

$\therefore$ Variance = $0^2 = 0$

$\therefore$ Option (*a*) is correct

Q.89. If *x* and *y* are related as 4*x* + 3*y* + 11 = 0 and mean deviation of *y* is 7.20, what is the mean deviation of x?

(*a*) 2.70 (*b*) 7.20
(*c*) 4.50 (*d*) 5.40

Solution:

Tricks

4 MD of X = + 3 MD of Y
(Always Positive)

or; 4 MD(x) = 3 × 7.20

or MD(x) $= \frac{3 \times 7.20}{4}$

$= 5.40$

(*d*) is correct.

Q.90. The mean deviation about the mean for the data 12, 16, 24, 30, 35, 39, 40 is:

(*a*) 9.14 (*b*) 9.41
(*c*) 8.91 (*d*) 9.81

Solution:

X	$\lvert X-\bar{X}\rvert$
12	16
16	12
24	4
30	2
35	7
39	11
40	12
$\Sigma X = 196$	$\Sigma\lvert X - \bar{X}\rvert = 64$

$\bar{X} = \frac{\Sigma X}{N} = \frac{196}{7} = 28$

$\therefore$ Mean Deviation $= \frac{\Sigma|X - \bar{X}|}{N}$

$= \frac{64}{7} = 9.14$

(*a*) is correct.

Q.91. If the Standard Deviation of data 2, 4, 5, 6, 8, 17 is 4.47, then Standard Deviation of the data 4, 8, 10, 12, 16, 34 is:

(*a*) 4.47 (*b*) 8.94
(*c*) 13.41 (*d*) 2.24

Solution:

SD of given data is 4.47.

If all observations are multiplied by 2; we get the resulting data.

$\therefore$ SD of New Data
$= 2 \times 4.47 = 8.94$

$\therefore$ (*b*) is correct.

Q.92. The mean and variance of a group of 100 observations are 8 and 9, respectively. Out of 100 observations, the mean and standard deviation of 60 observations are 10 and 2, respectively. Find the standard deviation of remaining 40 observations?

(*a*) 4.5
(*b*) 3.5
(*c*) 2.5
(*d*) 1.5

Solution:

N = 100; $\bar{X}_{12} = 8$;

Var. $= S_{12}^2 = 9$

$\therefore S_{12} = 3$

$N_1 = 60$; $\bar{X}_1 = 10$; $S_1 = 2$

$N_2 = 100 - N_1 = 100 - 60 = 40$

$\therefore \bar{X}_2 = \frac{N\bar{X}_{12} - N_1\bar{X}_1}{N_2}$

$= \frac{100 \times 8 - 60 \times 10}{40} = 5$

$d_1 = \bar{X}_1 - \bar{X}_2 = 10 - 8 = 2$

$d_2 = \bar{X}_2 - \bar{X}_{12} = 5 - 8 = -3$

$\therefore S_{12}^2 = \frac{N_1(S_1^2 + d_1^2) + N_2(S_2^2 + d_2^2)}{N}$

or; $3^2 = \frac{60(2^2 + 2^2) + 40(S_2^2 + (-3)^2)}{100}$

or; $900 = 480 + 40\,(S_2^2 + 9)$

or; $420 = 40\,(S_2^2 + 9)$

or; $S_2^2 + 9 = \frac{420}{40} = 10.5$

or; $S_2^2 = 1.5$

$\therefore S_2 = \sqrt{1.5} = 1.22$

No option.

Most approximate value of

$S_2 = 1.22$ can be taken 1.5.

$\therefore$ (*d*) should be correct.

Q.93. For a given set of normally distributed data, the following statistical parameters are known: Mean = 6; Standard deviation = 2.6; Median = 5 and Quartile deviation = 1.5, then the coefficient of quartile deviation equals to:

(*a*) 30 (*b*) 32

(*c*) 25 (*d*) 39

Solution:

Co-efficient of QD

$= \frac{Q_3 - Q_1}{\frac{2}{M_e}} \times 100$

$= \frac{QD}{M_e} \times 100 = \frac{1.5}{5} \times 100$

$= 30\%$

$\therefore$ (*a*) is correct.

Q.94. If the first quartile is 42.75 and the third quartile is 74.25, then the coefficient of quartile deviation is:

(*a*) 29.62 (*b*) 15.75

(*c*) 17.57 (*d*) 29.62

Solution:

Given

$Q_1 = 42.75$; $Q_3 = 74.25$

$\therefore$ Co-eff. of Q.D

$= \frac{Q_3 - Q_1}{Q_3 + Q_1} \times 100$

$= \frac{74.25 - 42.75}{74.25 + 42.75} \times 100$

$= \frac{31.75}{117} \times 100 = 26.92\%$

$\therefore$ (*d*) is correct.

23 CHAPTER PROBABILITY

Experiment:- The performance which produces the certain results is called Experiment.

Random Experiment:- If the results of the experiment depend on chance only, then the experiment is called Random Experiment. Example:- Tossing a coin; Throwing a die; drawing a card from well - shuffled pack of 52 cards etc.

Sample Space:- The set of all possible distinct outcomes of a random experiment is called SAMPLE SPACE (or Event Space). It is denoted by capital letter "S".

Ex-1 : A coin is tossed at random then S = {H, T} $\Rightarrow$ n(S) = 2

Either Head (H) or Tail (T) can occur on upper face of the coin.

Ex-2 : A die is thrown at random then S = {1, 2, 3, 4, 5, 6} $\Rightarrow$ n(S) = 6

$\because$ A die has 6 faces with face number 1, 2, 3, 4, 5, 6. One of them can occur at a time.

Ex-3 : Two coins are tossed together then S = {HH, HT; TH; TT} i.e. If both coins are tossed together then heads on both coins or Tails on both coins or Head on one coin and Tail on another one coin can occur. Another way to find Sample Space.

Total Sample Space "S" = cross - product of individual Sample - Space.

$\therefore$ S = {H, T} $\times$ {H, T}

= {H H, HT, TH, TT}

$\therefore$ $n(S) = n(S_1).n(S_2) = 2 \times 2 = 4$

Tricks : For Coins $n(S) = 2^{\text{No. of coins tossed together}}$

Ex-1 For 2 coins

$n(S) = 2^2 = 4$

Ex-3. For 3 coins tossed together

$n(S) = 2^3 = 8$.

For Dice

Ex-: If two dice are thrown together then, S = {1, 2, 3, 4, 5, 6} $\times$ {1, 2, 3, 4, 5, 6}
= {(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6);
(2, 1), (2, 2), ...; (2, 3);
(3, 1), (3, 2);.....;(3, 6);
(4, 1), (4, 2);.....;(4, 6);
(5, 1), (5, 2);.....;(5, 6);
(6, 1), (6, 2);.....;(6, 6)}

$\therefore$ $n(s) = n(s_1).\ n(s_2) = 6 \times 6 = 36$.

Tricks: For Dice

$n(S) = 6^{\text{No. of dice Thrown together}}$

PAST EXAM QUESTIONS WITH SOLUTIONS (MEMORY BASED)

Q.1. In a pack of playing cards with two jokers probability of getting king of spade is

(*a*) 4/13 (*b*) 4/52

(*c*) 1/52 (*d*) 1/54

[June 2010]

Solution : (*d*) Total No. of playing cards = 52 + 2 = 54

Sample Space $n(S) = {}^{54}c_1 = 54$

Total no. of spade king = 1

E = Event of getting 1 spade king = 1

$\therefore P(E) = \frac{1}{54}$

Q.2. Consider two events A and B not mutually exclusive, such that P(A) = 1/4, P(B) = 2/5, $P(A \cup B) = 1/2$, then $P(A\bar{B})$ is

(*a*) 3/7 (*b*) 2/10

(*c*) 1/10 (*d*) None of them

[June 2010]

Solution : (*d*) Since events A & B are not mutually exclusive. So, they are independent events.

$P(AB) = P(A \cap B) = P(A).P(B)$

$\therefore P(A\bar{B}) = P(A) - P(A \cap B) = P(A) - P(A).P(B)$

$= P(A).[1 - (B)]$

$= \frac{1}{4}\left(1 - \frac{2}{5}\right) = \frac{1}{4}.\frac{3}{5} = \frac{3}{20}$

Q.3. If x be the sum of two numbers obtained when two dice are thrown simultaneously then $P(x \geq 7)$ is

(*a*) 5/12 (*b*) 7/12

(*c*) 11/15 (*d*) 3/8

[June 2010]

Solution : (*b*) Sample Space n (S) = 36

E = Event of getting X >= 7

= {(1,6);(2,5);(3,4);(4;3);(5,2);(6,1);
(2,6);(3,5);(4,4);(5,3);(6,2);.....;
(6,6)}; $\therefore$ n (E) = 21

$\therefore$ Required Probability P(E) = $\frac{21}{36} = \frac{7}{12}$

Tricks :- See Nov. 2019 Qts.

Q.4. If P(A/B) = P(A), then A and B are

(*a*) Mutually exclusive events

(*b*) Dependent events

(*c*) Independent events

(*d*) Composite events ***[Dec. 2010]***

Solution : (*c*) P(A/B) = P(A)

Hence, A and B are independent events.

Q.5. A bag contains 3 white and 5 black balls and second bag contains 4 white and 2 black balls. If one ball is taken from each bag, the probability that both the balls are white is____

(*a*) 1/3 (*b*) 1/4

(*c*) 1/2 (*d*) None of these

[Dec. 2010]

Solution : (*b*) Let A = Event of getting 1 white ball from 1st bag.

B = Event of getting 1 white ball from 2nd bag.

A & B are Independent Events.

$P(A \cap B) = P(A).P(B)$

$= \frac{{}^3C_1}{{}^8C_1} \cdot \frac{{}^4C_1}{{}^6C_1} = \frac{3}{8} \times \frac{4}{6} = \frac{1}{4}$

Q.6. The odds in favour of A solving a problem is 5:7 and Odds against B solving the same problem is 9:6. What is the probability that if both of them try, the problem will be solved?

(*a*) 117/180 (*b*) 181/200

(*c*) 147/180 (*d*) 119/180

[Dec. 2010]

Solution : (*a*) $P(A) = \frac{5}{12}$; $P(B) = \frac{6}{15}$

Probability that problem will be Solved

= 1 – Prob. that problem not solved

= 1 – P(A′).P(B′)

= 1 – [1 -P(A)][1-P(B)]

$= 1 - \left(1 - \frac{5}{12}\right)\left(1 - \frac{6}{15}\right)$

$= 1 - \frac{7}{12} \times \frac{9}{15} = \frac{180 - 63}{180} = \frac{117}{180}$

Q.7. Consider Urn 1 : 2 white balls, 3 black balls; Urn II : 4 white balls, 6 black balls. One ball is randomly transferred from first to second Urn, then one ball is drawn from II Urn. The probability that drawn ball is white is

(*a*) 22/65 (*b*) 22/46

(*c*) 22/55 (*d*) 21/45

[Dec. 2010]

Solution : (*c*)

Case I : 1 Black ball is transferred from Urn I to Urn II and then a white ball is picked from Urn II

Prob. $= \frac{3}{5} \times \frac{4}{11} = \frac{12}{55}$

Case II : 1 White ball is transferred from Urn I to II and then a white ball is picked from Urn II

Prob. $= \frac{2}{5} \times \frac{5}{11} = \frac{10}{55}$

From Case I + Case II;

P(White ball) $= \frac{12}{55} + \frac{10}{55} = \frac{22}{55}$

Q.8. If P $(A \cup B)$ = P(A), Find P $(A \cap B)$.

(a) P(A).P(B) (b) P(A) + P(B)

(c) 0 (d) P(B)

[June 2011]

Solution : (d) Given : $P(A \cup B) = P(A)$

we know that

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$\therefore$ we get $P(A \cap B)$ = P(B)

Q.9. A bag contains 5 Red balls, 4 Blue Balls and 'm' Green Balls. If the random probability of picking two green balls is 1/7. What is the No. of green Balls (m)

(a) 5 (b) 7

(c) 6 (d) None of above

[June 2011]

Solution : (c) Total balls = 5 + 4 + m = m + 9

$\therefore$ Probability of picking two green balls = $\frac{1}{7}$

TRICKS : Go by choices

For (c) Total = 6 + 9 = 15

$P = \frac{^6c_2}{^{15}c_2}$

$= \frac{15}{105} = \frac{1}{7}$ (True)

Q.10. The probability of Girl getting scholarship is 0.6 and the same probability for Boy is 0.8 Find the probability that at least one of the categories getting scholarship.

(a) 0.32 (b) 0.44

(c) 0.92 (d) None of these

[June 2011]

Solution : (c) Given

Probability of Girl getting scholarship P(A) = 0.6

Probability of Boy getting scholarship P(B) = 0.8

Required of at least one category getting scholarship:

= 1 – P(None getting scholarship)

= 1 – P(A^1).P(B^1) = 1 – (1 – 0.6).(1 – 0.8)

= 1 -(0.4). (0.2) = 1- 0.08 = 0.92

Q.11. A coin is tossed 5 times, what is the probability that exactly 3 heads will occur.

(a) $\frac{5}{16}$ (b) $\frac{1}{32}$ (c) $\frac{5}{36}$ (d) $\frac{3}{32}$

Solution : (a) Total No. of Tails (n) = 5

r = 3

Probability of getting Head (p) = 1/2

Probability of getting Tail (q) = 1/2

By Binomial Distribution,

$P(x = r) = {}^nC_r p^r q^{n-r}$

$P(r = 3) = {}^5c_3\left(\frac{1}{2}\right)^3\left(\frac{1}{2}\right)^{5-3} = 10.\frac{1}{2^5} = \frac{10}{32} = \frac{5}{16}$

Q.12. Arun & Tarun appear for an interview for two vacancies. The probability is Arun's selection is 1/3 and that of Tarun's selection is 1/5. Find the probability that only one of them will be selected.

(a) 2/5 (b) 4/5

(c) 6/5 (d) 8/5

[June 2012]

Solution : (a)

Let A & T are events of selection of Arun and Tarun respectively.

$P(A) = \frac{1}{3}$

$\therefore P(\bar{A}) = 1 - \frac{1}{3} = \frac{2}{3}$

$P(T) = \frac{1}{5}$

$\therefore P(\bar{T}) = 1 - \frac{1}{5} = \frac{4}{5}$

$\therefore$ Probability that only one will be selected

$= P(A).P(\bar{T}) + P(\bar{A}).P(T)$

$= \frac{1}{3}\times\frac{4}{5} + \frac{2}{3}\times\frac{1}{5} = \frac{4}{15} + \frac{2}{15} = \frac{6}{15} = \frac{2}{5}$

Q.13. A company employed 7 CA's, 6 MBA's and 3 Engineer's. In how many ways the company can form a committee if the committee has two members of each type.

(a) 900 (b) 1,000

(c) 787 (d) 945

[June 2012]

Solution : (d) The number of ways to make a committee containing two members of each type

$= {}^7C_2 \times {}^6C_2 \times {}^3C_2$

$= 21 \times 15 \times 3$

$= 945$

Q.14. Two dice are thrown together. Find the probability of getting a multiple of 2 on one dice and multiple of 3 on the other.

(a) 2/3

(b) 1/6

(c) 1/3

(d) None of the above

[Dec. 2012]

Solution : (b)

Sample space n(S) = 36

Let 'E' = 'Events of getting a multiple of 2 on the Ist die and multiple of 3 on the IInd die

= {(2,3);(2,6);(4,3);(4,6);(6,3);(6,6)}

n(E) = 6

$P(E) = \frac{n(E)}{n(S)} = \frac{6}{36} = \frac{1}{6}$

Q.15. The odds against A solving a certain problem are 4 to 3 and the odds in favour of B solving the same problem are 7 to 5. What is the probability that the problem will be solved if they both try?

(a) 15/21 (b) 16/21

(c) 17/21 (d) 13/21

[Dec. 2012]

Solution : (b) The odd against A solving a certain problem = 4 : 3

P(A) = Prob (to solve the problem) = $\frac{3}{4+3} = \frac{3}{7}$

$P(\bar{A})$ = prob (not to solve the problem) = $\frac{4}{4+3} = \frac{4}{7}$

The odds in favour of B solving the same problem = 7 : 5

P(B) = Prob (to solve the problem) = $\frac{7}{7+5} = \frac{7}{12}$

$P(\bar{B})$ = Prob (not to solve the problem) = $\frac{5}{7+5} = \frac{5}{12}$

Probability (the problem is solved)

$1 - P(\bar{A} \cap \bar{B}) = 1 - P(\bar{A}).P(\bar{B}) = 1 - \frac{4}{7}.\frac{5}{12}$

Probability (problem is solved) = $1 - \frac{5}{21} = \frac{16}{21}$

Q.16. A bag contains 6 red balls and some blue balls. If the probability of drawing a blue ball from the bag is twice that of a red ball, find the number of blue balls in the bag

(a) 10 (b) 12

(c) 14 (d) 16

[Dec. 2012]

Solution : (b) Let No. of Blue ball, = X

Total Ball in the Bag = (6 + X)

Prob of a Red ball P(R)

$= \frac{^6C_1}{^{6+x}C_1} = \frac{6}{6+x}$

and prob of a Blue Ball P(B)

$= \frac{^xC_1}{^{6+x}C_1} = \frac{x}{6+x}$

Given, P(B) = 2 P(R)

$\frac{X}{(6+X)} = \frac{2\times6}{(6+X)} \Rightarrow X = 12$

Tricks : GBC

Q.17. The odds that a book will be received favourably by 3 independent reviewers are 5 to 2, 3 to 4, 4 to 3 respectively, then the probability that out of 3 critics the majority will be favorable is_____

(a) $\frac{209}{343}$ (b) $\frac{209}{434}$

(c) $\frac{209}{443}$ (d) $\frac{209}{350}$

[June 2013]

Solution : (a) is correct

Let A; B and C are three independent reviewers (Event)

Given: odds in favour of Events

$i.e. \frac{P(A)}{P(A^1)} = \frac{5}{2} : \frac{P(B)}{P(B^1)} = \frac{3}{4} : \frac{P(C)}{P(C^1)} = \frac{4}{3}$

$\therefore P(A) = \frac{5}{7}; P(A^1) = \frac{2}{7}$

$P(B) = \frac{3}{7}; P(B^1) = \frac{4}{7}$

$P(C) = \frac{4}{7}; P(C^1) = \frac{3}{7}$

Prob.(Majority will be favourable) =

$P(A).P(B).P(C^1) + P(A)P(B^1)P(C) + P(A^1).P(B).P(C) + P(A).P(B).P(C)$

$= \frac{5}{7}.\frac{3}{7}.\frac{3}{7} + \frac{5}{7}.\frac{4}{7}.\frac{4}{7} + \frac{2}{7}.\frac{3}{7}.\frac{4}{7} + \frac{5}{7}.\frac{3}{7}.\frac{4}{7}$

$= \frac{45+80+24+60}{343} = \frac{209}{343}$

Q.18. Find the probability of drawing spade on each of 2 consecutive draws from a well shuffled pack of cards when the draws are without replacement.

(a) $\frac{2}{51}$ (b) $\frac{3}{51}$

(c) $\frac{4}{51}$ (d) $\frac{4}{51}$

[June 2013]

Solution : (b) is correct

P(spades on consecutive draws of 2 cards)

$= \frac{13_{c_1}}{52_{c_1}} \times \frac{12_{c_1}}{51_{c_1}} = \frac{13}{52} \times \frac{12}{51}$

$= \frac{3}{51} = \frac{1}{17}$

Q.19. A bag contains 2 red 3 green and 2 blue balls. If 2 balls are drawn at random from the bag find the probability that none of them will be blue.

(a) $\frac{11}{21}$ (b) $\frac{5}{7}$

(c) $\frac{10}{21}$ (d) $\frac{2}{7}$

[June 2013]

Solution : (c) is correct

Sample Space = n (S) = $^7c_2 = 21$

p(None are blue) = $\frac{5_{c_2}}{7_{c_2}} = \frac{10}{21}$

Q.20. If P(A) = 0.45, P(B) = 0.35, P(A and B) = 0.25 then P(A/B)

(a) 1.4 (b) 1.8

(c) 0.714 (d) 0.556

[Dec. 2013]

Solution : (c) is correct

$P(A/B) = \frac{P(A \cap B)}{P(B)} = \frac{0.25}{0.35}$

$= 0.714$

Q.21. Two coins are tossed simultaneously then the probability of getting exactly one head is

(a) $\frac{3}{4}$ (b) $\frac{2}{3}$

(c) $\frac{1}{4}$ (d) $\frac{1}{2}$

[Dec. 2013]

Solution : (d) is correct

P(Exactly 1 head) = P(H).P(T) + P(T).P(H)

$= \frac{1}{2}.\frac{1}{2} + \frac{1}{2}.\frac{1}{2} = \frac{2}{4} = \frac{1}{2}$

Q.22. The probability that a cricket team winning a match at Kanpur is 2/5 and loosing a match at Delhi is 1/7. What is the probability of the team winning at least one match?

(a) $\frac{3}{35}$ (b) $\frac{32}{35}$

(c) $\frac{18}{35}$ (d) $\frac{17}{35}$

[Dec. 2013]

Solution : (b) is correct

P(At least 1 match win)

= 1- P (No match win)

$= 1 - \left(1 - \frac{2}{5}\right)\frac{1}{7} = 1$-P (Loosing at Kanpur).P (Loosing at Delhi)

$= 1 - \frac{3}{5}.\frac{1}{7} = 1 - \frac{3}{35} = \frac{32}{35}$

Q.23. For any two events A_1, A_2; let $P(A_1)=\frac{2}{3}, P(A_2)=\frac{3}{8}$, $P(A_1 \cap A_2)=\frac{1}{4}$ then A_1, A_2 are

(a) Mutually Exclusive but not independent events

(b) Mutually Exclusive and independent events

(c) Independent but not Mutually Exclusive

(d) None *[June 2014]*

Solution : (c) is correct

$(A_1 \cap A_2)=\frac{1}{4} \neq 0$

So, A_1 and A_2 are not Mutually Exclusive Events.

$P(A_1 \cap A_2)=P(A_1).P(A_2)$

$=\frac{2}{3}\times\frac{3}{8}=\frac{1}{4}(given)$

$\therefore A_1$ & A_2 are clearly Independent Events

Q.24. If a pair of dice is thrown what is the probability of occurring neither 7 nor 11?

(a) $\frac{1}{6}$ (b) $\frac{1}{8}$

(c) $\frac{2}{9}$ (d) $\frac{7}{9}$

[June 2014]

Solution : (d) is correct

$n(s) = 6^2 = 36$

Let A Event of getting Their sum = 7

= {(1,6),(2,5),(3,4),(4,3),(5,2),(6,1)}

n(A) = 6

Let B = Event of getting their sum = 11

= {(5,6);(6,5)}

n(B) = 2

$P(A \cup B)=\frac{n(A)+n(B)}{n(s)}$

[$\because$ A & B are mutually Exclusive Events]

$=\frac{6+2}{36}=\frac{8}{36}=\frac{2}{9}$

P(Neither 7 nor 11) = $P(A \cup B)^1$

$= 1-p(A \cup B)$

$= 1-\frac{2}{9}=\frac{7}{9}$

Q.25. An urn contains 2 red and 1 green balls, another urn contains 2 red and 2 green balls. An urn was selected at random and then a ball was drawn from it. If it was found to be red then the probability that it has been drawn from first urn is

(a) $\frac{4}{7}$ (b) $\frac{3}{7}$

(c) $\frac{2}{3}$ (d) $\frac{7}{12}$

[June 2014]

Solution : (a) is correct

Baye's Theorem Question

Let A & B are selection of 1st & 2nd urns respectively.

$\therefore P(A) = P(B) = \frac{1}{2}$

E = Event of getting red ball.

$P(E/A)=\frac{2}{3}$; $P(E/B)=\frac{2}{4}=\frac{1}{2}$

$\therefore P(A/E)=\frac{P(A).P(E/A)}{P(A).P(E/A)+P(B).P(E/B)}$

$=\frac{\frac{1}{2}\cdot\frac{2}{3}}{\frac{1}{2}\cdot\frac{2}{3}+\frac{1}{2}\cdot\frac{1}{2}}=\frac{\frac{2}{3}}{\frac{2}{3}+\frac{1}{2}}=\frac{2}{3}\times\frac{6}{7}=\frac{4}{7}$

Q.26. If 6 coins are tossed simultaneously then the probability of obtaining exactly 2 heads is

(a) $\frac{1}{64}$ (b) $\frac{63}{64}$

(c) $\frac{15}{64}$ (d) None

[Dec. 2014]

Solution : (c) is correct

n = 6; p = $\frac{1}{2}$ (prob. of getting head)

$q = 1-p = 1-\frac{1}{2}=\frac{1}{2}$

p(x = 2)

$={}^6c_2.p^2.q^4=15.\left(\frac{1}{2}\right)^2.\left(\frac{1}{2}\right)^4=\frac{15}{64}$

Q.27. A die is thrown twice then the probability that the sum of the number is divisible by 4 is

(a) $\frac{1}{9}$ (b) $\frac{1}{3}$

(c) $\frac{11}{36}$ (d) $\frac{1}{4}$

[Dec. 2014]

Solution : (d) is correct

$n(s) = 6^2 = 36$

Let E = Event that the sum of numbers is divisible by 4.

= {(1,3),(2,2),(3,1),(2,6),(3,5),(4,4),(5,3),(6,2),(6,6)}

n(E) = 9

$\therefore P(E)=\frac{n(E)}{n(S)}=\frac{9}{36}=\frac{1}{4}$

Q.28. There are 6 positive and 8 negative numbers. Four number are selected at random without replacement and multiplied. Find the probability that the product is positive.

(a) $\frac{420}{1001}$ (b) $\frac{409}{1001}$

(c) $\frac{70}{1001}$ (d) $\frac{505}{1001}$

[June 2015]

Solution : (d) is correct

Let 6 positive Nos. are 1, 2, 3, 4, 5, 6, and 8 negative Nos. are –1,–2,–3, ...; –8

$\therefore$ Sample space

$= n(s) = {}^{14}C_4 = \frac{14!}{(4!)(10!)}$

$=\frac{14.13.12.11.10!}{4.3.2.1.10!}$

$= 1001$

Let Event = E = such that product of them is positive

$\therefore n(E) = {}^6C_4+{}^6C_2.{}^8C_2+{}^8C_4$ = (All + ve) (Two +ve & two -ve) + (All 4 are -ve)

$= 15 + 15 \times 28 + 70$

$= 505$

$\therefore P(E)=\frac{n(E)}{n(S)}=\frac{505}{1001}$

Q.29. $P(A^1)=3/8; P(A^2)=2/3; P(A^1 \cap A^2)=1/4$ then A_1 and A_2 will be

(a) Mutually exclusive & independent

(b) Exclusive but not independent

(c) Independent but not exclusive

(d) None *[June 2015]*

Solution : (c) is correct

$\because P(A_1 \cap A_2)=\frac{1}{4}$ (given) $\neq 0$

$\therefore A_1$ & A_2 are not Mutually Exclusive Events

$P(A_2 \cap A_2)=P(A_1).P(A_2)=\frac{3}{8}\times\frac{2}{3}=\frac{1}{4}$

Clearly A_1 and A_2 are Independent Events

Q.30. The sum of two numbers obtained in a single throw of two dice is 'S'. Then the probability of 's' will be maximum when 'S' =

(a) 5 (b) 7

(c) 6 (d) 8

[June 2015]

Solution : (b) is correct

S=Sum of face values of two due.

S={(1,6),(2,5),(3,4),(4,3),(5,2),(6,1)}

n(s) = 6 it is maximum if sum of their face is 7.

Q.31. When an unbiased dice is rolled, find the odds in favour of getting of multiple of 3.

(a) 1/6 (b) 1/4

(c) 1/2 (d) 1/3

[Dec. 2015]

Solution : (c) is correct

S = {1, 2, 3, 4, 5, 6}

Let E = {3,6}; E^1 = {1,2,3,4,5,6}-{3,6}

= {1,2,4,5} $\Rightarrow$ n(E) = 2; $n(E^1) = 4$

Odds in favour of Event

$E=\frac{n(E)}{n(E^1)}=\frac{2}{4}=\frac{1}{2}$

Q.32. Three coins are rolled, what is the probability of getting exactly two heads:

(a) 1/8 (b) 3/8

(c) 7/8 (d) 5/8

[Dec. 2015]

Solution : (b) is correct.

Given $n = 3$

P = Prob. (head) in 1 trial = $\frac{1}{2}$

$q = 1-p = 1-\frac{1}{2}=\frac{1}{2}$

$P(X=2)={}^3C_2.p^2.q^1=3.\left(\frac{1}{2}\right)^2.\frac{1}{2}=\frac{3}{8}$

Q.33. If a random sample of 500 Oranges produces 25 rotten oranges. Then the estimate of the proportion of rotten oranges in the sample is:

(a) 0.01 (b) 0.05

(c) 0.028 (d) 0.0593

[Dec. 2015]

Solution : (b) is correct.

$P=\frac{25}{500}=0.05$

Q.34. Two letter are drawn at random from word "HOME" find the probability that there is no vowel.

(a) 5/6 (b) 1/6

(c) 1/3 (d) None

[Dec. 2015]

Solution : (b) is correct.

$n(S) = {}^4C_2 = 6$.

E = Event of no vowel = {H; M}

$\therefore n(E) = {}^2C_2 = 1$.

$\therefore P(E)=\frac{n(E)}{n(S)}=\frac{1}{6}$

Q.35. A bag contains 15 one rupee coins, 25 two rupee coins and 10 five rupee coins. If a coin is selected at random from the bag, then the probability of not selecting a one rupee coin is:

(a) 0.30 (b) 0.70

(c) 0.25 (d) 0.20

[Dec. 2015]

Solution : (b) is correct.

$P=\frac{25+10}{50}=0.70$

Q.36. If $P(A)=\frac{2}{3}, P(B)=\frac{3}{5}, P(A \cup B)=\frac{5}{6}$, then P(A/B) is

(a) $\frac{7}{12}$ (b) $\frac{5}{12}$

(c) $\frac{1}{4}$ (d) $\frac{1}{2}$

[June 2016]

Solution : (b)

$P(A \cap B)=P(A)+P(B)-P(A \cup B)$

$=\frac{2}{3}+\frac{3}{5}-\frac{5}{6}$

$=\frac{20+18-25}{30}=\frac{13}{30}$

$P\left(\frac{A}{B^1}\right)=\frac{P(A \cap B^1)}{P(B^1)}$

$=\frac{P(A)-P(A \cap B)}{1-P(B)}$

$=\frac{\frac{2}{3}-\frac{13}{30}}{1-\frac{3}{5}}=\frac{\frac{20-13}{30}}{\frac{5-3}{5}}=\frac{7}{30}\times\frac{5}{2}=\frac{7}{12}$

Q.37. Two dice are tossed what is the probability that the total is divisible by 3 or 4

(a) $\frac{20}{36}$ (b) $\frac{21}{36}$

(c) $\frac{14}{36}$ (d) None

[June 2016]

Solution : (a)

$n(S) = 36$

A = Event of getting Nos. such that the sum of their face Nos. is divisible by 3 = (sum 3 + sum 6 + sum 9 + sum 12)

= {(1,2),(2,1);(1,5),(2,4),(3,3),(4,2),(5,1),(3,6),(4,5),(5,4),(6,3),(6,6)}

$n(A) = 12$

B = Event of getting Nos. such that the sum of their face Nos. is divisible by 4 = (sum 4 + sum 8 + sum 12)

= {(1,3),(2,2);(3,1);(2,6),(3,5),(4,4);(5,3);(6,2);(6,6)}

$n(B) = 9$

A ∩ B = Divisible by LCM of 3 & 4 = 12

= sum 12 = {(6,6)}

$n(A \cap B) = 1$

$$P(A \cup B) = \frac{n(A) + n(B) - n(A \cap B)}{n(S)}$$

$$= \frac{12 + 9 - 1}{36} = \frac{20}{36} = \frac{5}{9}$$

(*a*) is correct.

Q.38. If 2 dice are rolled simultaneously then the probability that their sum is neither 3 nor 6 is

(*a*) 0.5 (*b*) 0.75

(*c*) 0.25 (*d*) 0.80

[June 2016]

Solution : (*d*)

A = event that sum is 3

= {(1,2);(2,1)}

$n(A) = 2$

B = event that sum is 6

= {(1,5),(2,4),(3,3),(4,2),(5,1)}

$n(B) = 5$

$A \cap B = \phi$

$\therefore n(A \cap B) = 0$

$$P(A \cup B) = \frac{n(A) + n(B) - n(A \cap B)}{n(S)}$$

$$= \frac{2 + 5 - 0}{36} = \frac{7}{36}$$

$$P(A \cup B)' = 1 - P(A \cup B) = 1 - \frac{7}{36}$$

$$= \frac{29}{36} = 0.80$$

Q.39. In a game, cards are thoroughly shuffled and distributed equally among four players. What is the probability that a specific player gets all the four kings?

(*a*) $\frac{52_{C_4} \times 48_{C_{13}}}{52_{C_{13}}}$ (*b*) $\frac{4_{C_4} \times 48_{C_9}}{52_{C_{13}}}$

(*c*) $\frac{13_{C_4} \times 39_{C_9}}{52_{C_{13}}}$ (*d*) $\frac{4_{C_4} \times 39_{C_9}}{52_{C_{13}}}$

[June 2016]

Solution : (*b*)

Each candidate will get 13 cards.

$\therefore n(S) = {}^{52}C_{13}$

let E = Event of getting all 4 kings and rest 9 cards by a player out of 48.

$\therefore n(E) = {}^4C_4 \cdot {}^{48}C_9$

$$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{{}^4C_4 \cdot {}^{48}C_9}{{}^{52}C_{13}}$$

(*b*) is correct

Q.40. A bag contains 4 red and 5 black balls. Another bag contains 5 red, 3 black balls. If one ball is drawn at random from each bag. Then the probability that one red and one black ball drawn is _____.

(*a*) $\frac{12}{72}$ (*b*) $\frac{25}{72}$

(*c*) $\frac{37}{72}$ (*d*) $\frac{13}{72}$

[June 2016]

Solution : Prob. (1 red and 1 black balls)

$= P(R_1) \cdot P(B_2) + P(B_1) \cdot P(R_2)$

Where R_1 = event of getting red ball from 1st bag.

R_2 = " " " " 2nd "

B_1 = " " Black ball from 1st bag.

B_2 = " " " 2nd "

$$\therefore \text{Prob.} = \frac{{}^4C_1}{{}^9C_1} \times \frac{{}^3C_1}{{}^8C_1} + \frac{{}^5C_1}{{}^9C_1} \times \frac{{}^5C_1}{{}^8C_1}$$

$$= \frac{4}{9} \times \frac{3}{8} + \frac{5}{9} \times \frac{5}{8} = \frac{12 + 25}{72} = \frac{37}{72}$$

Q.41. In a discrete random variable follows uniform distribution and assumes only the value 8, 9, 11, 15, 18, 20. Then $P(X \le 15)$ is _____

(*a*) 1/2 (*b*) 1/3

(*c*) 2/3 (*d*) 2/7

[June 2016]

Solution : (*c*)

E = Event of Nos. ≤ 15 = {8, 9, 11, 15}

$$P(X \le 15) = \frac{n(E)}{n(S)} = \frac{4}{6} = \frac{2}{3}$$

Q.42. A bag contains 6 green and 5 red balls. One ball is drawn at random. The probability of getting a red ball is?

(*a*) $\frac{5}{11}$ (*b*) $\frac{6}{11}$

(*c*) $\frac{5}{6}$ (*d*) None

[Dec. 2016]

Solution : (*a*) is correct.

$n(S) = {}^{11}C_1 = 11$

Let E = Event of getting a red ball.

$n(E) = {}^5C_1 = 5$

$$P(E) = \frac{5}{11}$$

Q.43. If two events A, B $P(A) = \frac{1}{2}$; $P(B) = \frac{1}{3}$ and $P(A \cup B) = \frac{2}{3}$, then find $P(A \cap B)$?

(*a*) $\frac{1}{4}$ (*b*) $\frac{1}{6}$

(*c*) $\frac{2}{3}$ (*d*) $\frac{1}{2}$

[Dec. 2016]

Solution : (*b*) is correct.

$$P(A \cap B) = P(A) + P(B) - P(A \cup B)$$

$$= \frac{1}{2} + \frac{1}{3} - \frac{2}{3} = \frac{1}{6}$$

Q.44. If $P(A) = \frac{2}{3}$, $P(B) = \frac{3}{8}$, $P(A \cap B) = \frac{1}{4}$, then the events A & B are_____

(*a*) Independent and mutually exclusive

(*b*) Independent but not mutually exclusive

(*c*) Mutually exclusive but not independent

(*d*) Neither Independent nor exclusive ***[Dec. 2016]***

Solution : (*b*) is correct.

Since, $P(A \cap B) \neq 0$, So A & B are not mutually exclusive events.

Now, $P(A \cap B) = P(A).P(B) = \frac{2}{3} \cdot \frac{3}{8} = \frac{1}{4}$

Hence, Events A & B are Independent events.

So, (*b*) is correct.

Q.45. The probability of getting atleast one 6 from 3 throws of a perfect die is

(*a*) $\frac{5}{6}$ (*b*) $\left(\frac{5}{6}\right)^3$

(*c*) $1 - \left(\frac{1}{6}\right)^3$ (*d*) $1 - \left(\frac{5}{6}\right)^3$

[June 2017]

Solution : (*d*) is correct

n = 3 (Trials)

P = Prob. of getting 6 in 1 trial = $\frac{1}{6}$

$q = 1 - p = 1 - \frac{1}{6} = \frac{5}{6}$

$$P(x \ge 1) = 1 - P(x < 1)$$

$$= 1 - P(x = 0) = 1 - {}^3C_0 \cdot P^0 \cdot q^3$$

$$= 1 - 1.1.\left(\frac{5}{6}\right)^3 = 1 - \left(\frac{5}{6}\right)^3$$

Q.46. For any two events A and B

(*a*) P(A-B) = P(A)-P(B)

(*b*) P(A-B) = P(A) - P(A ∩ B)

(*c*) P(A-B) = P(B) - P(A ∩ B)

(*d*) P(B-A) = P(B) + P(A ∩ B)

[June 2017]

Solution : (*b*)

Q.47. If $P(A) = \frac{2}{3}$, $P(B) = \frac{1}{4}$, $P(A \cap B) = \frac{1}{12}$ then $P\left(\frac{B}{A}\right) =$ ____

(*a*) $\frac{1}{8}$ (*b*) $\frac{7}{8}$ (*c*) $\frac{1}{3}$ (*d*) $\frac{2}{5}$

[June 2017]

Solution : (*a*) is correct

$$P\left(\frac{B}{A}\right) = \frac{P(A \cap B)}{P(A)}$$

$$= \frac{1/12}{2/3} = \frac{1}{12} \times \frac{3}{2} = \frac{1}{8}$$

Q.48. For the events A & B if $P(A) = \frac{1}{2}$, $P(B) = \frac{1}{3}$ and $P(A \cap B) = \frac{1}{4}$ then $P\left(\frac{A}{B}\right) =$

(*a*) 1/2 (*b*) 1/6 (*c*) 2/3 (*d*) 3/4

[Dec. 2017]

Solution : (*d*)

$$P\left(\frac{A}{B}\right) = \frac{P(A \cap B)}{P(B)} = \frac{1/4}{1/3} = \frac{3}{4}$$

Q.49. If A & B are two mutually exclusive events such that $P(A \cup B) = \frac{2}{3}$, $P(A) = \frac{2}{5}$, then P (B):

(*a*) 4/15 (*b*) 4/9

(*c*) 5/9 (*d*) 7/15

[Dec. 2017]

Solution : (*a*)

$P(A \cup B) = P(A) + P(B)$

[$\because$ A & B are two mutually exclusive events]

$$\frac{2}{3} = \frac{2}{5} + P(B)$$

$$\text{or ; } P(B) = \frac{2}{3} - \frac{2}{5} = \frac{10 - 6}{15} = \frac{4}{15}$$

Q.50. If a brother and a sister are applied for 2 vacancies in the same post. The probability that brother will select is 1/7 and that of sister is 1/5, then the probability that (i) Both will select (ii) Only one will select, (iii) None of them will select:

(*a*) $\frac{1}{35}, \frac{10}{35}, \frac{24}{35}$ (*b*) $\frac{24}{35}, \frac{7}{35}, \frac{14}{35}$

(*c*) $\frac{3}{35}, \frac{24}{35}, \frac{11}{35}$ (*d*) $\frac{24}{35}, \frac{6}{35}, \frac{20}{35}$

[Dec. 2017]

Solution : (*a*)

Let A and B are events of selection of brother and sister respectively.

$\because$ Both events are independent.

(*i*) P(Both selected)

$$= P(A \cap B) = P(A) \cdot P(B)$$

$$= \frac{1}{7} \cdot \frac{1}{5} = \frac{1}{35}$$

(*ii*) P(Only one will be selected]

$$= \{P(A) - P(A \cap B)\} + \{P(B) - P(A \cap B)\}$$

$$= \frac{1}{7} - \frac{1}{35} + \frac{1}{5} - \frac{1}{35}$$

$$= \frac{1}{5} + \frac{1}{7} - \frac{2}{35}$$

$$= \frac{7 + 5 - 2}{35} = \frac{10}{35}$$

(*iii*) P(None of them will be selected)

$$= P(A^1) \cdot P(B^1) = \left(1-\frac{1}{7}\right) \cdot \left(1-\frac{1}{5}\right)$$

$$= \frac{6}{7} \times \frac{4}{5} = \frac{24}{35}$$

Q.51. If 4 letters are put randomly among the 4 envelopes then the probability that all are not put in correct envelopes:

(*a*) 1/24 (*b*) 1

(*c*) 23/24 (*d*) 9/24

[June 2018]

Solution : (*c*)

$n(s) = 4! = 24$

Let E = Events of putting letter in right envelop.

$\therefore n(E) = 1.1.1.1 = 1$

$$p(E) = \frac{n(E)}{n(S)} = \frac{1}{24}$$

$$p(E^1) = 1 - 1/24 = 23/24$$

Q.52. Two broad divisions of probability are:

(*a*) Subjective probability and objective probability

(*b*) Deductive probability and mathematical probability

(*c*) Statistical probability and mathematical probability

(*d*) None of these

[May 2018]

Solution : (*a*)

Two broad divisions of Probability are

(i) Subjective Probability

(ii) Objective Probability

Q.53. The term "chance" and probability are synonyms:

(*a*) True (*b*) False

(*c*) Both (*d*) None

[May 2018]

Solution : (*a*)

Q.54. The theorem of Compound Probability states that for any two events A and B

(*a*) $P(A \cap B) = P(A) \times P(B/A)$

(*b*) $P(A \cup B) = P(A) \times P(B/A)$

(*c*) $P(A \cap B) = P(A) \times P(B)$

(*d*) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ ***[CA (F) May 2018]***

Solution :

(*a*) The theorem of Compound Probability states that for two events A and B

$$P(A \cap B) = P(A) \times P(B/A)$$

Q.55. Variance of random variable x is given by

(*a*) $E(X-\mu)^2$

(*b*) $E[X-E(X)]^2$

(*c*) $E(X^2-\mu)$

(*d*) (*a*) or (*b*)

[May 2018]

Solution :

(*d*) Variance of a random variable x is given by

$$V(x) = E(X-\mu)^2$$

or

$$V(x) = E[X-E(X)]^2$$

Note : $\because \mu = E(X)$

Q.56. What is the probability of having at least one 'six' appear in 3 throws of a perfect die?

(*a*) 5/6 (*b*) $(5/6)^3$

(*c*) $1-(1/6)^3$ (*d*) $1-(5/6)^3$

[May 2018]

Solution :

(*d*) For a die Probability of getting Six

$$P(A) = \frac{1}{6} = p$$

$$P(\overline{A}) = 1 - \frac{1}{6} = \frac{5}{6} = q$$

Here n = 3

P(getting at least '1' Six) = $P(X \geq 1)$

$$= 1 - P(X < 1)$$

$$= 1 - P(X = 0)$$

$$= 1 - {}^3C_0 \cdot \left(\frac{1}{6}\right)^0 \cdot \left(\frac{1}{6}\right)^{3-0}$$

$$= 1 - 1 \times 1 \times \left(\frac{5}{6}\right)^3$$

$$= 1 - \left(\frac{5}{6}\right)^3$$

Q.57. Sum of all probabilities of mutually exclusive and exhaustive events is equal to

(*a*) 0 (*b*) 1/2

(*c*) 1/4 (*d*) 1

[Nov. 2018]

Solution : (*d*)

If events are mutually exclusive and exhaustive events then

Sum of all probabilities = 1.

Q.58. If $P(A) = \frac{1}{2}$, $P(B) = \frac{1}{3}$, and $P(A \cap B) = \frac{1}{4}$ then $P(A \cup B)$ is equal to

(*a*) $\frac{11}{12}$ (*b*) $\frac{7}{12}$ (*c*) $\frac{10}{12}$ (*d*) $\frac{1}{6}$

[Nov. 2018]

Solution : (*b*)

$$P(A \cap B) = P(A) + P(B) - P(A \cap B)$$

$$= \frac{1}{2} + \frac{1}{3} - \frac{1}{4} = \frac{6+4-3}{12} = \frac{7}{12}$$

Q.59. Two different dice are thrown simultaneously, then the probability, that the sum of two numbers appearing on the top of dice is 9 is

(*a*) $\frac{1}{9}$

(*b*) $\frac{8}{9}$

(*c*) $\frac{7}{9}$

(*d*) None of the above

[Nov. 2018]

Solution : (*a*)

$n(S) = 6^2 = 36$

E = {(3, 6), (4, 5), (5, 4), (6, 3)}

n(E) = 4

$$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{4}{36} = \frac{1}{9}$$

Q.60. If $(A \cup B) = 0.8$ and $P(A \cap B) = 0.3$ then $P(\overline{A}) + P(\overline{B})$ is equal to:

(*a*) 0.3 (*b*) 0.5

(*c*) 0.9 (*d*) 0.7

[Nov. 2018]

Solution : (*c*)

$P(A \cap B) = P(A) + P(B) - P(A \cap B)$

or ; $0.8 = P(A) + (B) - 0.3$

or ; $P(A) + P(B) = 0.8 + 0.3 = 1.1$

$\therefore P(\overline{A}) + P(\overline{B}) = 1 - P(A) + 1 - P(B)$

$= 2 - [P(A) + P(B)]$

$= 2 - 1.1 = 0.9$

Q.61. The probability that a leap year has 53 Wednesday is

(*a*) $\frac{2}{7}$ (*b*) $\frac{3}{5}$

(*c*) $\frac{1}{7}$ (*d*) $\frac{2}{3}$

[Nov. 2018]

Solution : (*a*)

1 Leap year = 366 days = 52 weeks & 2 days

$\therefore$ S = {(Sun ; Mon) ; (Mon ; Tues) ; (Tues ; Wed) ; (Wed ; Thurs) ; (Thurs ; Fri) ; (Fri ; Sat) ; (Sat ; Sun)

$\therefore n(S) = 7$

E = Event of getting wednesday

= {Tues ; Wed) ; (Wed ; Thurs)}

n(E) = 2

$$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{2}{7}$$

Q.62. A coin is tossed six times, then the probability of obtaining heads and tails alternatively is

(*a*) $\frac{1}{2}$ (*b*) $\frac{1}{32}$

(*c*) $\frac{1}{64}$ (*d*) $\frac{1}{16}$

[Nov. 2018]

Solution : (*b*)

P(Head & Tail alternatively)

= P(H) . P(T) . P(H) . P(T) . P(H) . P(T).

+ P(T) . P(H) . P(T) . P(H) . P(T) . P(H)

$$= \left(\frac{1}{2}\right)^6 + \left(\frac{1}{2}\right)^6$$

$$= \frac{1}{64} + \frac{1}{64} = \frac{2}{64} = \frac{1}{32}$$

Q.63. Ram is known to hit a target in 2 out of 3 shots where as Shyam is known to hit the same target in 5 out of 11 shots. What is the probability that the target would be hit if they both try?

(*a*) $\frac{9}{11}$ (*b*) $\frac{6}{11}$

(*c*) $\frac{10}{33}$ (*d*) $\frac{3}{11}$

[Nov. 2018]

Solution : (*a*)

$P(Ram) = P(R) = \frac{2}{3}$

$P(R^1) = 1 - \frac{2}{3} = \frac{1}{3}$

and $P(Shyam) = P(S) = \frac{5}{11}$

$\Rightarrow P(S^1) = 1 - \frac{5}{11} = \frac{6}{11}$

$\therefore$ P (Target hit) = 1 – P (Target not hit)

$$= 1 - P(R^1) \cdot P(S^1) = 1 - \frac{1}{3} \cdot \frac{6}{11}$$

$$= 1 - \frac{2}{11} = \frac{9}{11}$$

Q.64. The probability that a student is not a swimmer is $\frac{1}{5}$, then the probability that out of five students four are swimmer is

(*a*) $\left(\frac{4}{5}\right)^4\left(\frac{1}{5}\right)$ (*b*) ${}^5C_1\left(\frac{1}{5}\right)^4\left(\frac{4}{5}\right)$

(*c*) ${}^5C_4\left(\frac{4}{5}\right)^4\left(\frac{1}{5}\right)$ (*d*) None

[Nov. 2018]

Solution : (*c*)

Given that

let q = Prob. that a student is not a swimmer $= \frac{1}{5}$

$\therefore$ P = Prob. (Swimmer) = 1 – *q* =

$$1 - \frac{1}{5} = \frac{4}{5}$$

n = 5

$\therefore p(X = 4) = {}^5C_4 \cdot p^4 \cdot q^1$

$$= {}^5C_4 \cdot \left(\frac{4}{5}\right)^4 \cdot \left(\frac{1}{5}\right)^1$$

Q.65. If Y $\geq$ x then mathematical expectation is

(*a*) E (X) > E (Y)

(*b*) E (X) $\leq$ E (Y)

(*c*) E (X) = E (Y)

(*d*) E (X) . E (Y) = 1

[June 2019]

Solution :

(*b*) If $y \geq x$

then $E(y) \geq E(x)$

$E(x) \leq E(y)$

Q.66. Two event A and B are such that they do not occurs simultaneously then they are called _____ events

(*a*) Mutually exhaustive

(*b*) Mutually exclusive

(*c*) Mutually independent

(*d*) Equally likely

[June 2019]

Solution : (*b*)

Q.67. According to Baye's theorem.

$$P(E_K/A)=\frac{P(E_K)P(A/E_K)}{\sum_{i}^{n} P(E_1)P(A/E_1)}$$

(*a*) E_1, E_2 ..... are mutually exclusive

(*b*) $P(E/A_1), P(E/A_2)$, ... are equal to 1

(*c*) $P(A_1/E), P(A_2/E)$, ... are equal to 1

(*d*) A & E_1's are disjoint sets.

[June 2019]

Solution :

(*b*) According to Baye's Theorem

$$P(E_K/A)=\frac{P(E_K)P(A/E_K)}{\sum_{i=1}^{i=n} P(E_i)\cdot P(A/E_i)}$$

Where, E_1, E_2, E_3 ..... are Mutually Exclusive.

Q.68. If a coin is tossed 5 times then the probability of getting Tail and Head Occurs alternatively is

(*a*) $\frac{1}{8}$ (*b*) $\frac{1}{16}$

(*c*) $\frac{1}{32}$ (*d*) $\frac{1}{64}$

[June 2019]

Solution : (*b*)

P(getting tail and Head occurs Alternatives)

= P(HTHTH) or P(THTHT)

$$=\left(\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}\right)+\left(\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}\right)$$

$$=\frac{1}{32}+\frac{1}{32}=\left(\frac{1+1}{32}\right)$$

$$=\frac{2}{32}=\frac{1}{16}$$

Q.69. When 2 - dice are thrown Simultaneously then the probability of getting at least one 5 is

(*a*) $\frac{11}{36}$ (*b*) $\frac{5}{36}$

(*c*) $\frac{8}{15}$ (*d*) $\frac{1}{7}$

[June 2019]

Solution :

(*a*) If two dice are thrown then sample space n(S) = 36

Events 'A' = getting at least one '5'

'A' = {(5,1) ; (5,2) ; (5,3) ; (5. 4) ; (5, 5) ; (5, 6)

(1,5) ; (2,5) ; (3,5) ; (4. 5) ; (6, 5)}

n (A) = 11

$$p(A)=\frac{n(A)}{n(S)}=\frac{11}{36}$$

Q.70. If two letters are taken at random from the word HOME, what is the Probability that none of the letters would be vowels:

(*a*) 1/6 (*b*) 1/2

(*c*) 1/3 (*d*) 1/4

[Dec. 2019]

Solution : (*a*)

$n(S) = {}^4C_2 = 6$

Let E = Event of getting 2 consonants *i.e.* not vowel.

$\therefore n(E) = {}^2C_2 = 1$

$$\therefore P(E)=\frac{n(E)}{n(S)}=\frac{1}{6}$$

Q.71. A bag contains 15 one rupee coins, 25 two rupee coins and 10 five rupee coins. If a coin is selected at random from the bag, then the probability of not selecting a one rupee coin is

(*a*) 0.30 (*b*) 0.70

(*c*) 0.25 (*d*) 0.20

[Dec. 2019]

Solution : (*b*)

Total coins = 15 + 25 + 10 = 50

$n(S) = {}^{50}C_1 = 50.$

Let E = Event of selecting no one rupee coin.

$\therefore n(E) = {}^{25+10}C_1 = {}^{35}C_1 = 35$

$$\therefore P(E)=\frac{n(E)}{n(s)}=\frac{35}{50}=0.70.$$

Q.72. The chance of getting 7 or 11 in a throw of 2 dice is

(*a*) 7/9 (*b*) 5/9

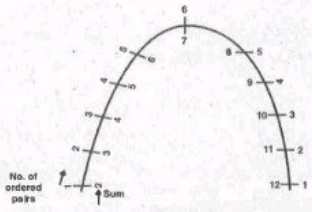
(*c*) 2/9 (*d*) None of these

[Dec. 2019]

Solution : (*c*)

Tricks:

Remember this diagram.



$n(s)=6^2=36$

Let E = Sum 7 or 11

$n(E)=6+2=8$

$$P(E)=\frac{n(E)}{n(s)}=\frac{8}{36}=\frac{2}{9}$$

Q.73. When 2 fair dice are thrown what is the probability of getting the sum which is a multiple of 3?

(*a*) 4/36 (*b*) 8/36 (*c*) 2/36 (*d*) 12/36

[Dec. 2020]

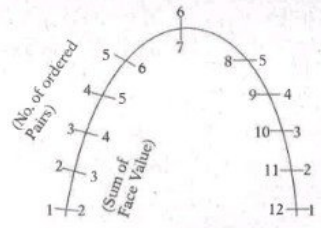
Solution :

$n(s)$ = sample space = $6^2 = 36$

E = The sum which is multiple of 3

$n(E)$ = sum (3) + sum (6) + sum (9) + sum (12)

= 2 + 5 + 4 + 1 = 12



$$P(E)=\frac{n(E)}{n(S)}$$

$$=\frac{12}{36}$$

(*d*) is correct.

Q.74. When two coins are tossed simultaneously the probability of getting atleast one tail?

(*a*) 1 (*b*) 0.75

(*c*) 0.5 (*d*) 0.25

[Dec. 2020]

Solution :

Sample Space = S = {HH; HT, TH; TT}

$n(S) = 4$

E = Event of at least 1 tail

= {HT, TH,TT}

$n(E) = 3$

$$\therefore P(E)=\frac{n(E)}{n(S)}=\frac{3}{4}=0.75$$

(*b*) is correct

Q.75. When 3 dice are rolled simultaneously the probability of a number on the third die is greater than the sum of the numbers on two dice is

(*a*) 12/216 (*b*) 36/216

(*c*) 48/216 (*d*) 60/216

[Dec. 2020]

Solution :

Sample Space = $n(S) = 6^3 = 216$

E = Event that Number on third die is greater that sum of the number on two dice.

$\therefore n(E) = 3[n(1 > \text{sum}) + n(2 > \text{sum}) + n(3 > \text{sum}) + n(4 > \text{sum}) + n(5 > \text{sum}) + n(6 > \text{sum})]$

$= 3[0 + 0 + 1 + (1 + 2) + (1 + 2 + 3) + (1 + 2 + 3 + 4)] = 3 \times [1 + 3 + 6 + 10]$

$= 20 \times 3 = 60$

$$\therefore P(E)=\frac{n(E)}{n(s)}=\frac{60}{216}$$

(*d*) is correct

Q.76. If A speaks 75% of truth and B speaks 80% of truth. In what percentage both of them likely contradict with each other in narrating the same questions?

(*a*) 0.60 (*b*) 0.45

(*c*) 0.65 (*d*) 0.35

[Dec. 2020]

Solution :

Let A = Event of Speaking truth by A

B = Event of Speaking truth by B

$\therefore P(A) = 75\% = 0.75; P(A') = 1 - P(A) = 1 - 0.75 = 0.25$

$P(B) = 80\% = 0.80;$

$P(B') = 1 - P(B) = 1 - 0.80 = 0.20$

$P(\text{Contradict}) = P(A)P(B') + P(A')P(B)$

$= 0.75 \times 0.20 + 0.25 \times 0.80$

$= 0.35 = 35\%$

(*d*) is correct

Q.77. An event that can be sub-divided into further events is called as.

(*a*) A composite event

(*b*) A complex event

(*c*) A mixed event

(*d*) A simple event

[Jan. 2021]

Solution : (*a*) is correct

An event that can be sub-divided into further events is called composite or compound Events.

Example : In the experiment of throwing a die: The event of getting an even number is a composite number. This event can be further sub-divided or broken down into 3 simpler event

1. The event of getting 2.
2. The event of getting 4 and
3. The event of getting 6.

Q.78. Three identical and balanced dice are rolled. The probability that the same number will appear on each of them is.

(a) $\frac{1}{6}$ (b) $\frac{1}{18}$

(c) $\frac{1}{36}$ (d) $\frac{1}{24}$

[Jan. 2021]

Solution : (c) is correct

Sample space = $n(s) = 6^3 = 216$.

Let A = Event of getting same number on all 3 dice

= {(1, 1, 1); (2, 2, 2); (3, 3, 3); ...; (6, 6, 6)}

$\therefore \quad n(A) = 6.$

$\therefore \quad P(A) = \frac{n(A)}{n(S)} = \frac{6}{216} = \frac{1}{36}$

Q.79. A basket contains 15 white balls, 25 red balls and 10 blue balls. If a ball is selected at random, the probability of selecting not a white ball.

(a) 0.20 (b) 0.25

(c) 0.60 (d) 0.70

[Jan. 2021]

Solution : (d) is correct

Total balls = 15 + 25 + 10 = 50

Sample space of getting 1 ball

$= n(S) = 50c_1 = 50$

Let A = Event of getting not a white ball means event of getting a ball out of 10 blue and 25 red balls

$\therefore \quad n(A) = 35c_1 = 35$

$\therefore \quad P(A) = \frac{n(A)}{n(S)}$

$= \frac{35}{50} = 0.70$

Q.80. Two dice are thrown simultaneously. The probability of a total score of 5 from the outcomes of dice is.

(a) $\frac{1}{18}$ (b) $\frac{1}{12}$

(c) $\frac{1}{9}$ (d) $\frac{2}{5}$

[Jan. 2021]

Solution : (c) is correct.

Sample space = $n(S) = 6^2 = 36$

Let A = Event of getting numbers on both dice such that their sum is equal to 5.

= {(1,4), (2, 3), (3, 2), (4, 1)}

n(A) = 4

$\therefore \quad P(A) = \frac{n(A)}{n(S)} = \frac{4}{36} = \frac{1}{9}$

Q.81. Two dice are thrown simultaneously. The probability of a total score of 5 from the outcomes of dice is.

(a) $\frac{1}{18}$ (b) $\frac{1}{12}$

(c) $\frac{1}{9}$ (d) $\frac{2}{5}$

[July 2021]

Solution : (c) is correct.

Sample space = $n(S) = 6^2 = 36$

Let A = Event of getting numbers on both dice such that their sum is equal to 5.

= {(1, 4), (2, 3), (3, 2), (4, 1)}

n(A) = 4

$\therefore \quad P(A) = \frac{n(A)}{n(S)} = \frac{4}{36} = \frac{1}{9}$

Q.82. A biased coin is such that the probability of getting a head is thrice the probability of getting a tail. If the coin is tossed 4 times, what is the probability of getting a head all the times?

(a) 2/5 (b) 81/128

(c) 81/256 (d) 81/64

[July 2021]

Solution : (c) is correct. Given n = 4

Let probability of getting head = p

and probability of getting tail = q.

Given p = 3q.

$\because \quad p + q = 1$

or $\quad 3q + q = 1$

or $\quad 4q = 1$

or $\quad q = \frac{1}{4}$

$\therefore \quad p = 3q = 3 \times \frac{1}{4} = \frac{3}{4}$

$p(X = 4) = {}^4c_4.p^4.q^0$

$= 1.\left(\frac{3}{4}\right)^4.1 = \frac{81}{256}$

Q.83. If there are 16 phones, 10 of them are Android and 6 of them are of Apple, then the probability of 4 randomly selected phones to include 2 Android and 2 Apple phone is

(a) 0.47 (b) 0.51

(c) 0.37 (d) 0.27

[July 2021]

Solution : (c) is correct.

$n(s) =$ Sample Space

$= {}^{16}C_4 = \frac{|16}{|4.|12} = 1820$

Let E = Event of getting 2 Android and 2 Apple phones

$n(E) = {}^{10}C_2 \times {}^6C_2 = 45 \times 15 = 675$

$\therefore p(E) = n(E)\ \frac{n(E)}{n(S)} = \frac{675}{1820} = 0.37$

Q.84. If there are 48 marbles marked with numbers 1 to 48, then the probability of selecting a marble having the number divisible by 4 is

(a) 1/2 (b) 2/3

(c) 1/3 (d) 1/4

[July 2021]

Solution : (d) is correct

$n(s) =$ Sample Space $= {}^{48}C_1 = 48$

Let E = Event of getting a number divisible by 4

= {4, 8, 12, ... 48}

n(E) = 12

$p(E) = \frac{n(E)}{n(S)} = \frac{12}{48} = \frac{1}{4}$

Q.85. If in a class, 60% of the student study Mathematics and Science and 90% of the student study Science, then the probability of a student studying Mathematics given that he/she is already studying Science is

(a) 1/4 (b) 2/3

(c) 1 (d) 1/2

[July 2021]

Solution : (b) is correct.

Let A = Event of studying Mathematics

B = Event of Studying Science.

Given

$p(A \cap B) = 60\% = 0.60$

and $\quad p(B) = 90\% = 0.90$

$p\left(\frac{A}{B}\right) = \frac{p(A \cap B)}{p(B)} = \frac{0.60}{0.90}$

$= \frac{6}{9} = \frac{2}{3}$

Q.86. A bag contains 7 Blue and 5 Green balls One ball is drawn at random. The probability of getting a Blue ball is

(a) 5/12 (b) 12/35

(c) 7/12 (d) 0

[July 2021]

Solution : (c) is correct.

Let Sample Space = $n(S) = {}^{12}C_1 = 12$

Let E = Event of getting a blue ball

$\therefore \quad n(E) = {}^7C_1 = 7$

$\therefore \quad p(E) = \frac{n(E)}{n(S)} = \frac{7}{12}$

Q.87. The probability that a football team loosing a match at Kolkata is 3/5 and winning a match at Bengaluru is 6/7, the probability of the team winning at least one match is

(a) 3/35 (b) 18/35

(c) 32/35 (d) 17/35

[July 2021]

Solution : (c) is correct.

Let p(A') = probability of loosing match in Kolkata = $\frac{3}{5}$

$\therefore \quad p(A) = 1 - p(A') = 1 - \frac{3}{5} = \frac{2}{5}$

Let p(B) = proof. of winning match in Bengaluru.

$= \frac{6}{7}$

$\therefore \quad p(B') = 1 - p(B) = 1 - \frac{6}{7} = \frac{1}{7}$

p(At least one match winning)

= 1 – p(Loosing both match)

= 1 – p(A'). p(B')

$= 1 - \frac{3}{5}.\frac{1}{7} = \frac{35-3}{35} = \frac{32}{35}$

Q.88. For any two dependent events A and B, P(A) = 5/9 and P(B) = 6/11 and P(A∩B) = 10/33. What are the values of P(A/B) and P(B/A)?

(a) 5/9, 6/11 (b) 5/6, 6/11

(c) 1/9, 2/9 (d) 2/9, 4/9

[Dec. 2021]

Solution : (a)

$P(A/B) = \frac{P(A \cap B)}{P(B)} = \frac{\frac{10}{33}}{\frac{6}{11}}$

$= \frac{\frac{5}{\cancel{10}}}{\frac{\cancel{33}}{3}} \times \frac{\frac{\cancel{11}}{\cancel{6}}}{\frac{\cancel{3}}{3}} = \frac{5}{9}$

$P(B/A) = \frac{P(A \cap B)}{P(A)} = \frac{\frac{10}{33}}{\frac{5}{9}}$

$= \frac{\frac{2}{\cancel{10}}}{\frac{\cancel{33}}{11}} \times \frac{\frac{3}{\cancel{9}}}{5} = \frac{6}{11}$

Q.89. Which of the following pair of events E and F are mutually exclusive?

(a) E = {Ram's age is 13} and F = {Ram is studying in a college}

(b) E = {Sita studies in a school} and F = {Sita is a play back singer}

(c) E = {Raju is an elder brother in a family} and F = {Raju's father has more than one son}

(d) E = {Banu studied B.A. English literature} and F = {Banu can read English novels}

[Dec. 2021]

Solution : (a)

Note : 13 years old student cannot get admission in college.

Q.90. Four unbiased coins are tossed simultaneously. The expected number of heads is:

(a) 1 (b) 2

(c) 3 (d) 4

[Dec. 2021]

Solution : (b)

Given

n = 4; P = Probability of getting head

$= \frac{1}{2}$

∴ Expected No. of heads

= Mean of getting head

$= np = 4 \times \frac{1}{2} = 2$

Q.91. Assume that the probability for rain on a day is 0.4. An umbrella salesman can earn Rs. 400 per day in case of rain on that day and will lose Rs. 100 per day if there is no rain. The expected earnings (in Rs.) per day of the salesman is

(a) 400 (b) 200

(c) 100 (d) 0

[Dec. 2021]

Solution : (c)

Rain (x)	P	Px
400	0.4	160
–100	0.6	– 60
		$\sum Px = 100$

∴ Expected earning = $\sum Px = 100$

Q.92. The probability distribution of a random variable *x* is given below:

x:	1	2	4	5	6
P:	0.15	0.25	0.2	0.3	0.1

What is the standard deviation of x?

(*a*) 1.49 (*b*) 1.56

(*c*) 1.69 (*d*) 1.72

[Dec. 2021]

Solution : (*c*)

Variance = $\sigma^2 = \Sigma Px^2 - (\Sigma Px)^2$

Calculator Tricks

*$\Sigma Px^2 = 1^2 \times 0.15$ = button (Press)

4×0.25 = button (Press)

16×0.2 = button (Press)

25×0.3 = button (Press)

36×0.1 = button (Press) then GT button

= 15.45 (M+) button

*For ΣPx = 1×0.15 = button (Press)

2×0.25 = button (Press)

4×0.2 = button (Press)

5×0.3 = button (Press)

6×0.1 = button (Press) n GT button

$= 3 \times 55 \times n$ = button

(M–) button.

Finally press MRC button 2 times

Then Press √ button

we get SD = σ = 1.687

= 1.69

Q.93. In a group of 20 males and 15 females 12 males and 8 females are service holders. What is the probability that a person selected at random from the group is a service holder given that the selected person is a male?

(*a*) 0.40 (*b*) 0.60

(*c*) 0.45 (*d*) 0.55

[Dec. 2021]

Solution : (*b*)

	Males	Females
Total	20	15
Service holder	12	8
Non-Service holder	8	7

Probability of male service holder

$$= \frac{12}{20} = 0.60$$

Q.94. There are 3 boxes with the following composition:

Box I : 7 Red + 5 White + 4 Blue balls

Box II : 5 Red + 6 White + 3 Blue balls

Box III : 4 Red + 3 White + 2 Blue balls

One of the boxes is selected at random and a ball is drawn from it.

What is the probability the drawn ball is red?

(*a*) 1249/3024 (*b*) 1247/3004

(*c*) 1147/3024 (*d*) 1/2

[Dec. 2021]

Solution : (*a*)

Probability of selection of each box = $\frac{1}{3}$

Prob. of getting red ball

$$= P(\text{Box I}) - P\left(\frac{\text{Red}}{\text{Box I}}\right) + P(\text{Box - II}).P\left(\frac{\text{Red}}{\text{Box II}}\right) + P(\text{Box - III}).P\left(\frac{\text{Red}}{\text{Box III}}\right)$$

$$= \frac{1}{3}.\frac{7}{16} + \frac{1}{3}.\frac{5}{14} + \frac{1}{3}.\frac{4}{9}$$

$$= \frac{1}{3}\left[\frac{7}{16} + \frac{5}{14} + \frac{4}{9}\right]$$

= 0.41302910052

= 0.4130

GBC $A = \frac{1249}{3024} = 0.41302910052$

$\therefore$ (*a*) is correct.

Q.95. For a probability distribution, probability is given by, $P(X) = \frac{X_i}{k}$; $X_i = 1, 2, \ldots\ldots 9$. The value of k is:

(*a*) 55 (*b*) 9

(*c*) 45 (*d*) 81

[Dec. 2021]

Solution : (*b*)

$P(x) = \frac{x_i}{K} = \frac{n(E)}{n(S)}$

Here $n(S) = K = {}^9C_1 = 9$

Q.96. If P (A) = 0.3, P (B) = 0.8 and P (B/A) = 0.5. Find P (A∪B).

(*a*) 0.7 (*b*) 0.95

(*c*) 0.60 (*d*) 0.59

[June 2022]

Solution : $\because P(B/A) = \frac{P(A \cap B)}{P(A)} = 0.5$

or $P(A \cap B) = 0.5\ P(A)$

$= 0.5 \times 0.3 = 0.15$

$\therefore P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$= 0.3 + 0.8 - 0.15 = 0.95$

$\therefore$ (*b*) is correct.

Q.97. What is the chance that a leap year selected at random will contain 53 Fridays?

(*a*) 3/7 (*b*) 1/7

(*c*) 2/7 (*d*) 4/7

[June 2022]

Solution : (*c*) is correct

No. of days in a leap year = 366

= 52 weeks & 2 days

Means 52 Fridays will be sure but in rest two days Friday lies or not.

So sample Space for those 2 days

S = {(Sun, Mon); (Mon; Tues); (Tues; wed); (Wed; Thurs); (Thurs; Fri); (Fri; Sat); (Sat; Sun)}

$\therefore n(s) = 7$

E = Event of getting Friday

= {(Thurs; Fri); (Fri; Sat.)}

$\therefore n(E) = 2$

$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{2}{7}$

Q.98. Two balanced dice are rolled. The probability of getting 1 in at lest one dice is x/36 where x is

(*a*) 12 (*b*) 1

(*c*) 11 (*d*) 2

[June 2022]

Solution : (*c*) is correct

Sample Space = $n(s) = 6^2 = 36$

Event E = {(1,1), (1,2), (1,3),....; (1,6); (6,1), (5,1), (4,1), (3,1), (2,1)}

$\therefore n(E) = 11$

$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{11}{36} = \frac{x}{36}$

$\therefore x = 11$

Q.99. Thirty balls are serially numbered and placed in a bag. Find chance that the first ball drawn is a multiple of 3 or 5.

(*a*) 8/15 (*b*) 2/15

(*c*) 1/2 (*d*) 7/15

[June 2022]

Solution : $n(s) = {}^{30}c_1 = 30$

Let A = Event of getting No. multiple of 3

= {3, 6, 9, 12, 15, 18, 21, 24, 27, 30}

n(A) = 10

B = Event of getting No. multiple of 5

= {5, 10, 15, 20, 25, 30}

n(B) = 6

$A \cap B$ = Multiple of 3 & 5 both

= LCM of 3 & 5 = 15

$A \cap B$ = {15; 30}

$n(A \cap B) = 2$

$P(A \cup B) = \frac{n(A \cup B) - n(A) + n(B) - n(A \cap B)}{n(s)}$

$= \frac{10+6-2}{30} = \frac{14}{30} = \frac{7}{15}$

(*d*) is correct.

Q.100. The odds in favour of an event A is 2 : 3 and odds against an event B is 6 : 4 the probability that only one of A and B occurs is y/25 where y is

(*a*) 12 (*b*) 15

(*c*) 18 (*d*) 9

[June 2022]

Solution : Given:

$\frac{P(A)}{P(A')} = \frac{2}{3} \Rightarrow P(A) = \frac{2}{2+3} = \frac{2}{5}$

$P(B) = \frac{3}{2+3} = \frac{3}{5}$

And $\frac{P(B')}{P(B)}$

$= \frac{6}{4} = \frac{3}{2} \Rightarrow P(B) = \frac{2}{3+2} = \frac{2}{5}$

$P(B') = \frac{3}{3+2} = \frac{3}{5}$

Events should be independent

So, P (Only one of A & B occurs)

$= P(A).P(B') + P(A').P(B)$

$= \frac{2}{5} \times \frac{3}{5} + \frac{3}{5} \times \frac{2}{5}$

$= \frac{6+6}{25} = \frac{12}{25} = \frac{y}{25}$ (given)

$\therefore y = 12$

(*a*) is correct

Q.101. The odds in favour of event A, in a trial, is 3:1. In a three independent trials, the probability of no occurrence of the event A is

(*a*) 1/64 (*b*) 1/32

(*c*) 1/27 (*d*) 1/8

[June 2022]

Solution : Given:

n = No. of trials = 3

Odds in Favour of event A

$\frac{P(A)}{P(A')} = \frac{3}{1}$

$= P(A) = \frac{3}{3+1} = \frac{3}{4}$

Here $P = P(A) = \frac{3}{4}$

Then $q = P(A') = 1 - P(A) = 1 - \frac{3}{4} = \frac{1}{4}$

$\therefore P(x = 0) = 3c_0 p^6 q^3$

$= 1.1. \left(\frac{1}{4}\right)^3 = \frac{1}{64}$

$\therefore$ (*a*) is correct

Q.102. A machine is made of two parts A and B The manufacturing process of each part is such that probability of defective in part A is 0.08 and that B is 0.05. What is the probability that the assembled part will not have any defect?

(*a*) 0.934 (*b*) 0.864

(*c*) 0.85 (*d*) 0.874

[Dec. 2022]

Solution : *Given:*

$P(A') = 0.08 \Rightarrow P(A) = 1 - P(A')$

$= 1 - 0.08 = 0.92$

and $P(B') = 0.05 \Rightarrow P(B) = 1 - P(B')$

$= 1 - 0.05 = 0.95$

P(No defective) = P(A).P(B)

$= 0.92 \times 0.95 = 0.874$

$\therefore$ (*d*) is correct

Q.103. If $P(A) = \frac{1}{3}, P(B) = \frac{3}{4}$ and $P(A \cup B) = \frac{11}{12}$ then $P\left(\frac{B}{A}\right)$ is :

(*a*) $\frac{1}{6}$ (*b*) $\frac{4}{9}$

(*c*) $\frac{1}{2}$ (*d*) $\frac{1}{8}$

[Dec. 2022]

Solution : $P(A \cap B) = P(A) + P(B) - P(A \cup B)$

$= \frac{1}{3} + \frac{3}{4} - \frac{11}{12}$

$= \frac{4+9-11}{12} = \frac{2}{12} = \frac{1}{6}$

$\therefore P(B/A) = P\frac{(A \cap B)}{P(A)} = \frac{1/6}{1/3} = \frac{1}{6} \times \frac{3}{1} = \frac{1}{2}$

$\therefore$ (*c*) is correct

Q.104. The probability that a leap year has 53 Monday is:

(a) $\frac{1}{7}$ (b) $\frac{2}{3}$

(c) $\frac{2}{7}$ (d) $\frac{3}{5}$

[Dec. 2022]

Solution : A Leap year = 366 days

= 52 weeks & 2 days

Means 52 Mondays (Sure) but doubts on rest 2 days

So Sample Space = S = {(Sun, Mon); (Mon, Tues); (Tues, Wed); (Wed, Thurs); (Thurs, Fri); (Fri, Sat); (Sat, Sun)}

$\therefore \quad n(s) = 7$

Let E = Event of getting Monday

= {(Sun, Mon); (Mon, Tues)}

$\therefore \quad n(E) = 2$

$$P(E) = \frac{n(E)}{n(S)} = \frac{2}{7}$$

$\therefore$ (c) is correct

Q.105. Suppose A and B are two independent events with probabilities P(A) # 0 and P(B) # 0. Let A' and B' be their complements. Which one of the following statements is FALSE?

(a) $P(A \cap B) = P(A)P(B)$

(b) $P(A/B) = P(A)$

(c) $P(A \cup B) = P(A) + P(B)$

(d) $P(A' \cap B') = P(A')P(B')$

[Dec. 2022]

Solution : $\therefore$ A and B are two Independent variables.

$\therefore \quad P(A \cap B) = P(A).P(B) \neq 0$

Because P(A); P(B) $\neq 0$

So $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$\neq P(A) + P(B)$

$\therefore$ (c) is correct

Q.106. The Theorem of compound Probability states that for any two events A and B

(a) $P(A \cap B) = P(A) \times P(B/A)$

(b) $P(A \cup B) = P(A) \times P(B/A)$

(c) $P(A \cap B) = P(A) \times P(B)$

(d) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

[Dec. 2022]

Solution : (a) $P(A \cap B) = P(A).P(B/A)$

Q.107. If a number is selected at random from the first 50 natural numbers, what will be the probability that the selected is a multiple of 3 and 4?

(a) 5/50 (b) 2/25

(c) 3/50 (d) 4/25

[Dec. 2022]

Solution : Sample space = $n(S) = {}^{50}C_1 = 50$

Let E = Event of getting a No. divisible by 3 & 4

i.e. LCM of 3 & 4 = 12

E = {12, 24, 36, 48}

$n(E) = {}^{4}C_1 = 4$

$$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{4}{50} = \frac{2}{25}$$

$\therefore$ (b) is correct

Q.108. If three coins are tossed simultaneously, what is the probability of getting two heads together.

(a) 1/4 (b) 1/8

(c) 5/8 (d) 3/8

[Dec. 2022]

Solution : Sample space = $n(S) = 2^3 = 8$

3 coins means 3 heads are considered.

Let E = Event of getting 2 heads

$\therefore \quad n(E) = {}^{3}C_2 = 3$

$$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{3}{8}$$

(d) is correct

Q.109. Company 'A' produces 10% defective products, company 'B' produces 20% defective products and company 'C' produces 5% defective products. If choosing a company is an equally likely event, what is probability that product chosen is free from defect?

(a) 0.88 (b) 0.80

(c) 0.79 (d) 0.78

[June 2023]

Solution : Selection of Company A = $\frac{1}{3}$

" " " B = $\frac{1}{3}$

& " " " C = $\frac{1}{3}$

Let E = Event of Selecting Non-defective Product

$$\therefore p(E/A) = 1 - \frac{10}{100} = 0.9$$

$$p(E/B) = 1 - \frac{20}{100} = 0.8$$

$$p(E/C) = 1 - \frac{5}{100} = 0.95.$$

$\therefore$ Probability of getting Non-defective Product =

$p(A) \times p(E/A) + p(B) \times p(E/B) + p(C) \times p(E/C)$

$$= \frac{1}{3} \times 0.9 + \frac{1}{3} \times 0.8 + \frac{1}{3} \times (0.95)$$

$$= \frac{1}{3}(0.9 + 0.8 + 0.95) = 0.88333...$$

$= 0.88$

$\therefore$ (a) is correct.

Q.110. For any two events 'A' and 'B' it is known that P(A) = 2/3, P(B) = 3/8 and P(A $\cap$ B) = 1/4, then the events A and B are:

(a) Mutually exclusive and Independent

(b) Mutually not exclusive and Independent

(c) Mutually exclusive but not independent

(d) Neither independent nor mutually exclusive

[June 2023]

Solution : $P(A \cap B) = P(A) \times P(B)$

$$= \frac{1}{4} = \frac{2}{3} \times \frac{3}{8}$$

$\Rightarrow \frac{1}{4} = \frac{1}{4}$ (True)

$\therefore$ (b) is correct.

Q.111. The probability that a four digit number comprising the digits 2, 5, 6 and 7, without repetition of digits, would be divisible by 4 is:

(a) 1/2 (b) 3/4

(c) 1/4 (d) 1/3

[June 2023]

Solution : Total No. of Numbers n(s) = $\underline{|4} = 24$

Note: If last two digits of a Number is divisible by 4 then that whole No. is divisible by 4.

Number ending with 52; 56; 72; 76; are divisible by 4.

So n(E) = Event

$$= \frac{\underline{|2}(52)}{\text{Fix}} + \frac{\underline{|2}(56)}{\text{Fix}} + \frac{\underline{|2}(72)}{\text{Fix}} + \frac{\underline{|2}(76)}{\text{Fix}}$$

$= 2 \times 1 + 2 \times 1 + 2 \times 1 + 2 \times 1$

$= 8$

$$\therefore p(E) = \frac{n(E)}{n(S)} = \frac{8}{24} = \frac{1}{3}$$

$\therefore$ (d) is correct.

Q.112. Four persons are chosen at random from a group of 3 men, 2 women and 4 children. The probability that exactly 2 of them are children, is:

(a) $\frac{10}{21}$ (b) $\frac{1}{12}$

(c) $\frac{1}{5}$ (d) $\frac{1}{9}$

[June 2023]

Solution : Total persons = 3 + 2 + 4 = 9

Sample Space = $n(S) = {}^{9}C_4 = 126$

Let E = Event of getting exactly 2 children.

$n(E) = {}^{4}C_2 \times {}^{5}C_2 = 6 \times 10 = 60$

$$\therefore p(E) = \frac{n(E)}{n(S)} = \frac{60}{126} = \frac{10}{21}$$

(a) is correct.

Q.113. If $P(A) = \frac{1}{3}$, $P(B) = \frac{1}{4}$, $P(A/B) = \frac{1}{6}$, the probability $P\left(\frac{B}{A}\right)$ is:

(a) $\frac{1}{8}$ (b) $\frac{1}{4}$

(c) $\frac{3}{8}$ (d) $\frac{1}{2}$

[June 2023]

Solution : $p(A \cap B) = p(B) \times p(A/B)$

$$= \frac{1}{4} \times \frac{1}{6} = \frac{1}{24}$$

$$\therefore p(B/A) = \frac{p(A \cap B)}{p(A)} = \frac{\frac{1}{24}}{\frac{1}{3}}$$

$$\frac{1}{24} \times \frac{3}{1} = \frac{1}{8}$$

$\therefore$ (a) is correct.

24 CHAPTER PROBABILITY (THEORETICAL) DISTRIBUTION

PAST EXAM QUESTIONS WITH SOLUTIONS (MEMORY BASED)

Q.1. The Variance of standard normal distribution is

(a) 1 (b) μ

(c) σ^2 (d) 0

[June 2010]

Solution : (c)

Q.2. In Binomial distribution, n = 9 and P = 1/3 what is the value of variance:

(a) 8 (b) 4

(c) 2 (d) 16

[June 2010]

Solution : (c) $q = 1 - p = 1 - 1/3 = 2/3$

So, Variance = $npq = 9 \cdot \frac{1}{3} \cdot \frac{2}{3} = 2$

Q.3. If standard deviation of a poisson distribution is 2, then its

(a) Mode is 2

(b) Mode is 4

(c) Modes are 3 and 4

(d) Modes are 4 and 5

[Dec. 2010]

Solution : (c) $\because$ S.D = 2 $\Rightarrow$ Variance = $\sigma^2 = 4$

$\because$ In poisson distribution, Mean = variance = 4 (Integer)

So; it is bi-modal

$\therefore$ Modes are m and (m-1)

i.e., Mo = 4 and 3,

Q.4. The area under the Normal curve is

(a) 1 (b) 0

(c) 0.5 (d) –1

[Dec. 2010]

Solution : (a)

Q.5. For a normal distribution $N(\mu, \sigma^2)$, $P(\mu - 3\sigma < x < \mu + 3\sigma)$ is equal to

(a) 0.9973 (b) 0.9546

(c) 0.9899 (d) 0.9788

[Dec. 2010]

Solution : (a)

$\because$ Area in $P(\mu - 36 < x < \mu + 36)$ = 0.9973

Q.6. If for a Binomial distribution B (n,p) the mean = 6 and Variance = 2 then 'p' is

(a) 2/3 (b) 1/3

(c) 3/5 (d) 1/4

[Dec. 2010]

Solution : (a) Mean = 6 = np

& Variance = 2 = npq $\Rightarrow$ 6q = 2 $\Rightarrow$ q = 1 / 3

So, $p = 1 - q = 1 - \frac{1}{3} = \frac{2}{3} \Rightarrow p = \frac{2}{3}$

Q.7. If the inflexion points of a Normal Distribution are 6 and 14. Find its Standard Deviation?

(a) 4 (b) 6

(c) 10 (d) 12

[June 2011]

Solution : (a)

Upper point of inflexion $= \mu + \sigma = 14$ ..... (i)

& Lower point of inflexion $= \mu - \sigma = 6$ .....(ii)

Eqn . (i) – (ii), we get

$2\sigma = 14 - 6 = 8$; So, $\sigma = 4$

Hence, S.D $(\sigma) = 4$

Q.8. In a Binomial Distribution, if mean is k-times the variance, then the value of 'k' will be_____.

(a) p (b) q

(c) 1 – p (d) $\frac{1}{1-P}$

[June 2011]

Solution : (d)

We know that in Binomial Distribution:

Mean = np & Variance = npq

From question

Mean = k(Variance) $\Rightarrow$ np = K:(npq) $\Rightarrow$ kq = 1

$\therefore K = 1/q \ \therefore K = \frac{1}{1-p}$

Q.9. The mean of Binomial distribution is 20 and Standard deviation is 4 then;

(a) n = 100, p = 1/5, q = 4/5

(b) n = 50, p = 2/5, q = 2/5

(c) n = 100, p = 2/5, q = 4/5

(d) n = 100, p = 1/5, q = 3/5

[Dec. 2011]

Solution : (a)

Given, Mean = 20; S.D = 4

$\Rightarrow$ np = 20; Variance = npq = $(4)^2$

$\Rightarrow$ npq = 16

$\Rightarrow$ 20q = 16; $q = \frac{4}{5}$

Hence $p = 1 - q = 1 - \frac{4}{5}; \ p = \frac{1}{5}$

So, $np = n \times \frac{1}{5} = 20 \Rightarrow n = 20 \times 5 = 100$

Q.10. A Company has two cars which it hires out during the day. The number of Cars demanded with mean 1.5. Then percentage of days on which only one car was in demand is equal to

(a) 23.26 (b) 33.47

(c) 44.62 (d) 46.40

[Dec. 2011]

[Given Exp. (–1.5) = 0.2231]

Solution : (b)

Given; mean = m = 1.5

Formula , $P(x) = \frac{e^{-m}.m^x}{x!}$

So, $P(X=1) = \frac{e^{-1.5}.(1.5)^1}{1.!} = \frac{0.2231 \times 1.5}{1}$

= 0.33465 = 0.3347 = 33.47 %

Q.11. The binomial distribution with mean 3 & variance 2 is:

(a) $\left(\frac{2}{3}+\frac{1}{4}\right)^{2-9}$ (b) $\left(\frac{2}{6}+\frac{1}{6}\right)^{2-9}$

(c) $\left(\frac{2}{3}+\frac{1}{3}\right)^{9}$ (d) $\left(\frac{2}{5}+\frac{1}{5}\right)^{2-9}$

[Dec. 2011]

Solution : (c) Given mean = np = 3

Variance = npq = 2

$3q = 2$; So, $q = 2/3$; Hence $p = 1 - \frac{2}{3} = \frac{1}{3}$

Since, $np = n \times \frac{1}{3} = 3$; So, n = 9

The binomial distribution is $(q+p)^n = \left[\frac{2}{3}+\frac{1}{3}\right]^9$

Q.12. For binomial distribution

(a) Variance < Mean (b) Variance = Mean

(c) Variance > Mean (d) None of the above

[June 2012]

Solution : (a) For Binomial distribution

npq < np $\Rightarrow$ Variance < Mean

Q.13. If X is a Poisson variate and E(x) = 1, then P (x > 1) is

(a) $1 - \frac{e^{-1}}{2}$ (b) $1 - e^{-1}$ (c) $1 - 2e^{-1}$ (d) $1 - \frac{5}{2}e$

[June 2012]

Solution : (c) Since, $P(x) = \frac{e^{-m}m^x}{x!}$; E(X) = m = 1 = mean

$\therefore P(x > 1) = 1 - P(x < 1)$

$= 1 - [P(x = 0) + P(X = 1)]$

$= 1 - \left[\frac{e^{-1}.1^0}{0!} + \frac{e^{-1}.1^1}{1!}\right]$

$= 1 - [e^{-1} + e^{-1}] = 1 - 2e^{-1}$

Q.14. The mean and the variance of a random variable X having the probability density function $P(X = x) = \exp.\left\{-(x-4)^2\right\}/\sqrt{\pi}, -\infty < x < \infty$ is

(a) $4, \frac{1}{2}$ (b) $4, \frac{1}{\sqrt{2}}$ (c) 2,2 (d) $2, \frac{1}{2}$

[June 2012]

Solution : (a) Normal distribution - density function is:

$$P(X = x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}, \ -\infty < X < \infty$$

Given equation:

$$P(X = x) = \frac{1}{\sqrt{\pi}} e^{-(x-4)^2} = \frac{1}{\frac{1}{\sqrt{2}}\sqrt{2\pi}} . e^{-\frac{1}{2}\left(\frac{x-4}{1/\sqrt{2}}\right)^2}$$

Comparing given function with the standard form, we get Mean (u) = 4

S.D $(\sigma) = \frac{1}{\sqrt{2}}$

$\therefore Variance(\sigma^2) = \frac{1}{2}$

Q.15. In a Normal Distribution

(a) The first and second quartile are equidistant from median

(b) The second and third quartiles are equidistant from the median

(c) The first and third quartiles are equidistant from the median

(d) None of the above

[Dec. 2012]

Solution : (c) In a Normal Distribution: "The first and third quartiles are equidistant from the median".

Q.16. If a parameters of a binomial distribution are n and p then, this distribution tends to a poisson distribution when

(a) $n \to \infty, p \to 0$

(b) $p \to 0, np = \lambda$

(c) $p \to \infty, np = \lambda$

(d) $n \to \infty, p \to 0, np = \lambda$ *[Dec. 2012]*

where 'λ' is a finite constant

Solution : (d)

Q.17. If a random variable x follows Poisson distribution such that E(x)=30, then the variance of the distribution is

(a) 7 (b) 5

(c) 30 (d) 20

[Dec. 2012]

Solution : (c) In Poisson distribution,

Mean = Variance

E(X) = 30 = Mean ; So, Variance = 30

Q.18. In a normal distribution quartile deviation is 6 the standard deviation will be

(a) 4 (b) 9

(c) 7.5 (d) 6

[Dec. 2012]

Solution : (b) In Normal distribution

4 S.D. = 6. Q.D.

$S.D. = \frac{6}{4} Q.D. = \frac{6}{4} \times 6 = 9$

Q.19. Which of the following is false in case of Normal distribution.

(a) it is multi model

(b) mean = median = mode

(c) it is symmetric

(d) Total area is 1

[June 2013]

Solution : (a) No; it is uni-modal not multi-modal.

Q.20. If x~B (5,p) and p(x = 2) = 0.4362 and p (x = 3) = 0.2181 then p =

(a) 3/4 (b) 1/3 (c) 2/3 (d) 1/4

[June 2013]

Solution : (b) is correct

Given; n = 5

$P(X = 2) = {}^5c_2.p^2q^3 = 10.p^2q^3 = 0.4362$ _____(1)

$P(X = 3) = {}^5c_3.p^3.q^2 = 0.2181$

$10p^3q^2 = 0.2181$ _____(2)

Eqn.(1) ÷(2); We get

$\frac{10p^2q^3}{10p^3q^2} = 2$; or $\frac{q}{p} = 2$; or $2p = q$

or $2p = 1 - p$; or $2p + p = 1$; or $p = \frac{1}{3}$

Q.21. In a poisson distribution

(*a*) Mean & SD are equal

(*b*) Mean, variance are equal

(*c*) SD & variance are equal

(*d*) both (*a*) and (*b*)

[June 2013]

Solution : (*b*) Mean = Variance.

Q.22. In Binomial Distribution, $\mu=4$ and $\sigma^2=3$ then mode =

(*a*) 4 (*b*) 4.25

(*c*) 4.5 (*d*) 4.1

[June 2013]

Solution : (*a*) is correct.

Since, Mean = np = 4 & npq = 3 (Given)

So, 3 q = 4; So, q = 3 / 4 & p = 1 – q = 1/4

n.(1/4) = 4; Hence n = 16

Now, (n +1) p = (16 +1) (1/4) = 4.25

Rule : Mo = The integral part of (n + 1) p = 4.25 = 4; So, Mo = 4

Q.23. In Normal distribution mean median and mode are

(*a*) Equal

(*b*) Not equal

(*c*) Zero

(*d*) None of the above

[Dec. 2013]

Solution : (*a*) is correct.

Q.24. If the points of inflexion of a normal curve are 6 and 14 then standard deviation is

(*a*) 4 (*b*) 8

(*c*) 16 (*d*) 32

[Dec. 2013]

Solution : (*a*) is correct.

Given that, Lower point of inflexion $= \mu-\sigma = 6$ .....(i)

Upper point of inflexion $= \mu+\sigma = 14$ .....(ii)

Eqn. (ii) – (i); we get

$2\sigma = 8$

$\sigma = 4$

Q.25. There are 75 students in a class and their average marks is 50 and S.D of marks is 5. Number of students who have secured more than 60 marks (Given that area under the normal curve for Z = 2 is 0.4772) is_____

(*a*) 1 (*b*) 2 (*c*) 3 (*d*) 4

[Dec. 2013]

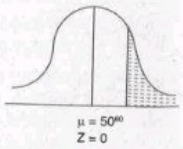
Solution : (*b*) is correct

Given N = 75;

Mean = $\mu = 50$; SD = $\sigma = 5$

Z at $x = 60 = \dfrac{X-\mu}{\sigma} = \dfrac{60-50}{5} = 2$

$P(X > 60) = P(z > 2)$



$= 0.5 - p(0 \le z \le 2)$

$= 0.5 - 0.4772 = 0.0228$

Total No. of students scoring more than 60 marks = N.P(x > 60)

$= 75 \times 0.0228 = 1.71 = 2$

Q.26. If a variate X has, Mean > variance, then its distribution will be

(*a*) Binomial

(*b*) Poisson

(*c*) Normal

(*d*) t-distribution

[June 2014]

Solution : (*a*) is correct

Note :- np > npq :- Mean > Variance

Q.27. Mean & variance of a Binomial variate are 4 and $\frac{4}{3}$ respectively then P(x ≥ 1) will be

(*a*) $\frac{728}{729}$ (*b*) $\frac{1}{729}$

(*c*) $\frac{723}{729}$ (*d*) None

[June 2014]

Solution : (*a*) is correct

Mean = np = 4; Variance = npq = $\frac{4}{3}$

or $4q = \frac{4}{3}$; or, $q = \frac{1}{3}$

$p = 1 - q = 1 - \frac{1}{3} = \frac{2}{3}$

Since, np = 4; So, $n.\frac{2}{3} = 4$ or n = 6

$\therefore P(X \ge 1) = 1 - p(X < 1)$

$= 1 - p(x = 0)$

$= 1 - {}^6C_0.p^0.q^6$

$= 1 - 1.1.(1/3)^6 = 1 - \frac{1}{729} = \frac{728}{729}$ N

Q.28. 5,000 students were appeared in an examination. The mean of marks was 39.5 with standard deviation 12.5 marks. Assuming the distribution to be normal, find the number of students recorded more than 60% marks. [Given when Z = 1.64 area of normal curve = 0.4494]

(*a*) 1000 (*b*) 505

(*c*) 253 (*d*) 2227

[June 2014]

Solution : (*c*) is correct

Given $\mu = 39.5$; $\sigma = 12.5$

Z at $x = 60 = \dfrac{X-\mu}{\sigma} = \dfrac{60-39.5}{12.5} = 1.64$

$P(X > 60\%) = 0.5 - p(39.5 \le X \le 60)$

$= 0.5 - p(0 \le z \le 1.64)$

$= 0.5 - 0.4494 = 0.0506$

No. of students scoring more than 5,000 students = N.P (x > 60%)

$= 5000 \times 0.0506 = 253$

Q.29. Let the distribution function of a random variable x be F(x) = P(x ≤ x), then F(5)-F(2)

(*a*) P(2 ≤ x < 5)

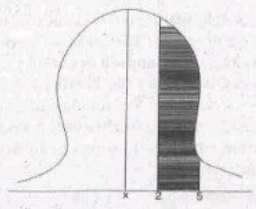
(*b*) P(2 ≤ x ≤ 5)

(*c*) P(2 ≤ x ≤ 5)

(*d*) P(2 < x < 5)

[Dec. 2014]

Solution : (*b*) is correct



F(5) – F(2)

$= p(0 \le x \le 5) - p(0 \le x \le 2)$

$= p(2 < x \le 5)$.

Q.30. For a Binomial distribution mean is 4 and variance is 3 then, 3rd central moment is

(*a*) 5/2 (*b*) 7/4

(*c*) 3/2 (*d*) 1/3

[Dec. 2014]

Solution : (*c*) is correct

np = 4; npq = 3

$\therefore 4q = 3 \Rightarrow q = \frac{3}{4}; p = 1 - q$

$= 1 - \frac{3}{4} = \frac{1}{4}$

Formula ; 3rd Central Moment

$\mu_3 = npq(q-p) = 3\left(\frac{3}{4} - \frac{1}{4}\right) = 3 \times \frac{2}{4}$

$= 3/2$

Q.31. In a Normal distribution mean = 2 and variance = 4 then, 4th central moment is

(*a*) 16 (*b*) 32

(*c*) 48 (*d*) 64

[Dec. 2014]

Solution : Mean = 2; var. = $\sigma^2 = 4$

Formula; 4th Central Moment

$= \mu_4 = 3\sigma^4 = 3.(\sigma^2)^2 = 3 \times 4^2 = 48$

Q.32. X and Y are two independent Normal variables, then the distribution of x + y is_____

(*a*) Normal distribution

(*b*) t-distribution

(*c*) Chi-Square distribution

(*d*) F-distribution

[Dec. 2014]

Solution : (*a*) is correct.

X and Y are two independent variables which follows Normal-distribution

∴ x + y also follows Normal distribution.

Q.33. In the Binomial distribution the parameters are n and p, then X assumes values

(*a*) Between 0 and n

(*b*) Between 0 and n both inclusive

(*c*) Between 0 and 1

(*d*) Between 0 and ∞

[June 2015]

Solution : (*b*) is correct.

$P(x = r) = {}^nC_r.p^r.q^{n-r}$

Where r = 0 , 1, 2 ,.....; n

Q.34. In _____distribution, Mean = Variance

(*a*) Binomial (*b*) Poisson

(*c*) Normal (*d*) None

[June 2015]

Solution : (*b*) is correct.

Q.35. Under normal curve $\mu \pm 3\sigma$ covers ___ of the area of items.

(*a*) 100% (*b*) 99%

(*c*) 99.73% (*d*) 99.37%

[June 2015]

Solution : (*c*) is correct.

Q.36. Wages paid to workers follows

(*a*) Binominal distribution

(*b*) Poisson distribution

(*c*) Normal

(*d*) Chi-Square

[Dec. 2015]

Solution : (*c*) is correct.

Q.37. For a Binominal distribution, the parameters are 15 and 1/3 Find mode:

(*a*) 5 and 6 (*b*) 5.5

(*c*) 5 (*d*) 6

[Dec. 2015]

Solution : (*c*) is correct.

Given $n = 15; p = \frac{1}{3}$

∴ Mode = Integral part of $(n+1)p$

$= (15+1)\frac{1}{3} = 5.33$

∴ Mo = 5

Q.38. Standard Deviation of Binominal distribution is -

(*a*) npq (*b*) $(npq)^2$

(*c*) $\sqrt{npq}$ (*d*) $n^2p^2q^2$

[Dec. 2015]

Solution : (*c*) is correct.

Q.39. The Normal curve is

(*a*) Positively skewed

(*b*) Negatively skewed

(*c*) Symmetrical

(*d*) All these

[June 2016]

Solution : (*c*) is correct.

Q.40. For a poisson variate X, P(X = 1) = P(X = 2). What is the mean of X?

(*a*) 1 (*b*) 3/2

(*c*) 2 (*d*) 5/2

[June 2016]

Solution : (*c*)

$\therefore P(X = 1) = P(X = 2)$

$\frac{m^1 \cdot e^{-m}}{1!} = \frac{m^2 \cdot e^{-m}}{2!} \Rightarrow 1 = \frac{m}{2} \quad \therefore m = 2$

So, m = mean of x = 2

Q.41. In_____distribution mean = variance.

(*a*) Binomial (*b*) Normal

(*c*) Poisson (*d*) t

[Dec. 2016]

Solution : (*c*) is correct.

Q.42. _____ is/are Bi-parametric distribution(s)

(a) Binomial (b) Poisson
(c) Normal (d) Both (a) & (c)

[Dec. 2016]

Solution : (d) correct.

Q.43. In Poisson distribution $\mu_4 = 2$, then find μ_2.

(a) 2 (b) 4
(c) $\frac{2}{3}$ (d) $\frac{1}{2}$

[Dec. 2016]

Solution : (c) correct

∵ Fourth moment of poisson - Distribution

$\mu_4 = 3\mu_2$

$2 = 3\sigma_2$

$\Rightarrow \sigma_2 = \frac{2}{3}$

Q.44. The second & third moments of observations (–6, –4, –2, 0, 2, 4, 6) are _____

(a) (12, 0) (b) (0, 12) (c) (16, 0) (d) (0, 16)

[Dec. 2016]

Solution : (c) is correct; $\mu_2 = \frac{\sum (x-\bar{X})^2}{N} = \sigma^2 = 16$; $\mu_3 = 0$ (Always)

Q.45. If X & Y are two independent Normal variates with means μ_1 and μ_2 and standard deviations σ_1 & σ_2 respectively, then X + Y follows _____

(a) Mean $= \mu_1 + \mu_2$, S.D $= 0$

(b) Mean $= \mu_1 + \mu_2$, S.D $= \sigma_1^2 + \sigma_2^2$

(c) Mean $= 0$, S.D $= \sigma_1^2 + \sigma_2^2$

(d) Mean $= \mu_1 + \mu_2$, S.D $= \sqrt{\sigma_1^2 + \sigma_2^2}$

[Dec. 2016]

Solution : (d) is correct.

Q.46. In _____ distribution, mean = variance.

(a) Binomial (b) Poisson
(c) Normal (d) None

[June 2017]

Solution : (b)

Q.47. In Binomial distribution, if variance = mean² then n & p are:

(a) $1, \frac{1}{2}$ (b) 1, 1
(c) $2, \frac{1}{2}$ (d) $3, \frac{1}{2}$

[June 2017]

Solution : (a) is correct

Tricks : GBC.

Mean $= np = 1.\frac{1}{2} = \frac{1}{2}$

Var. $= npq = 1.\frac{1}{2}.\left(\frac{1}{2}\right) = (\text{mean})^2$

Q.48. If X ~ N (50, 16) then which of the following is not possible.

(a) P(X > 60) = 0.30 (b) P(X < 50) = 0.50
(c) P(X < 60) = 0.40 (d) P(X > 50) = 0.50

[June 2017]

Solution : (c)

for (c)

$P(x < 60) = P(x < 50) + P(50 \le x \le 60)$

$= 0.0.5 + P(50 \le x \le 60)$

definitely greater than 50%.

∴ (c) not possible.

Q.49. The distribution of demand is as follows:

Demand	5	6	7	8	9	10
Probability	0.05	0.1	0.3	0.4	0.1	0.05

The mean is given by

(a) 7.55 (b) 7.85 (c) 1.25 (d) 8.35

[Dec. 2017]

Solution : (a) Mean $= \sum Px$

$= 5\,(0.05) + 6\,(0.1) + 7\,(0.3) + 8\,(0.4) + 9\,(0.1) + 10\,(0.05)$

$= 7.55$

Q.50. In _____ distribution, mean = variance:

(a) Binomial (b) Poisson
(c) Normal (d) None of these

[Dec. 2017]

Solution : (b)

Q.51. An example of a bi-parametric discrete probability distribution is:

(a) Binomial distribution
(b) Poisson distribution

(c) Normal distribution
(d) Both (a) & (b)

[Dec. 2017]

Solution : (a)

Q.52. In Normal distribution 95% observation lies between _____ & _____:

(a) $(\mu - 2\sigma, \mu + 2\sigma)$
(b) $(\mu - 3\sigma, \mu + 3\sigma)$
(c) $(\mu - 1.96\sigma, \mu + 1.96\sigma)$
(d) $(\mu - 2.58\sigma, \mu + 2.58\sigma)$

[Dec. 2017]

Solution : (c)

Q.53. If x is a poisson variate with mean m then $z = \frac{x-m}{\sqrt{m}}$ follows _____ distribution:

(a) Normal
(b) Binomial
(c) Bernoulli
(d) None of the above

[June 2018]

Solution : (a)

Q.54. The mean of a Binomial distribution is _____:

(a) np (1 – p)
(b) np
(c) $\sqrt{p(1-p)}$
(d) None of the above

[June 2018]

Solution : (b)

Q.55. Mean of poisson distribution is 6 then variance is _____:

(a) 6 (b) $\sqrt{6}$
(c) 4 (d) 3

[June 2018]

Solution : (a)

Q.56. For a Poisson variate X, P(X = 2) = 3P (X = 4), then the standard deviation of X is

(a) $\sqrt{2}$ (b) 3
(c) 4 (d) 5

[Nov. 2018]

Solution : (a)

∵ $P(X = 2) = 3\,P(X = 4)$

or ; $\frac{m^2 . e^{-m}}{2!} = 3 . \frac{m^4 . e^{-m}}{4!}$

$\Rightarrow \frac{1}{2} = \frac{3.m^2}{24}$

or $m^2 = 4 \Rightarrow m = 2$

∴ Var. $m = \sigma^2 = 2$

$\sigma = \sqrt{2}$

Q.57. The mean of the Binomial distribution $B\left(4, \frac{1}{3}\right)$ is equal to

(a) $\frac{3}{5}$ (b) $\frac{4}{3}$
(c) $\frac{8}{3}$ (d) $\frac{3}{4}$

[Nov. 2018]

Solution : (b)

Given; $n = 4$; $P = \frac{1}{3}$;

Mean $= np = 4.\frac{1}{3} = \frac{4}{3}$

Q.58. If for a Normal distribution $Q_1 = 54.52$ and $Q_3 = 78.86$, then the median of the distribution is

(a) 12.17 (b) 66.69 (c) 39.43 (d) None of these

[Nov. 2018]

Solution : (b)

Given; $Q_1 = 54{\cdot}52$; $Q_3 = 78{\cdot}86$.

It is normalty distributed *i.e.* symmetrical data.

∴ Mean = Mode $= m_e = \frac{Q_1 + Q_3}{2} = \frac{54{\cdot}52 + 78{\cdot}86}{2} = 66.69.$

Q.59. What is the mean of X having the following density function?

$f(x) = \frac{1}{4\sqrt{2\pi}} e^{\frac{(x-10)^2}{32}}$ for $-\infty < x < \infty$

(a) 4 (b) 10
(c) 40 (d) None of the above

[Nov. 2018]

Solution : (b)

Comparing it $f(x) = \frac{1}{4\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-10}{4}\right)^2}$ with the Standard formula

$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}$

Where $-\infty < x < \infty$.

We get ; Mean $= \mu = 10$ and $\sigma = 4$

Q.60. 4 coins were tossed 1,600 times. What is the probability that all 4 coins do not turn head upward at a time?

(a) $1600\,e^{-100}$ (b) $1000\,e^{-100}$ (c) $100\,e^{-1600}$ (d) e^{-1600}

[June 2019]

Solution : (d) Probability of getting a head in a throw of a coin $= \frac{1}{2}$

Probability of getting 4 heads upward in a throw of four coins $= \frac{1}{2^4} = \frac{1}{16} = p$(let)

Given that

Here, n = 1600

$\therefore$ Mean = m = np

$= 1600 \times \frac{1}{16} = 100$

$P(\text{No Head}) = P(X = 0) = \frac{e^{-100} \cdot (100)^0}{0!} = \frac{e^{-100} \cdot 1}{1}$

$= e^{-100}$

Q.61. If mean and variance are 5 and 3 respectively then relation between p and q is:

(a) $p > q$ (b) $p < q$

(c) $p = q$ (d) p is symmetric

[June 2019]

Solution :

(b) Mean = 5, $\Rightarrow$ np = 5; Variance = 3

$\Rightarrow$ npq = 3

$\Rightarrow 5q = 3$

$\Rightarrow q = 3/5$

$p = 1 - q = 1 - 3/5 = 2/5$

Hence, $p < q$

Q.62. In a Poisson distribution if P(x = 4) = P(x = 5) then the parameter of Poisson distribution is:

(a) $\frac{4}{5}$ (b) $\frac{5}{4}$

(c) 4 (d) 5

[June 2019]

Solution : (d)

Given that in Poisson distribution

$P(x = 4) = P(x = 5)$

$\Rightarrow \frac{e^{-m} \cdot m^4}{4!} = \frac{e^{-m} \cdot m^5}{5!}$

$\Rightarrow \frac{1}{4!} = \frac{m}{5!}$

$\Rightarrow \frac{1}{24} = \frac{m}{120}$

Hence m = 5

Q.63. Area between – 1.96 to + 1.96 in a normal distribution is:

(a) 95.45% (b) 95% (c) 96% (d) 99%

[June 2019]

Solution : (b)

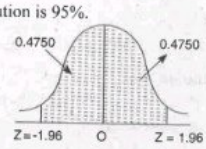
Area between – 1.96 to + 1.96 in a Normal distribution is 95%.

$\because P(z = 1.96) = 0.4750$

$\therefore P(-1.96 \le z \le 1.96) = 0.4750 \times 2$

$= 0.9500$

$= 95\%$



Q.64. In normal distribution what is the ratio of QD:MD:SD

(a) 12:10:15 (b) 15:10:12

(c) 10:15:12 (d) 10:12:15

[Dec. 2019]

Solution : (d)

$\because$ 6 QD = 5 MD = 4 SD.

Tricks: GBC

Let (a) is correct.

So; QD = 12; MD = 10 & SD = 15

but $6 \times 12 \neq 5 \times 10 \neq 4 \times 15$

So; (a) is not correct.

for (d)

$\because$ QD : MD : SD = 10 : 12 : 15

$\therefore$ QD = 10; MD = 12 & SD = 15

can be assumed.

So, $6 \times 10 = 5 \times 12 = 4 \times 15$ (True)

i.e. QD : MD : SD = 10 : 12 : 15

satisfies condition 6 QD = 5 MD = 4 SD

$\therefore$ (d) is correct.

Q.65. For a normal distribution $\sqrt{\frac{2}{\pi}} e^{-2(x-3)^2}$ mean and standard deviation will be -

(a) $3, \frac{1}{2}$ (b) $3, \frac{1}{\sqrt{2}}$

(c) $3, \sqrt{2}$ (d) None of these

[Dec. 2019]

Solution : (a)

$f(x) = \sqrt{\frac{2}{\pi}} \cdot e^{-2(x-3)^2}$

$= \sqrt{\frac{4}{2\pi}} \cdot e^{-\frac{4}{2}(x-3)^2}$

$= \frac{2}{\sqrt{2\pi}} \cdot e^{-\frac{1}{2}\frac{(x-3)^2}{1/4}}$

$= \frac{1}{\frac{1}{2}\sqrt{2\pi}} \cdot e^{-\frac{1}{2}\left(\frac{x-3}{1/2}\right)^2}$

Comparing it with standard form

$f(x) = \frac{1}{\sigma\sqrt{2\pi}} \cdot e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}$

We get; $\sigma = \frac{1}{2}; \mu = 3$

$\therefore$ Mean = 3; $\sigma = \frac{1}{2}$

Q.66. Area covered normal curve by $(\mu \pm 3\sigma)$

(a) 68.28% (b) 95.96%

(c) 99.73% (d) 99.23%

[Dec. 2019]

Solution : (c)

Area between $\mu - 3\sigma$ and $\mu + 3\sigma$ in normal curve

= 99.73%

i.e. All except 100 – 99.73

= 0.27%

Q.67. If x is binomial variate with parameter 15 and 1/3 what is the value of mode of the distribution

(a) 5 & 6 (b) 5.5

(c) 5 (d) 6

[Dec. 2019]

Solution : (c)

Given that

n = 15; $P = \frac{1}{3}$

$\therefore (n+1)P = (15+1) \cdot \frac{1}{3} = 5.33.....$

Formula

M_0 = Integral part of (n + 1) P = 5

If (n + 1) P is in fraction.

Q.68. In Poisson distribution which of the following is same.

(a) Mean and variance

(b) Mean and SD

(c) Both

(d) None of these

[Dec. 2019]

Solution : (a)

Q.69. If for a Binomial distribution B(n,p); n = 4 and also P(x = 2) = 3 P(x = 3) then the value of P is equal to

(a) $\frac{9}{11}$ (b) 1

(c) $\frac{1}{3}$ (d) $\frac{1}{9}$

[Dec. 2019]

Solution : (c)

$\because P(X = 2) = 3.\ P(X = 3)$

or ; ${}^4C_2 \cdot p^2 \cdot q^2 = 3, {}^4C_3 \cdot p^3 \cdot q^1$

or ; $6 \cdot q = 3 \cdot 4 \cdot p$

or ; $6q = 12p$

or ; $q = 2p$

$\because p + q = 1$

So, $p + 2p = 1 \Rightarrow 3p = 1$

$\therefore p = \frac{1}{3}$

Q.70. Let x be a Poisson random variable with parameter λ. Then p(x) is equal to

(a) $\frac{e^{\lambda} - e^{-\lambda}}{2}$ (b) $\frac{e^{\lambda} + e^{-\lambda}}{2}$

(c) $\frac{e^{2\lambda} - 1}{2}$ (d) $\frac{\lambda^x \cdot e^{-\lambda}}{x!}$

[Dec. 2019]

Solution : (d)

Q.71. Which of the following is uniparametric distribution?

(a) Normal

(b) Poisson

(c) Binomial

(d) Hyper geometric

[Dec. 2020]

Solution : (b)

Q.72. If the probability of success in a binomial distribution is less than one-half, then the binomial distribution.....

(a) is skewed to left

(b) is skewed to right

(c) has two modes

(d) has median at a point > mean + ½

[Dec. 2020]

Solution : (b)

For Binomial Distribution

(i) if P = Probability of Success $< \frac{1}{2}$

The Binomial Distribution is positively skewed i.e. skewed to right.

(ii) if P = Probability of success $> \frac{1}{2}$

Then Binomial Distribution is negatively skewed *i.e.* skewed to left.

(b) is correct.

Q.73. If we change the parameter(s) of a ..... distribution the Shape of probability curve does not change.

(a) Binomial (b) Normal

(c) Poisson (d) Non-Gaussian

[Dec. 2020]

Solution : (b)

Q.74. Which one of the following has Poisson distribution?

(a) The number of days to get a complete cure.

(b) The number of defects per meter on long roll of coated polythene sheet.

(c) The errors obtained in repeated measuring of the length of a rod.

(d) The number of claims rejected by an insurance agency.

[Dec. 2020]

Solution : (b)

Q.75. For a Poisson distributed variable X, we have P(X = 7) = 8. P (X = 9), the mean of the distribution is

(a) 4 (b) 3

(c) 7 (d) 9

[Dec. 2020]

Solution : Let Mean of Poisson distribution = m

$P(x = 7) = 8.P(x = 9)$

$\frac{m^7 e^{-m}}{\lfloor 7} = 8 \cdot \frac{m^9 e^{-m}}{\lfloor 9}$

or $\frac{1}{\lfloor 7} = \frac{8 \cdot m^2}{9.8. \lfloor 7}$

or $9 = m^2 \Rightarrow m = \sqrt{9} = 3$

Mean = m = 3

(b) is correct.

Q.76. The quartile deviation of a normal distribution with mean 10 and standard deviation 4 is.....

(a) 54.24 (b) 23.20

(c) 0.275 (d) 2.70

[Dec. 2020]

Solution : QD = Quartile Deviation

$= 0.675.s$

$= 0.675 \times 4 = 2.70$

(d) is correct.

Q.77. If the parameter of poisson distribution is m and mean + S.D.= $\frac{6}{25}$ then find m.

(a) $\frac{3}{25}$ (b) $\frac{1}{25}$

(c) $\frac{4}{25}$ (d) $\frac{3}{5}$

[Dec. 2020]

Solution : (*a*) is correct

Given

$$P(X=1) = P(X=2)$$

$$\Rightarrow \quad \frac{m^1 \cdot e^{-m}}{\lfloor 1} = \frac{m^2 \cdot e^{-m}}{\lfloor 2}$$

or $$\frac{1}{1} = \frac{m}{2}$$

or $$m = 2$$

Now $$P(X=4) = \frac{m^4 \cdot e^{-m}}{\lfloor 4}$$

$$= \frac{2^4 \cdot e^{-2}}{24} = \frac{16 \cdot e^{-2}}{24}$$

$$= \frac{2 \cdot e^{-2}}{3}$$

Q.82. Which one of the following is an uniparametric distribution?

(*a*) Poisson (*b*) Normal

(*c*) Binomial (*d*) Hyper geometric

[Jan. 2021]

Solution : (*a*) is correct

Parameter of Poisson distribution

= *m* (Mean) only

Q.83. For a normal distribution, the value of third moment about mean is.

(*a*) 0 (*b*) 1 (*c*) 2 (*d*) 3

[Jan. 2021]

Solution : (*a*) is correct

For normal distribution

1st moment $= \mu_1 = \frac{\sum (X - \bar{X})}{N} = 0$ [because $\Sigma(X - \bar{X}) = 0$]

2nd Central Moment $= \mu_2 = \frac{\sum (X - \bar{X})^2}{N}$ = Variance = σ^2

3rd Central Moment $= \mu_3 = \frac{\sum (X - \bar{X})^3}{N} = 0$

because $\Sigma(X - \bar{X})^3 = 0$ [Always]

Q.84. The value of K for the probability density function of a variate X is equal to

X	0	1	2	3	4	5	6
P (X)	5K	3K	4K	6K	7K	9K	11K

(*a*) 39 (*b*) 1/40 (*c*) 1/49 (*d*) 1/45

[July 2021]

Solution : (*d*) is correct.

∵ For a Probability Density Function

$$\Sigma p(X) = 1$$

$$\therefore \quad 5K + 3K + 4K + 6K + 7K + 9K + 11K = 1$$

$$\Rightarrow \quad 45K = 1$$

$$\therefore \quad K = \frac{1}{45}$$

Q.85. In normal distribution, Mean. Median and Mode are

(*a*) Zero (*b*) Not Equal (*c*) Equal (*d*) Null

[July 2021]

Solution : (*c*) is correct.

Q.86. If X is a Poisson variate such that P(x = 1) = 0.7, P(x = 2) = 0.3, then P(x = 0) =

(*a*) $e^{6/7}$ (*b*) $e^{-6/7}$ (*c*) $e^{-2/3}$ (*d*) $e^{-1/3}$

[July 2021]

Solution : (*b*) is correct.

Given

$$p(X=1) = 0.7$$

or $$\frac{m^1 e^{-m}}{\lfloor 1} = me^{-m} = 0.7 \qquad (1)$$

and ∵ $$p(X=2) = \frac{m^2 e^{-m}}{\lfloor 2} m = \frac{m^2 e^{-m}}{2} = 0.3 \qquad (2)$$

Eqn. (2), Eqn. (1); we get

$$\frac{m^2 e^{-m}}{2 \cdot me^{-m}} = \frac{0.3}{0.7}$$

or $$\frac{m}{2} = \frac{3}{7} \Rightarrow m = \frac{6}{7}$$

$$\therefore \quad p(X=0) = \frac{m^0 e^{-m}}{\lfloor 0} = 1 \frac{e^{-6/7}}{1}$$

$$= e^{-6/7}$$

Q.87. If X is a binomial variate with p = 1/3, for the experiment of 90 trials, then the standard deviation is equal to

(*a*) $-\sqrt{5}$ (*b*) $\sqrt{5}$

(*c*) $\sqrt[3]{5}$ (*d*) $\sqrt{15}$

[July 2021]

Solution : (*c*) is correct.

Given $p = \frac{1}{3} \Rightarrow q = 1 - p = 1 - \frac{1}{3} = \frac{2}{3}$

and n = 90

Variance $= \sigma^2 = npq = 90 . \frac{1}{3} \frac{2}{3} = 20$

SD $= \sigma = \sqrt{20} = \sqrt{4 \times 5} = 2\sqrt{5}$

Q.88. For a certain type of mobiles, the length of time between charges of the battery is normally distributed with a mean of 50 hours and a standard deviation of 15 hours. A person owns one of these mobiles and wants to know the probability that the length of time will be between 50 and 70 hours is (Given $\phi(1.33) = 0.9082$, $\phi(0) = 0.5$)

(*a*) –0.4082 (*b*) 0.5 (*c*) 0.4082 (*d*) –0.5

[July 2021]

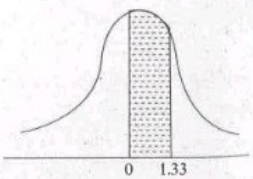
Solution : (*c*) is correct.

Given

Mean = μ = 50 hours

and SD = σ = 15 hours.

$$p(50 \le X \le 70) = p\left(\frac{50-50}{15} \le Z \le \frac{70-50}{15}\right)$$



where $$z = \frac{x - \mu}{\sigma}$$

$$= p(0 \le z \le 1.33)$$

$$= \phi(1.33) - \phi(0)$$

$$= 0.9082 - 0.5 = 0.4082$$

Q.89. The average number of advertisements per page appearing in a newspaper is 3. What is the probability that in a particular page zero number of advertisements are there?

(*a*) e^{-3} (*b*) e^{0}

(*c*) e^{+3} (*d*) e^{-1}

[Dec. 2021]

Solution : (*a*)

Given: Mean = m = 3

$$P(X=0) = \frac{m^0 e^{-m}}{\lfloor 0} = \frac{1 . e^{-m}}{1}$$

$$= e^{-m} = e^{-3}$$

Q.90. If, for a Poisson distributed random variable X, the probability for X taking value 2 is 3 times the probability for X taking value 4, then the variance of X is

(*a*) 4 (*b*) 3

(*c*) 2 (*d*) 5

[Dec. 2021]

Solution : (*c*)

Given

$P(x = 2) = 3P(x = 4)$

or $\frac{m^2 \cdot e^{-m}}{\lfloor 2} = 3 \frac{m^4 e^{-m}}{\lfloor 4}$

or $\frac{1}{2} = \frac{3}{\frac{24}{12}} m^2$

$\Rightarrow m^2 = 4 \quad \therefore m = 2$

Mean = Variance = 2

Q.91. Let X be normal distribution with mean 2.5 and variance 1. If $P[a < X < 2.5] = 0.4772$ and that the cumulative normal probability value at 2 is 0.9772, then a =?

(*a*) 1.5 (*b*) 3

(*c*) –3.5 (*d*) –4.5

[Dec. 2021]

Solution : No option

Given $P(Q) = P(Z \le 2) = 0.9772$

$\therefore P(Z = 2) = 0.9772 - 0.5 = 0.4772$

Mean = $\mu = 2.5$

Variance = $\sigma^2 = 1$

$\Rightarrow \sigma = 1$

Z at $X = a = \frac{x - \mu}{\sigma} = \frac{a - 2.5}{1}$

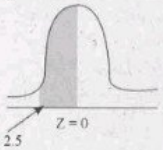
Z at $X = 2.5 = \frac{2.5 - 2.5}{1} = 0$

$P(a < X < 2.5) = P(a - 2.5 < Z < 0)$

$= 0.4772$

$\Rightarrow P(a - 2.5 < Z < 0)$

$= P(-2 < Z < 0)$



$\therefore a - 2.5 = -2$

or $a = 2.5 - 2$

$= 0.5$

No. option.

Its nearest value is 1.5.

So **(A)** may be Answer.

Q.92. The manufacturer of a certain electronic component is certain that 2% of his product is defective. He sells the components in boxes of 120 and guarantees that not more than 2% in any box will be defective.

Find the probability that a box, selected at random would fail to meet the guarantee? (Given that $e^{-2.4} = 0.0907$)

(*a*) 0.49 (*b*) 0.39

(*c*) 0.37 (*d*) 0.43

[Dec. 2021]

Solution : (*d*)

Let m = mean = n.p = $120 \times \frac{2}{100} = 2.4$

P (Fail the guarantee) = P (X > 2.4)

$= 1 - P(X \le 2.4)$

$= 1 - [P(X = 0) + P(X = 1) + P(X = 2)]$

$= 1 - \left[\frac{m^0 . e^{-m}}{\lfloor 0} + \frac{m^1 . e^{-m}}{\lfloor 1} + \frac{m^2 . e^{-m}}{\lfloor 2}\right]$

$= 1 - e^{-m}\left[1 + m + \frac{m^2}{2}\right]$

$= 1 - e^{-2.4}\left[1 + 2.4 + \frac{(2.4)^2}{2}\right]$

$= 1 - 0.907\ (6.28)$

$= 0.430404$

$= 0.43$

Q.93. A renowned hospital usually admits 200 patients everyday. One per cent patients, on an average, require special room facilities. On one particular morning, it was found that only one special room is available. What is the probability that more than 3 patients would require special room facilities?

(*a*) 0.1428 (*b*) 0.1732 (*c*) 0.2235 (*d*) 0.3450

[Dec. 2021]

Solution : (*a*)

Given

n = 200

p = 1% = 0.01.

Let mean = m = np = 200 × 0.01

= 2.

So, $P(x > 3) = ?$

$p(x > 3) = 1 - p(x \le 3)$

$= 1 - [P(x = 0) + P(x = 1) + P(x = 2) + P(x = 3)]$

$= 1 - \left[\frac{m^0 e^{-m}}{\lfloor 0} + \frac{m^1 e^{-m}}{\lfloor 1} + \frac{m^2 e^{-m}}{\lfloor 2} + \frac{m^3 e^{-m}}{\lfloor 3}\right]$

$= 1 - e^{-m}\left[\frac{1}{1} + \frac{2}{1} + \frac{2^2}{2} + \frac{2^3}{6}\right]$

$= 1 - (2.7183)^{-2}[1 + 2 + 2 + 4/3]$

$1 - (2.7183)^{-2}\left(\frac{19}{3}\right)$

Calculator

Press button

2.7183 ÷ = 2 times × 19 ÷ 3 +/– button + 1 = button

We get 0.1428

(*a*) is correct

Q.94. The binomial distribution, having mean and standard deviation as 3 and 1.5, has number of trials equal to

(*a*) 3 (*b*) 6

(*c*) 8 (*d*) 12

[June 2022]

Solution : Mean = np =3 (given)

and $\sqrt{npq} = 1.5$

$\therefore npq = (1.5)^2 = 2.25$

or 3q = 2.25

$\therefore q = \frac{2.25}{3} = 0.75$

$\therefore p = 1 - q = 1 - 0.75 = 0.25$

$\therefore np = 3$

or $n = \frac{3}{p} \therefore n = \frac{3}{0.25} = 12$

$\therefore$ (*d*) is correct

Q.95. The mean of binomial distribution is

(*a*) Always less than its variance

(*b*) Always more than its variance

(*c*) Always equal to its variance

(*d*) Always equal to its standard deviation

[June 2022]

Solution : Mean of Binomial Distribution = np

Its Variance = npq

Clearly np>npq because 0<q<1

$\therefore$ (*b*) is correct

Q.96. The variance of a normal distribution is given to be 16. The mean deviation about mode is

(*a*) 3.2 (*b*) 8

(*c*) 12.8 (*d*) 12

[June 2022]

Solution : Var = $\sigma^2 = 16$

$\sigma = 4$

$\therefore MD = 0.8.\sigma$

$= 0.8 \times 4 = 3.2$

$\therefore$ MD about Mean = Median = Mode = 3.2

($\bar{x} = M_e = M_o$) because it is Normally distributed.

$\therefore$ (*a*) is correct.

Q.97. The standard deviation of a Poisson variate X is 1.732. The P [–2.9 < X < 3.54] is

(*a*) $13e^{-3}$ (*b*) $9e^{-3}$

(*c*) $4e^{-2}$ (*d*) e^{-4}

[June 2022]

Solution : Given

$SD = \sqrt{np} = \sqrt{m} = 1.732 = \sqrt{3}$

$\therefore m = 3$

$P(X = r) = \frac{m^r . e^{-m}}{\lfloor r}$

Where r = 0,1,2,3,——(Whole No.)

P = (–2.9 < X < 3.54)

= P (Whole Nos. b/w – 2.9 & 3.54)

= P (X = 0) + P(X = 1) + P(X = 2) + P (X =3)

$= \frac{m^0 . e^{-m}}{\lfloor 0} + \frac{m^1 . e^{-m}}{\lfloor 1} + \frac{m^2 . e^{-m}}{\lfloor 2} + \frac{m^3 . e^{-m}}{\lfloor 3}$

$= e^{-m}\left(m^0 + \frac{m}{1} + \frac{m^2}{2} + \frac{m^3}{6}\right)$

$= e^{-3}\left(1 + \frac{3}{1} + \frac{3^2}{2} + \frac{3^3}{6}\right)$

$= e^{-3} \times 13 = 13e^{-3}$

$\therefore$ (*a*) is correct.

Q.98. For a normal distribution, the first and third quartiles are given to be 37 and 49, the mode of the distribution is

(*a*) 37 (*b*) 49

(*c*) 43 (*d*) 45

[June 2022]

Solution : For Normal Distribution

$Q_1 = 37; Q_3 = 49$

$\therefore Mean = \mu = \frac{Q_1 + Q_3}{2} = \frac{37 + 49}{2} = 43$

$\therefore$ It is Normally Distributed

$\therefore$ Mean = Median = Mode = 43

$\therefore$ (*c*) is correct.

Q.99. Skewness of normal distribution is:

(*a*) Negative (*b*) Positive

(*c*) Zero (*d*) Undefined

[Dec. 2022]

Solution: (*c*) is correct.

Q.100. If a Poisson distribution is such that P(X = 2) = P(X = 3) then the variance of the distribution is

(*a*) $\sqrt{3}$ (*b*) 3

(*c*) 6 (*d*) 9

[Dec. 2022]

Solution: Let mean = *m* = variance

$\because P(X = 2) = P(X = 3)$

[$\because$ It follows poisson Distribution]

$\therefore \frac{m^2 . e^{-m}}{\lfloor 2} = \frac{m^3 . e^{-m}}{\lfloor 3}$

or; $\frac{1}{\lfloor 2} = \frac{m}{3 \times \lfloor 2}$

or; $m = 3$

$\therefore$ Variance = *m* = 3

$\therefore$ (*b*) is correct

Q.101. The standard Deviation of Binomial distribution is:

(*a*) *npq* (*b*) $\sqrt{npq}$

(*c*) *np* (*d*) $\sqrt{np}$

[Dec. 2022]

Solution: Variance = $\sigma^2 = npq$

$\therefore \sigma = SD = \sqrt{npq}$

(*b*) is correct

Q.102. The speeds of a number of bikes follow a normal distribution model with a mean of 83 km/hr and a standard deviation of 9.4 km/hr. Find the probability that a bike picked at random is travelling at more than 95 km/hr.?

(*a*) 0.1587 (*b*) 0.38

(*c*) 0.49 (*d*) 0.278

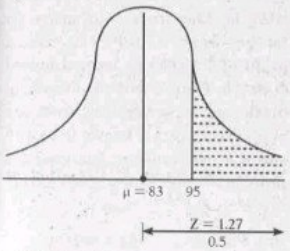
[Dec. 2022]

Solution: *Given* $\mu = 83; \sigma = 9.4$

Z at $x = 95 = \frac{x - \mu}{\sigma} = \frac{95 - 83}{9.4}$

= 1.2765 ..... = 1.27

P(Z = 1.27)



= 0.3980 = 0.40

= 0.40%

$\therefore P(X > 95)$

$= P(Z > 1.27)$

$= 0.5 - P(0 \le Z \le 1.27)$

$= 0.5 - 0.3980$

$= 0.102$

[No option but it is most nearest to 0.1587]. So option (*a*) is correct.

Q.103. Between 9 AM and 10 AM, the average number of phone calls per minute coming into the switchboard of a company is 4. Find the probability that during one particular minute, there will be either 2 phone calls or no phone calls (given $e^{-4} = 0.018316$).

(*a*) 0.156 (*b*) 0.165

(*c*) 0.149 (*d*) 0.194

Solution: Given mean = m = 4

Here Poisson Distribution is suitable.

$\therefore$ p (2 phone calls or no phone calls)

= p (x = 2 or x = 0)

= p (x = 2) + p (x = 0)

$= \frac{m^2 \times e^{-m}}{\lfloor 2} + \frac{m^0 \times e^{-m}}{\lfloor 0}$

$= e^{-m}\left[\frac{m^2}{2} + \frac{1}{1}\right]$

$= e^{-4}\left[\frac{4^2}{2} + 1\right]$

$= 0.018316(8+1) = 0.164843$

$= 0.165$

$\therefore$ (*b*) is correct.

Q.104. The probability distribution of *x* is given below :

Value of x	1	0	Total
Probability	p	1 – p	1

Mean is equally to:

(*a*) p (*b*) 1 – p

(*c*) 0 (*d*) 1

Solution:

Mean = Expected Value

$= \sum px = 1 \times p + 0(1-p)$

$= p + 0 = p$

$\therefore$ (*a*) is correct.

Q.105. If a Poisson distribution is such that $P(X = 2) = \frac{1}{3}P(X = 3)$, then the standard deviation of the distribution is:

(*a*) $\sqrt{3}$ (*b*) 3

(*c*) 2 (*d*) 1

Solution:

$P(x = 2) = \frac{1}{3}P(x = 3)$

or; $\frac{m^2 \times e^{-m}}{\lfloor 2} = \frac{1}{3} \times \frac{m^3 \times e^{-m}}{\lfloor 3}$

where m = mean.

$\Rightarrow \frac{1}{2} = \frac{1}{3} \times \frac{m}{3}$

$\therefore m = 9$

Mean = Variance = $SD^2 = 9$

$\therefore SD = \sqrt{9} = 3$

$\therefore$ (*b*) is correct.

Q.106. If a random variable *X* has the following probability distribution, then the expected value of *X* is:

X	–1	–2	0	1	2
f(*x*)	$\frac{1}{3}$	$\frac{1}{6}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{1}{3}$

(*a*) $\frac{3}{2}$ (*b*) $\frac{1}{2}$

(*c*) $\frac{1}{6}$ (*d*) $\frac{1}{3}$

Solution:

Expected value = $\sum px$

$= \sum\{x \times f(x)\}$

$= (-1)\times\frac{1}{3} + (-2)\times\frac{1}{6} + 0\times\frac{1}{5} + 1\times\frac{1}{6} + 2\times\frac{1}{3}$

$= \frac{1}{3}(2-1) + \frac{1}{6}(-2+1) + 0$

$= \frac{1}{3} - \frac{1}{6} = \frac{2-1}{6} = \frac{1}{6}$

$\therefore$ (*c*) is correct.

Q.107. On a commodity exchange when booking trades with provision for stop-losses, a trader can make a profit of ₹ 50,000 or incur a loss of ₹ 20,000. The probabilities of making profit and incurring loss, from the past experience, are known to be 0.75 and 0.25 respectively. The expected profit to be made by trader should be:

(*a*) ₹ 32,500 (*b*) ₹ 35,000

(*c*) ₹ 30,000 (*d*) ₹ 40,000

Solution: Expected Profit

$= \sum Px = 50{,}000 \times 0.75 + (-20{,}000) \times 0.25$

= ₹ 32,500

$\therefore$ (*a*) is correct.

Q.108. The incidence of skin diseases in a chemical plant occurs in such a way that the workers have 20% chance of suffering from it. What is the probability that out of 6 workers 4 or more will have skin diseases?

(*a*) 0.1696 (*b*) 0.01696

(*c*) 0.1643 (*d*) 0.01643

Solution: Given

p = 20% = 0.2

q = 1 – p = 1 – 0.2 = 0.8

n = 6

$\therefore p(x \geq 4) = p(x = 4) + p(x = 5) + p(x = 6)$

$= {}^6C_4 \times p^4 \times q^2 + {}^6C_5 \times p^5 \times q + {}^6C_6 \times p^6 \times q^0$

$= 15 \times (0.2)^4 \times (0.8)^2 + 6 \times (0.2)^5 \times (0.8) + 1 \times (0.2)^6 \times 1$

= 0.01696

$\therefore$ (*b*) is correct.

25 CHAPTER SAMPLING THEORY OF ESTIMATION

Some Important Terms.

CENSUS:- A large volume of statistical information is collected by way of periodic enumerations is called Census. Example Census of the voters of the population of eligible voters.

POPULATION OR UNIVERSE :- The aggregate of statistical information on a particular character of all the members covered by an investigation/enquiry is called **Population or Universe.** For example, marks obtained by students in CA CPT exam. constitute population.

SAMPLE :- The part of the population which is actually selected in the course of an investigation/enquiry to ascertain the characteristics of the population is called **Sample.**

SAMPLING :- The methods or techniques by which samples are drawn is called Sampling.

Sampling is used in various areas such as -

(*a*) In Marketing Research for assessing customers' behavior.

(*b*) In Industry for Statistical Quality Control.

(*c*) In Business for inspecting the incoming lots of materials from suppliers.

(*d*) In Auditing for test checking the accounts/transactions.

Remember some useful notations

	Population (Parameter)	Sample (Statistic)
Size	N	n
Mean	μ	$\bar{X}$
Proportion	P	p
Standard Deviation	σ	s

PARAMETER ;- A statistical measure based on each and every item of the universe/population is called **Parameter.** They are N, μ, P, σ. It shows the characteristic of the universe/ population. Since the parameter remains a constant, it has **neither a sampling fluctuation nor sampling distribution nor a standard error.** They are used as estimates of parameters as to calculate the standard error of statistic.

STATISTIC:- A statistical measure based on items/observation of a sample

is called **Statistic.** They are n, $\overline{X}$, p, s. It shows the characteristic of the universe/ population. It varies from sample to sample, it has **sampling fluctuation, sampling distribution and standard error.** Sampling distribution of a statistic is the probability distribution of that statistic and **standard error** is the standard deviation of the sampling of a statistic distribution. Usually parameters are unknown and statistics are used as estimates of parameters.

OBJECTIVES OF SAMPLING :-

1. To obtain the maximum information about the population with the minimum effort; (e.g. to estimate the unknown characteristics of the population)
2. To state the limits of accuracy of estimates based on sample.
3. To draw inferences on the behavior of the population.

When units are so chosen from the universe that the selected unit will not figure again, the sampling is said done **without replacement**, otherwise known as **with replacement.**

Without Replacement :- No. of samples with size **n** observations out of Population size N

$$= {}^{N}C_{n} = \frac{N!}{n!.(N-n)!}$$

With Replacement :- No. of samples with size **n** observations out of Population size N

$$= N^{n}$$

Example:- How many No. of samples of 2 observations out of 5 can be made. (*i*) with replacement,

(*ii*) Without Replacement

Soln.:- Given that N = 5, n = 2

(*i*) with replacement :- No. samples = $N^{n} = 5^{2} = 25$

(*ii*) Without Replacement :- No. samples $= {}^{N}C_{n} = \frac{N!}{n!.(N-n)!}$

$${}^{5}C_{2} = \frac{5!}{2!.(5-2)!} = \frac{5.4.3!}{2.1.3!} = 10$$

METHODS OF SAMPLING

The different methods of sampling are discussed below:

1. Deliberate, Purposive or Judgment Sampling

Meaning - Under this method selection of sample items is often based on certain predetermined criteria fixed by the individual judgment of the sampler.

Advantages

1. A purposive sample may not vary widely from the average.
2. It is economical and useful if the sample size is small.

Disadvantages

1. This is much scope for personal bias.
2. Degree of accuracy of the estimates is not known.
3. As the sample size increases, the estimates become unreliable due to accumulation of bias.

2. Block or Cluster Sampling

Meaning - Under this method, certain blocks or clusters of higher concentration are selected for complete enquiry e.g. all transactions of a particular period in a year. These clusters are used often in multistage sampling wherein sampling is done in stages.

Suitability - It is suitable where there is an unequal concentration of individual units in the universe.

3. Area Sampling

Meaning - Under this method, the total geographical area (if big) is divided into a number of smaller non-overlapping areas and then some of the smaller areas are selected and all units of the selected areas constitute the sample.

Advantage - It generally makes field interviewing efficient.

Suitability - It is suited in inquiries to be conducted over a large area, when the list of population concerned is not available.

4. Quota Sampling

Meaning - Under this method, each person engaged in the primary selection of data is assigned a fixed quota of investigations e.g. 50 salaried persons in the age group of 25–30 years. Within the quota, the selection of sample items depends entirely on personal judgment.

Advantage - The benefits of stratification are available. Disadvantage-There is scope for personal bias.

Suitability - It is suitable in marketing research studies where it is not possible to stick to it without delay and expenditure.

5. Random (or Probability) Sampling

Meaning - Under this method, selection of sample items is based on chance in such a manner that each unit of the population has an equal chance of being included in the sample. The methods of obtaining a random sample include Lottery System, Random Tables, Nth number etc.

Advantages

1. There is no scope of personal bias.
2. Each item has an equal chance of being selected.
3. It provides more accurate and reliable data.
4. It becomes possible to have an idea about the errors of estimation.

Disadvantages - It is not suitable if the field of enquiry is small.

Suitability - It is suitable when the population is more or less homogeneous with respect to characteristics under study.

Usefulness - The theories of sampling distribution and test of significance are based on random sampling only.

6. Systematic Sampling

Meaning - Under this method, selection of sampling items is done at uniform intervals of time, space or order of occurrence.

Advantages - Actual selection of the sample is easier and quicker. A systematic sample is practically equivalent to a random sample if the characteristic under study is independent of the order of arrangement of the units.

Disadvantage - The sample may be biased if there are periodic features associated with the sampling interval.

7. Stratified Sampling

Meaning - Under this method, the population is sub-divided into several groups (*called strata*) on the basis of purposive sampling and then samples of desired size are selected from each of them on the basis of random sampling. All the samples combined together give the stratified sample. Thus, it is a mixture of both purposive and random sampling.

Purposes - The main purposes of stratification are:

(*a*) to increase the overall estimates,

(*b*) to ensure that all sections of the population are adequately represented.

(*c*) to avoid a large size of the population and

(*d*) to avoid the heterogeneity of the population.

Advantages

1. It eliminates the difference between strata and thereby reduces the sampling error.
2. It brings about a gain in the precision of the sample estimate the strata variability is the least.
3. Independent estimates for different strata can be prepared.
4. There is not much scope for personal bias.

Disadvantage - The results may be misleading if the basis of stratification is not properly decided.

8. Multi Stage Sampling

Meaning - Under this method sampling is done in several stages starting from the larger units, intermediate units and finally reaching the ultimate units of selection.

Advantage - Usually, considerable saving in cost is achieved.

9. Sequential Sampling

Meaning - Under this method, a relatively small sample is tested for drawing a decision and if the first sample does not give evidence for a definite decision, more units are chosen at random and added to sample until a decision is possible using enlarged sample.

Usefulness - It is used to draw inference on the behavior of the population and in estimating the unknown characteristics of the population.

Advantages of Using Sampling Methods

1. These facilitate quick results.
2. These facilitate more skilled analysis.
3. These facilitate following up of non-responsive units
4. These facilitate the error estimation.
5. These involve lower costs.
6. These provide higher quality data.
7. These are more scientific as compared to census.

STATISTICAL LAWS

The possibility of reaching valid conclusions about the population on the basis of sample is based on the following two important laws:

1. Law of Statistical Regularity - It states that a sample of reasonably large size when selected at random is almost sure to represent the characteristics of the population. The selection is said to be at random, 'when every item in the universe has an equal chance of being selected. The larger the size of the sample more reliable is the result, because the sampling error is inversely proportional to the square root of the number of items in the sample.

2. Law of Inertia of large Numbers - It states that samples of large size shows a high degree of stability i.e. the results obtained from the samples are expected to be very close to the population characteristics. The greater the size of the sample, the greater will be compensation or tendency to neutralize extreme values and consequently more stable would be the result. For example, birth rate, death rate, etc., may vary from place to place, but for the country as a whole they will be found somewhat stable over a number of years.

STANDARD ERROR

Meaning :- Standard Error of a given statistic is the standard deviation of sampling-distribution of that statistic.

Reason to arises standard Error : - The standard error arises due to use of sampling (which is based on some items of the population) as against the complete enumeration censes enquiry (which is based on all items of the population).

Factor affecting - Standard Error depends on -

1. the sample size
2. the nature of the statistic *e.g.* mean, variance, etc.
3. the mathematical form of the sampling distribution
4. the values of some of the parameters used in the sampling distribution.

USEFULNESS OF STANDARD ERROR

1. It is used to find confidence limits within which parameters are expected to lie.

For example :- mean ± 1 S.E. will give 68.27% values,

mean ± 2 S.E. will give 95.45% of values

mean ± 3 S.E. will give 99.73% of values,

$\overline{X} \pm Z.S.E.(\overline{X})$, S ± Z S.E.(s) will give the confidence limit.

2. It is used in testing a given statistical hypothesis at different levels of Significance.

For example.

Confidence Level	Level of significance	Difference between observed and expected values	Whether or not Considered significant
95 %	5%	If the difference is more than 1.96 S.E.	Significant

Confidence Level	Level of significance	Difference between observed and expected values	Whether or not Considered significant
95%	5%	If the difference is less than 1.96 S.E.	Not significant
99%	1%	If the difference is more than 2.58 P.E.	Significant
99%	1%	If the difference is less than 2.58 P.E.	Not significant

Note: In practice, usually the hypotheses are tested at 5% level of significance. Unless otherwise stated in the examination.

COMPUTATION OF STANDARD ERROR OF THE MEAN

Population Size	When "σ" is known	When "σ" is unknown i.e."s" known
(I) * N is Large	$S.E._{\bar{x}} = \frac{\sigma}{\sqrt{n}}$	$S.E._{\bar{x}} = \frac{s}{\sqrt{n-1}}$
** N is unknown	Where, σ = Population S.D.	Where, S = Sample S.D.
*** $\frac{n}{N} < 0.05$	n = Sample size	n = Sample size
**** **SRSWR** (Simple Random Sampling with Replacement)		
(II) * $\frac{n}{N} \geq 0.05$	$SE(\bar{X}) = \frac{\sigma}{\sqrt{n}}\sqrt{\frac{N-n}{N-1}}$	$SE(\bar{X}) = \frac{s}{\sqrt{n-1}}\sqrt{\frac{N-n}{N-1}}$
** **SRSWOR** (Simple Random Sampling Without Replacement)		

COMPUTATION OF STANDARD ERROR OF THE PROPORTION

Standard Error of the proportion (P) = SE(p) as follows :

Population Size	When Population proportion is known	When Population proportion is not known
(I) * N is Large	$SE(p) = \sqrt{\frac{PQ}{n}}$	$SE(p) = \sqrt{\frac{pq}{n}}$
** N is unknown		
*** $\frac{n}{N} < 0.05$	*where, P* = Population proportion	*where, p* = Sample proportion
**** **SRSWOR** (Simple Random Sampling without Replacement)	$Q = 1-P$, n = Sample size	$q = 1-p$, n = Sample size
(II) * $\frac{n}{N} \geq 0.05$	$SE(p) = \sqrt{\frac{PQ}{n}}\sqrt{\frac{N-n}{N-1}}$	$SE(p) = \sqrt{\frac{pq}{n}}\sqrt{\frac{N-n}{N-1}}$
** **SRSWOR** (Simple Random Sampling Without Replacement)		

MEANING AND TWO WAYS OF ESTIMATION

Meaning - In the context of statistics, estimation is a statistical technique of estimating unknown population parameters from the corresponding sample statistic.

Two ways - A population parameter can be estimated in two ways:

1. Point Estimation, and
2. Interval Estimation

POINT ESTIMATION

Meaning - It provides a single value of a statistic that is used to estimate an unknown population parameter.

Estimator - The statistic which is used to obtain a point estimate is called estimator.

Estimate - The value of statistic is the estimate.

Example - If sample mean ($\bar{X}$) is used for estimating the population mean (μ), then $\bar{X}$ is called as estimator and the value of is called an estimate.

Criteria for a Good Estimator - According to R.A. Fisher, the criteria for a good estimator are:

(*a*) Unbiasedness, (*b*) Consistency, (*c*) Efficiency, (*d*) Sufficiency

(*a*) Unbiasedness - A statistic is said to be an unbiased estimator of parameter if its expected value is equal to the value of the parameter. The expected value of the statistic expressed as 'E' is the arithmetic mean of the sampling distribution of the statistic.

Thus,

1. The sample mean ($\bar{X}$) is an unbiased estimator of the population mean (μ) because mean of the sampling distribution of several means is equal to population mean (μ).

2. The sample variance (S^2) is a biased estimator of the population variance (σ^2) because the expected value of sample variance [$E(S^2)$] is not equal to population variance (σ^2).

3. An unbiased estimator of the population variance (σ^2) is given by –

$$\hat{S}^2 = S^2\left(\frac{n}{n-1}\right) = \sum (x_i - \bar{x})^2 \left(\frac{n}{n-1}\right)$$

This is because $E(\hat{S}^2) = \sigma^2$.

(*b*) Consistency - A statistic is said to be a consistent estimator of a parameter if it comes closer to the value of parameter as the sample size (n) tends to infinity. *For example,* in random sampling from a Normal population, both the sample mean and the sample median are consistent estimators of population mean *(μ).*

(*c*) Efficiency - A consistent statistic is said to be 'Most efficient' estimator of a parameter if its sampling variance is less than that of any other consistent estimator. *For example,* sample mean *(X)* is more efficient then median (Med.) in estimating the population mean (μ) since the variance of mean is smaller than variance of median.

A statistic which has the minimum variance among all estimators of population parameter is called the **Minimum Variance (MV) estimator**.

A statistic which is unbiased and has also minimum variance (i.e. most efficient) is called the **Minimum Variance Unbiased Estimator (MVUE)**.

Sufficiency - A statistic is said to be a 'sufficient estimator' of a parameter if it contains all information in the sample about the population parameter. *For example* in random sampling from a normal population, the sample means *()* is a sufficient estimator of μ.

Two Methods of Point Estimation - There are two methods of Point estimation as follows

I. Method of Maximum Likelihood
II. Method of Moments.

I. Method of Maximum Likelihood - It is a process of choosing as an estimator of population parameter, (Ø) that statistic which when substituted for population parameter (Ø), maximizes the likelihood function *L*.

$L = f(x_1, Ø)f(x_2, Ø), \ldots\ldots f(x, Ø)$

The statistic which maximizes the likelihood function *L* is called a **Maximum Likelihood Estimator (MLE)**.

Properties of MLE

1. It is consistent, most efficient and also sufficient provided a sufficient estimator exists.

2. It tends to be distributed normally for large samples.

3. It is not necessarily unbiased. A biased MLE can be converted into an unbiased estimator by a slight modification.

4. It is invariant under functional transformations.

INTERVAL ESTIMATION

Meaning - Interval Estimation provides an interval of finite width centered at the point estimate of the parameter, within which unknown parameter is expected to lie with a specified probability. Such an interval is called a confidence interval for population parameter.

Confidence Limits - The lower and upper limits of the confidence interval are called confidence limits.

Confidence Level (say 95%, 99%) and Confidence coefficient (i.e. value of Z from the Normal Distribution Table or value of t from t-distribution Table) corresponding to that confidence level.

The following table summaries when to use which value (Z or *t*):

Sample Size	When Population S. D. is known	When Population S. D. Is not known
n > 30	Value of Z (Z-Test)	Value of Z (Z-Test)
n ≤ 30	Value of Z (Z-Test) *Note:* The population must be normal	Value of *t* (t-Test)

Confidence Interval as follows

Sample Size	When Population S. D. is known	When Population S. D. is not known
n > 30	$\bar{X} \pm Z_\alpha \cdot SE(\bar{X})$	$\bar{X} \pm Z_\alpha \cdot SE(\bar{X})$
n ≤ 30	$\bar{X} \pm Z_\alpha \cdot SE(\bar{X})$	$\bar{X} \pm t_{\alpha,v} \cdot SE(\bar{X})$

Degree of freedom (v) = n-1

Confidence Coefficients Z from the table of areas under the standard normal probability distribution at various confidence levels are given below

Confidence Level	90%	95%	98%	99%	Almost sure level
Significance Level	10%	5%	2%	1%	
Confidence Coefficient Z	1.64	1.96	2.33	2.58	3.00

Illustrative Examples:-

Example 1. The quality control manager of a tyre company has sample of 100 tyres and has found the mean life time to be 30,214 km. The population s.d. is 860. Construct a 95% confidence interval for the mean life time for this particular brand of tyres.

Solution. Here $n = 100$, $\bar{x} = 30214$, a = 860.

Also $(1-\alpha)\% = 95\%$ so that $z_{\alpha=1.96}$ [From table]

$$\therefore S.E.(\bar{x}) = \frac{a}{\sqrt{n}} = \frac{860}{\sqrt{100}} = \frac{860}{10} = 86$$

∴ Confidence interval :- Lower Confidence Level $= (\bar{X}) - Z_\alpha . SE(\bar{X})$

$= 30214 - 86 \times 1.96$

$= 30214 - 168.56 =$ **30045.44**

Upper Confidence Level

$= \bar{X} + Z_\alpha . SE(\bar{X}) = 30214 + 86 \times 1.96$

$= 30214 + 168.56 =$ **30382.56**

Example 2. In a random selection of 64 of 600 road crossing in a town, the mean number of automobile accidents per year was found to 4.2 and the sample s.d was 0.8. Construct a 95% confidence interval for the mean number of automobile accidents per crossing per year.

Solution. Here n = 64, N = 600, s.d of sample **s** = 0.8,

$(1-\alpha)\% = 95\%$, so the value of $z_\alpha = 1.96$

Since we have a finite population of size 600 and $\frac{n}{N} = 64/600 = 1.106$, which is more than 0.05, so we use the following result to calculate the standard error of $\bar{X}$

$$S.E.(\bar{x}) = \frac{s}{\sqrt{n-1}}\sqrt{\frac{N-n}{N-1}} = \frac{0.8}{\sqrt{63}}\sqrt{\frac{600-64}{600-1}}$$

$$\frac{0.8}{7.39}\sqrt{\frac{536}{599}} = \frac{0.8}{7.93} \times 0.894 = 0.091$$

Lower Confidence Level

$= \bar{X} - Z_\alpha . SE(\bar{X}) = 4.2 - 0.091 \times 1.96 = 4.2 - 0.177 =$ **4.023**

Upper Confidence Level

$= \bar{X} + Z_\alpha . SE(\bar{X}) = 4.2 + 0.091 \times 1.96 = 4.2 + 0.177 =$ **4.377**

Example 3. A random sample of size 100 has mean 15, the population variance being 25. Find the interval estimate of the population mean with a confidence level of (i) 99% and (ii) 95%.

[C.A. (Intermediate); Nov. 1988]

Solution. Here $n = 100, \sigma^2 = 25, \bar{X} = 15$.

$$S.E.(\bar{x}) = \frac{\sigma}{\sqrt{n}} = \frac{5}{\sqrt{100}} = \frac{5}{10} = 0.5$$

***(i)* 99% confidence level** $z_\alpha = 2.58$

Confidence Intervals

$= \bar{X} \pm S.E.(\bar{X}) \times z_\alpha$

$= 15 \pm 0.5 \times 2.58 = 15 \pm 1.29$ *i.e.*, 13.71 to 16.29.

***(ii)* 95% Confidence level** $z_\alpha = 1.96$.

Confidence Intervals

$= \bar{X} \pm S.E.(\bar{X}) \times z_\alpha = 15 \pm (0.5) \times 1.96$

$= 15 \pm 0.98$ *i.e.* 14.02 to 15.98

Example 4. A sample of 100 gave a mean of 7.4 kg and a standard deviation of 1.2 kg. Find 95% confidence limits for population mean.

[C.A. (Found.); Nov. 2001]

Solution:- Standard error of mean S.E.

$$(\bar{x}) = \frac{\sigma}{\sqrt{n}} = \frac{1.2}{\sqrt{100}} = .02.$$

95% confidence limits for population mean are given by :

$$\bar{x} \pm 1.96\,\frac{a}{x},\ i.e.\ 7,4 \pm 1.96 \times 0.12$$

The confidence limits are: 7.1648 and 7.6352.

Example 5. (*a*) A random sample of size 65 was taken to estimate the mean annual income, of 1000'families and the mean and standard deviation were found to the Rs. 6300 and Rs. 9.5 respectively. Find a 95% confidence interval for the population.

[C.A. (Found); May 1996]

Solution. (*a*) We have n = sample size = 65 (large), N = 1000, $\bar{X} = 6300$, s = 9.5.

Since the sample is large, so we can assume that the sampling distribution is Normal.

Since $\frac{n}{N} = \frac{65}{1000} = 0.065 > .05$ therefore, the finite Population correction factor is used.

Thus we shall use the following result to calculate the standard Error of i.e.,

$$S.E.(\bar{X}) = \frac{s}{\sqrt{n-1}}\sqrt{\frac{N-n}{N-1}} = \frac{95}{\sqrt{64}} \times \sqrt{\frac{1000-65}{1000-1}}$$

$$= \frac{9.5}{8}\sqrt{\frac{935}{999}} = \frac{9.5\sqrt{.936}}{8} = \frac{9.5 \times 0.97}{8} = 1.15$$

Confidence interval

$= \left[\bar{x} - S.E.(\bar{x}) z_\alpha, \bar{x} + S.E.(\bar{x}) z_\alpha\right]$

$= [6300 - 1.15 \times 1.96;\ 6300 + 1.15 \times 1.96]$

i.e., [6300 – 2.25, 6300 + 2.25] or [6297.75, 6302.25].

Example 6. If sample mean is 20, population standard deviation is 3 and sample size is 64, find the interval estimate of the mean.

[C.A. (Found); Nov. 1999]

Solution:- Interval estimate of the sample mean is:

$$\bar{x} \pm \frac{a}{\sqrt{n}} \times 1.96 = 20 \pm \frac{3}{8} \times 1.96$$

Hence the interval estimate of mean is: [19.265, 20.735]

CONFIDENCE INTERVAL ESTIMATE OF THE PROPORTION

Population proportion. The population proportion P is the ratio of the number of elements possessing a characteristic to the total number of elements in the population, i.e.,

$$P = \frac{\text{Number of elements possessing the characteristic}}{\text{Total number of elements in the Population}}$$

If we multiply the population by 100, then we get the percentage and we may make use of percentage for the proportion and vice - versa.

Sample Proportion. The sample proportion p is the ratio of the number of elements possessing a characteristic to the total number of elements 'n' in the sample.

$$\textbf{Sample Proportion: p} = \frac{\text{Number of elements possessing the characteristic}}{\text{n = Total number of elements in the Population}}$$

It is important to note that the mean of sampling distribution of p equals the population proportion, i.e., E (P) = P.

Example 7. A random sample of 800 units from a large consignment showed that 200 were damaged. Find 95% confidence limits for the population proportion of damaged units in the consignment.

Solution. Here n = 800, Sample proportion

$$p = \frac{200}{800} = 0.25, q = 1 - 0.25 = 0.75.$$

$$S.E.(p) = \sqrt{\frac{pq}{n}} = \sqrt{\frac{0.25 \times 0.75}{800}} = 0.031$$

Also $(1-\alpha)\% = 95\%$ so that $z_\alpha = 1.69$

Confidence limits for the population proportion are: $p \pm z_\alpha \times S.E.(p)$.

Lower limit =

$p - z_\alpha \times S.E.(p) = 0.25 - 1.96 \times 0.031$

$= 0.25 - 0.06 = 0.19.$

Upper limit $= p + z_\alpha \times S.E.(p) = 0.25 + 1.96 \times 0.031 = 0.25 + 0.06 = 0.31.$

Hence, 95 % confidence limits for the population proportion of damaged units in the consignment are 0.19 and 0.31.

Example 8. Out of 300 households in a town 123 have T. V. sets. Find 95% confidence limits to the true value of the proportion of the households with T. V. sets in the whole town.

Solution: Here n = 300, Sample proportion $p = \frac{123}{300} = 0.41; q = 1 - 0.41 = 0.59$

$$S.E.p = \sqrt{\frac{pq}{n}} = \sqrt{\frac{0.41 \times 0.59}{300}} = 0.0283.$$

Also $(1-\alpha)\% = 95\%$ therefore, $z_\alpha = 1.96$.

Confidence limits $= p \pm z_\alpha \times S.E.(p)$

$= 0.41 \pm 1.96 \times 0.0283 = 0.41 \pm 0.055$

Lower limit $= 0.41 - 0.055 = 0.355$

Upper limit $= 0.41 + 0.055 = 0.465.$

Hence, 95 % confidence limits to the true value of the proportion of the households with T.V. sets in the whole town are 0.355 and 0.465.

Example 9. A factory is producting 50,000 pairs of shoes daily. From a sample of 500 pairs, 2% were found to be of substandard quality. Estimate the number of pairs that can be reasonably expected to be spoiled in the daily production and assign limits at 95% level of confidence.

[C.A. (Intermediate); May 1979, May 1987]

Solution. Here n = 500, Sample percentage p = 2%

$$S.E.(p) = \sqrt{\frac{p(100-p)}{n}} = \sqrt{\frac{2 \times 98}{500}} = 0.63$$

Also $(1-a)\% = 95\% \Rightarrow z_a = 1.96.$

∴ 95% confidence limits for the percentage of substandard quality are:

$p \pm S.E.(p) z_a = 2 \pm (1.96 \times 0.63) 2 \pm 1.23$

$= 2 - 1.23$ and $2 + 1.23 = 0.77$ and 3.23.

Number of pairs of shoes that can be expected to be spoiled in daily production lies between

$$\frac{0.77}{100} \times 50{,}000 = 385$$

and $\frac{3.23}{100} \times 50{,}000 = 1615$

Example 10. Out of 20,000 customer's ledger accounts, a sample of 600 accounts was taken to test the accuracy of posting and balancing where 45 mistakes were found. Assign limits within which the number of defective cases can be expected at 5% level.

[C.A. (Intermediate); May 1976]

Solution. Here n = 600, Sample proportion $p = \frac{45}{600} = 0.075$

$q = 1 - 0.075 = .952.$

$$S.E.(p) = \sqrt{\frac{pq}{n}}\sqrt{\frac{0.075 \times 0.925}{600}} = 0.011$$

Also $(1-a)\% = 95\% \Rightarrow z_a = 1.96.$

95% confidence limits are $p \pm z_a \times S.E(p)$

$= 0.075 \pm 1.96 \times 0.011 = 0.075 \pm 0.22 =$ 0.053 to 0.97

Hence at 5% level of significance the expected number of mistakes would lie between 0.053 and 0.097. The number of defective cases will lie between $0.53 \times 20{,}000 = 1060$ and $.097 \times 20{,}000 = 1940$.

Example 11. A random sample of 500 pineapples was taken from large consignment and 65 of them were found to be bad. Show that the standard deviation of the population of bad one in a sample of this size is 0.015 and deduce that the percentage of bad pineapples in the consignment lie between 8.5 and 17.5.

Solution. Here n = 500, Sample proportion

$$p=\frac{65}{500}=0.13 \quad q=1-0.13=0.87.$$

Standard deviation or standard error of population of bad pineapples

$$S.E.(p)=\sqrt{\frac{pq}{n}}=\sqrt{\frac{0.13\times0.87}{500}}=0.015$$

Here the level is not specific so we take Z = 3.

∴ 99.73% confidence limits for the proportion of bad pineapples

$p=\pm S.E.(p)z_\alpha=0.13\pm(3*0.015)=0.13\pm 0.045$ *i.e.* 0.085 to 0.175

Hence 99.73% confidence limits for percentage of bad pine apples 0.085 × 100 and 0.175 × 100 i.e., between 8.5% and 17.5%.

t - DISTRIBUTION

Example 12. A sample of size 9 from a normal population gave $\bar{x}=15.8$ and $s_x^2=10.3$. Find a 99% interval for population mean.

[C.A. (Intermediate), November 1985]

Solution. We are given $\bar{x}=15.5$. $s_x^2=10.3$ and n = 9.

∴ Degree of freedom = n − 1 = 9 − 1 = 8.

Also $t_{0.01}$ for 8 $d.f$ = 3.36 **[From t table]**

99% confidence limits for the population mean $\bar{x}$ are $\bar{x}\pm t_{0.01}\frac{s}{\sqrt{n-1}}$

$$=15.8\pm3.36\times\sqrt{\frac{10.3}{8}}$$

$$=15.8\pm3.36\times1.135=15.8\pm3.8136$$

$$=11.9864, 196136.$$

Hence 99% confidence interval ≈ [11.9864, 19.6136]

DETERMINATION OF SAMPLE SIZE

The determination of sample size for estimating a mean or proportion is a crucial question. By selecting a sample size lower than the correct size may affect reliability and a higher one will mean more cost and time. The determination of the size of a sample is the most important factor for the purposes of estimation of the value of the population parameters. We have following formula for it.

Sample size for Estimation a Mean

In order to determine the sample size for estimating a population mean, the following factors must be known:

(*i*) The desired confidence level.

(*ii*) The permissible sampling error E = $\bar{x}-u$.

(*iii*) The standard deviation 0'.

After having known the above mentioned three factors, **the size of sample mean n is given by** $n=\left(\frac{\sigma z_\alpha}{E}\right)^2$

Sample size for Estimating a Proportion

In this case we must know the following three factors:

(*i*) the desired confidence level.

(*ii*) the permissible sampling error E = difference between the estimate from the sample p and the parameter P to be estimated = P - p.

(*iii*) the estimated true proportion of success.

The sample size n is given by

$$n=\frac{z^2pq}{E^2} \quad \text{where} \quad q=1-p$$

Example 13. It is known that the population standard deviation in waiting time for L.P.G. gas cylinder in Delhi is 15 days. How large a sample should be chosen to be 95% confident, the waiting time is within 7 days of true average.

Solution. The required sample size is

$$n=\left(\frac{\sigma z}{E}\right)^2=\left(\frac{15\times1.96}{7}\right)^2=17.64.$$

Hence, the size of the sample is 18.

Example 14. A manufacturing concern wants to estimate average amount of purchase of its product in a month by the customers whose standard error is Rs. 10. Find the sample size if the maximum error is not to, exceed Rs.3 with a probability of 0.99.

Solution. It is given that'

$$p[|\bar{x}-u|,3]=0.99$$

$$\text{But } p\left[|\bar{x}-u|,258\frac{\sigma}{\sqrt{n}}\right]-0.09....(II)$$

From (I) and (II), we have

$$2.58\frac{\sigma}{\sqrt{n}}=3\Rightarrow\sqrt{n}=\frac{2.58\times10}{3}$$

$$\text{or} \quad n=\left(\frac{2.58\times10}{3}\right)^2=(8.6)2$$

$$=73.96\cong74.$$

Hence, the sample size should be 74.

Example 15. Mr. X wants to determine on the basis of sample study the mean time required to complete a certain job so that he may be 95% confident that the mean may remain within ± days of the true mean. As per the available records the population variance is 64 days. How large should the sample be for his study?

[C.A. (Intermediate); May 1987]

Solution. Here $\sigma=\sqrt{64}=8$. Also Z is N (0, 1).

It is given that

$$p[\bar{x}-u1<2]=0.95 \quad .....(I)$$

$$\text{But } p\left[(\bar{x}-u)\le1.96\frac{\sigma}{\sqrt{n}}\right]=0.95 \quad ...(II)$$

From (I) and (II), we get

$$\frac{1.96\times\sigma}{\sqrt{n}}=2\Rightarrow n=\left(\frac{1.96\times8}{2}\right)^2$$

$$=(7.84)2=61.42\approx62$$

Hence, the sample size should be 62.

Example 16. The business manager of a large company wants to check the inventory records against the physical inventories by a sample survey. He wants to almost assure that the maximum sampling error should not be more than 5% or below the true proportion of accurate records. The proportion of the accurate records is estimated at 35% from past experience. Determine the sample size.

Solution:- Here $p=0.35, E=5\%=0.05$. Confidence coefficient $1-\sigma\cong1$

We know that

$$p[|z|\ge3]=0.9973\cong1$$

[From standard normal Table]

$\Rightarrow z$ lies between −3 and +3 almost surely.

Here Z = 3.

Now, sample size $n=\frac{PQz_\alpha^2}{E^2}$

$$=\frac{0.35(1-0.35)\times3^2}{(0.05)^2}=\frac{0.35\times0.65\times9}{0.0025}$$

$$=\frac{2.0475}{0.0025}=819$$

Hence, the sample size is 819.

Q.17. In measuring reaction time, a psychologist estimated that the standard deviation is 1.08 seconds. What should be the size of the sample in order to be 99% confident that the error of her estimates of mean would not exceed 0.18 seconds?

(*a*) 240 (*b*) 210

(*c*) 300 (*d*) None

Ans.: (*a*)

Q.18. The incidence of a particular disease in an area in such that 20 % people of that area suffers from it. What size of sample should be taken so as to ensure that the error of estimation of the proportion should not be more than 5 % with 95% confidence ?

(*a*) 206 (*b*) 246

(*c*) 305 (*d*) None

Ans.: (*b*)

PREVIOUS YEAR QUESTIONS

Q.1. Sampling fluctuations may be described as:

(*a*) The variation in the values of a sample

(*b*) The differences in the values of a parameter

(*c*) The variation in the values of a statistic

(*d*) The variation in the values of observations

[Nov. 2006]

Solution : (*c*) If we compute the value of a statistic say, mean, it is quite natural that the value of the sample mean may vary from sample to sample as the sampling units of one sample may be different from that of the another sample.

Therefore, sampling fluctuations may be described as the variation in the values of a statistic.

Q.2. A random sample of size 17 has 52 as mean. The variance is 160. The 99% confidence for the mean are:

(*a*) [42.77,61.23]

(*b*) [44,58]

(*c*) [49,51]

(*d*) [37, 18]

[Nov. 2006]

Solution : (*a*) Given : $S=\sqrt{160}=12.65$;

Mean μ = 52 and sample size *i.e.* $n=17$

$$\text{Standard Error} = SE(\bar{X})=\frac{s}{\sqrt{n^2-1}}$$

$$\frac{12.65}{\sqrt{17-1}}=3.1625$$

'S' known and n < 30 , So t - Test will used. Degree of freedom = d.f. = n - 1 = 17-1= 16

$t_{0.005,16\,d.f.}=2.92$ (From Table)

$LCL=\bar{X}-t_{0.005,16}.SE(\bar{X})$

= 52 - (2.92).(3.1625) = 42.7655 = 42.77

$UCL=\bar{X}+t_{0.005,16}.SE(\bar{X})$

= 52 + (2.92).(3.1625) = 61.2345

= 61.23

Therefore, the confidence limits are given by [42.77,61.23]

Q.3. Which sampling provides separate estimates for population means for different purposes and also an over all estimate ?

(*a*) Multistage sampling

(*b*) Simple random sampling

(*c*) Systematic sampling

(*d*) Stratified sampling

[Nov. 2006]

Solution : (*d*) Stratified sampling provides separate for population means for differents segments and also an overall estimate.

Q.4. The criteria for an ideal estimator are:

(*a*) Unbiasedness, expectation, estimation and sampling

(*b*) Estimation, efficiency, expectation and sufficiency

(*c*) Consistency, efficiency, sufficiency and unbiasedness

(*d*) Estimation, consistency, efficiency and sufficiency.

[Feb. 2007]

Solution : (*c*) The criteria for an ideal estimator are consistency, efficiency, sufficiency and unbiasedness.

Q.5. The permissible sampling error is required to determine sample size for:

(*a*) Estimating a Proportion

(*b*) Estimating a Mean

(*c*) Both (*a*) & (*b*)

(*d*) None of these

[May 2007]

Solution : (*c*) The permissible sampling error is required to determine sample size for estimating a proportion and mean.

Q.6. If the population S.D. is known to be 5 for a population containing 80 units, then the standard error of sample mean for a sample of size 25 without replacement is:

(*a*) 0.83 (*b*) 0.80

(*c*) 0.93 (*d*) 0.74

[May 2007]

Solution : (*a*) $\sigma=5, N=80, n=25$

In case of WITHOUT REPLACEMENT

$$\therefore S.E.(\bar{X})=\frac{\sigma}{\sqrt{n}}\sqrt{\frac{N-n}{N-1}}$$

$$=\frac{5}{\sqrt{25}}\times\sqrt{\frac{80-25}{80-1}}=\frac{5}{5}\times\sqrt{0.696}=0.834$$

=0.83

Q.7. A researcher wishes to estimate the mean of a population by using sufficiently large sample. The probability is 0.95 that the sample mean will not differ from the true mean by more than 25% of the standard deviation. How large sample should be taken?

(*a*) 72 (*b*) 62

(*c*) 42 (*d*) 32

[May 2007]

Solution : (*b*) Given; Confidence Limit = 95%

$Z_{0.05} = 1.96$

Error = E = 0.25 of $\alpha = 0.25\,\alpha$

$$n = \left(\frac{Z_{0.05}\sigma}{E}\right)^2 = \left(\frac{1.96\sigma}{0.25\sigma}\right)^2$$

$$= 61.4656$$

$$\Rightarrow n = 62$$

Q.8. In determining the sample size for estimating a population mean, the number of factors must be known is:

(*a*) 2 (*b*) 3

(*c*) 4 (*d*) 5

[Aug. 2007]

Solution : (*b*) 3 factors must be known for determining the sample size for estimating a population mean *i.e.*

(*i*) the desired confidence level

(*ii*) permissible sampling error

$E = \bar{X} - \mu$

(*iii*) the standard deviation σ

Q.9. When we have an idea that the error might be involved, we use:

(*a*) Point Estimate

(*b*) Interval Estimate

(*c*) Both (*a*) & (*b*)

(*d*) None of these

[Aug. 2007]

Solution : (*b*) Interval estimation is when we have an idea that the error might be involved.

Q.10. A sample of size 3 is taken from a population of 10 members with replacement. If the sample observations are 1, 3 and 5 what is the estimate of the standard error of sample mean?

(*a*) 1.02 (*b*) 1.92

(*c*) 2.37 (*d*) 3.01

[Nov. 2007]

Solution : (*a*) Here, $\sum X = 1+3+5 = 9$

$$\sum X^2 = 1+9+25 = 35$$

$$S.D. = \sqrt{\frac{\sum X^2}{n} - \left(\frac{\sum X}{n}\right)^2}$$

$$= \sqrt{\frac{35}{3} - \left(\frac{9}{3}\right)^2} = \sqrt{2.666} = 1.633$$

$\therefore S.E(\bar{X})$ without replacement

$$= \frac{s}{\sqrt{n-1}} \times \sqrt{\frac{N-n}{N-1}}$$

$$= \frac{1.633}{\sqrt{3-1}} \times \sqrt{\frac{10-3}{10-1}}$$

$$= \frac{1.633}{\sqrt{2}} \times 0.882 = 1.02$$

Q.11. For a given sample of 200 items drawn from a large population, the mean is 65 and the standard deviation is 8. Find the 95% confidence limits for the population mean:

(*a*) [67.11,63.89]

(*b*) [66.11,63.89]

(*c*) [68.11, 65.89]

(*d*) None of these

[Nov. 2007]

Solution : (*b*) Given , $\bar{X} = 65$, S = 8

95% = confidence limits for population mean

So, Significance Level = 5 %

$$\text{Confidence Level} = \bar{X} \pm \frac{S}{\sqrt{n-1}} Z_\alpha$$

(fpc is ignored since population is large)

$$= 65 \pm \frac{6}{\sqrt{200-1}} \times 1.96 = 65 \pm 1.11$$

= (66.11, 63.89)

Q.12. An unbiased estimator:

(*a*) Has the smallest variance among all estimator

(*b*) Is always the best estimator

(*c*) Has an expected value equal to the true parameter value

(*d*) Always generates the true value of the parameter

[Nov. 2007]

Solution : (*c*) An unbiased estimator has an expected value equal to the true parameter value.

OR

A statistic 't' is said to be an unbiased estimate of the corresponding population parameter 0, if E(t) = 0

$\Rightarrow$ the mean value of the sampling distribution of the statistic 't' is equal to the parameter of the population.

Q.13. A simple random sample of size 10 is drawn without replacement from a universe containing 85 units. If the mean 90 and S.D. 4 is obtained from the sample, what is the estimate of the standard error of sample mean?

(*a*) 0.1176 (*b*) 0.58

(*c*) 1.19 (*d*) 1.26

[Feb. 2008]

Solution : (*d*) Here, n = 10, N = 85, $\bar{X} = 90$, s = 4

Since, Samples are drawn

WITHOUT REPLACEMENT

OR, $\frac{n}{N} = \frac{10}{85} = 0.1176 > 0.05$, so fpc is required.

$$S.E.(\bar{X}) = \frac{3}{\sqrt{n-1}} \times \sqrt{\frac{N-n}{N-1}}$$

$$= \frac{4}{\sqrt{10-1}} \times \sqrt{\frac{85-10}{85-1}}$$

$$= \frac{4}{\sqrt{9}} \times \sqrt{\frac{75}{84}} = \frac{4}{3} \times \sqrt{0.893}$$

$$= \frac{4}{3} \times 0.945$$

$$= 1.26$$

Q.14. A simple random sample of size 66 was drawn in the process of estimating the mean annual income of

950 families of a certain township. The mean and standard deviation of the samples were found to be Rs. 4730 and Rs. 7.65 respectively. Find a 95% confidence interval for the population mean:

(*a*) [4782.15,4731.85]

(*b*) [4728.15,4731.85]

(*c*) [4793.85,4801.85]

(*d*) None of these

[Feb. 2008]

Solution : (*b*) Given ; 95% = confidence limits for population mean

$$\text{S.E.}(\bar{X}) = \frac{S}{\sqrt{n-1}} \quad (\because \text{Sample mean is given})$$

$$= \frac{7.65}{\sqrt{66-1}} = \frac{7.65}{\sqrt{65}} = 0.949$$

Now confidence limits are :

$[\bar{X} \pm Z_\alpha \times S.E.(\bar{X})]$

$= [4730 \pm 0.948 \times 1.96]$

$= [4730 \pm 1.85] = [4728.15, 4728.85]$

Q.15. The sample mean is:

(*a*) An MVUE for population mean

(*b*) A sufficient estimator for population mean

(*c*) A consistent and efficient estimator for population mean

(*d*) All of these

[Feb. 2008]

Solution : (*d*) The Sample Mean fulfils all the conditions of a good estimator.

1. MVUE (Min. var. unbiased Estimator)
2. Sufficiency
3. Consistency
4. Efficiency

Q.16. Which sampling adds flexibility to the sampling process?

(*a*) Systematic sampling

(*b*) Multistage sampling

(*c*) Stratified sampling

(*d*) Simple random sampling

[Feb. 2008]

Solution : (*b*) Multistage Sampling adds flexibility into the sampling process which is lacking in other schemes.

Note : Students are advised to take note of the final result only and not deliberate on the calculations.

Q.17. For any unknown parameter, how many interval estimates exist?

(*a*) 1 (*b*) 2

(*c*) Many (*d*) 3

[June 2008]

Solution : (*c*) For any unknown parameter many interval estimates exist i.e. a range of values.

Q.18. If it is known that the 95% L.C.L. and U. C. L. to population mean are 48.04 and 51.96 respectively, what is the value of the population variance when the sample size is 100?

(*a*) 9 (*b*) 11

(*c*) 12 (*d*) 100

[June 2008]

Solution : (*d*) As we know, 95 % confidence limits are.

$\Rightarrow \bar{x} \pm \text{S.E.}(\bar{x}).z_\alpha$

$\Rightarrow \bar{x} - S.E.(\bar{x}) \times 1.96 = 48.04$ ..... (1)

$\Rightarrow \bar{x} + S.E.(\bar{x}) \times 1.96 = 51.96$ ..... (2)

Subtracting (1) from (2)

$2.\ \text{SE}(\bar{x}) \times 1.96 = 3.92$

$\therefore S.E.(\bar{x}) = 1$

But $\text{S.E.} = (\bar{x}) = \frac{\sigma}{\sqrt{n}}$ (from above)

$$\Rightarrow \frac{\sigma}{\sqrt{n}} = 1$$

$$\Rightarrow \frac{\sigma}{\sqrt{100}} = 1$$

$\sigma^2 = 100$

Q.19. The hypothesis which is tested for possible rejection under assumption, that is known is:

(*a*) Null Hypothesis

(*b*) Alternate Hypothesis

(*c*) Simple Hypothesis

(*d*) Composite Hypothesis

[Dec. 2008]

Solution : (*a*) In tests of hypothesis, we always begin with an assumption or hypothesis (*i.e.* an assumed value of a population parameter). This is called. Null Hypothesis. R.A. Fisher defined :—

Null Hypothesis as "the Hypothesis which is tested for possible rejection under the assumption that it is true."

Q.20. A Population comprises of 20 members. The number of all possible samples of size 2 that can be drawn from it without replacement.

(*a*) 210 (*b*) 380

(*c*) 190 (*d*) 400

[Dec. 2008]

Solution : (*c*) Sampling distribution without replacement:

As N = 20 and n = 2, the total number of possible samples WOR

$= {}^{N}C_2 = {}^{20}C_2 = 190$

Q.21. For an unbiased estimator which of these is not an absolute condition.

(*a*) Efficiency

(*b*) Sufficiency

(*c*) Unbiasedness

(*d*) Minimum variance

[Dec. 2008]

Solution : (*d*) For an unbiased estimator, minimum variance is not an absolute condition.

Q.22. In sampling, standard deviations are known as:

(*a*) Expectation

(*b*) Sampling Errors

(*c*) Standard Error

(*d*) All of the above

[June 2009]

Solution : (*c*) The Sampling Distribution possesses different characteristics. The mean of statistic, as obtained from its sampling distribution, is known as "expectation" and the standard deviation of the statistic T is known as the "Standard Error (SE)"

Q.23. When every member in population has an equal chance of being

selection, then that sampling is called_____.

(*a*) Restrictive

(*b*) Purposive

(*c*) Subjective

(*d*) Non-restrictive

[June 2009]

Solution : (*d*) When the units are selected independent of each other in such a way that each unit belonging to the population has an equal chance of being a part of the sample, the sampling is known as Simple Random Sampling.

Simple Random Sampling is also known as Non-Restrictive sampling as the sample is selected randomly and there is no restriction.

Q.24. Except sampling error, other errors in sampling are:

(*a*) Non-sampling errors

(*b*) Standard errors

(*c*) Sampling fluctuations

(*d*) All of these

[June 2009]

Solution : (*a*) Errors or biases in a survey may be defined as the deviation between the value of population parameter as obtained from a sample and its observed value. Errors are of two types:

(*i*) Sampling Errors-

Since only a part of the population is investigated, every sampling design is subjected to this of error. Factors contributing to sampling error are:

(*a*) Errors arising out due to defective planning design.

(*b*) Errors arising out due to substitution.

(*c*) Errors owing to faulty demarcation of units, etc.

(*ii*) Non-Sampling Errors-

This type of errors happen both in sampling and complete enumeration. Some factors responsible for this particular kind of biases are lapse of memory, preference for certain digits, ignorance, etc.

Q.25. Distribution formed of all possible value of statistics is called____.

(*a*) Sampling Distribution

(*b*) Classification

(*c*) Tabulation

(*d*) None

[Dec. 2009]

Solution : (*a*) Distribution formed of all possible value of statistics is called Sampling Distribution [Self-Explanatory].

Q.26. In sampling, standard error is:

(*a*) Standard deviation

(*b*) Quartile deviation

(*c*) Mean deviation

(*d*) Coefficient of variation

[Dec. 2009]

Solution : (*a*) The standard deviation of the statistic, as obtained from its sampling distribution is known as "Standard Error".

Therefore, in sampling, standard error is Standard Deviation.[Self-Explanatory].

Q.27. If every 9th unit is selected from universal set then this type of sampling is known as:

(*a*) Quota Sampling

(*b*) Systematic Sampling

(*c*) Stratified Sampling

(*d*) None of these

[Dec. 2009]

Solution : (*b*) Systematic sampling refers to a sampling scheme where the units constituting the sample are selected at regular interval after selecting the very first unit at random *i.e.* with equal probability. Therefore, if 9th unit is selected from universal set, then it is known as systematic sampling.

Q.28. The Standard deviation of the sampling distribution of a statistical distribution is a:

(*a*) Critical value

(*b*) Biased estimate

(*c*) Unbiased estimate

(*d*) Standard error

[Dec. 2010]

Solution : (*d*) The standard deviation of the statistic, as obtained from its sampling distribution is known as "STANDARD ERROR".

Therefore in sampling, standard error is Standard Deviation. [Self-Explanatory]

Q.29. The sampling is said to be large sampling if the size of the sample is:

(*a*) Greater than or equal to 30

(*b*) Less than 30

(*c*) Less than or equal to 35

(*d*) Less than 25

[Dec. 2010]

Solution : (*a*) Sampling is sad to be large sampling if the size of sample is greater than or equal to 30. [Self-Explanatory]

Q.30. The errors other than sampling error are termed as:

(*a*) Response error

(*b*) Non-response error

(*c*) Non-sampling error

(*d*) Type II error

[Dec. 2010]

Solution : (*c*) Errors are of two types-

(1) Sampling errors

(2) Non-sampling errors

Q.31. The method of sampling in which each unit of the population has an equal chance of being selected in the sample is:

(*a*) Random sampling

(*b*) Stratified sampling

(*c*) Systematic sampling

(*d*) None of the above

[Dec. 2010]

Solution : (*a*) Simple Random Sampling (SRS) :

When units are selected independent of each other in such a way that each unit belonging to the population has an equal chance of being a part of the samples, the sampling is known as Simple Random Sampling or just Random Sampling.

Q.32. The hypothesis which is tested for possible rejection under the assumption that it is known as:

(*a*) Biased hypothesis

(*b*) Alternative hypothesis

(*c*) Null hypothesis

(*d*) None of these

[Dec. 2010]

Solution : (*c*) Null hypothesis. (As per definition)

Q.33. A selection procedure of a sample, having no involvement of probability is known as:

(*a*) Purposive Sampling

(*b*) Judgment Sampling

(*c*) Subjective Sampling

(*d*) All of the above

[Dec. 2010]

Solution : (*d*) All of the above (as per definition)

Q.34. Standard Deviation of a Sampling Distribution is called_____.

(*a*) Standard Error

(*b*) Statistic

(*c*) Parameter

(*d*) None of the above

[June 2011]

Solution : (*a*) When the average amount of the variability of the observations of a population is computed, it is called the Standard Deviation. But when the average amount of the variability of the observations of a sampling distribution of a statistic is computed, it is known as Standard Error.

Thus, the Standard Deviation of the Sampling Distribution is known as Standard Error.

Q.35. If the standard error is 1/2 and the parameter of Normal population given to be S.D = 4 then, find the sample size ?

(*a*) 1024 (*b*) 16

(*c*) 64 (*d*) 36

[June 2011]

Solution : (*c*) Since, Standard Error

$$S.E = (\bar{X}) = \frac{\sigma}{\sqrt{n}}$$

n = sample size = ?

Given σ = S.D = 4 and S.E = 1/2

$$\therefore \frac{1}{2} = \frac{4}{\sqrt{n}} \text{ ; or, } n = 64$$

Q.36. The total number of samples of size n drawn from a population of size N units by simple random sampling without replacement is:

(*a*) N^n (*b*) ${}^{N}C_{n}$

(*c*) ${}^{n}C_{N}$ (*d*) n^N

[Dec. 2011]

Solution : (*b*) The total number of possible sample of size n out of N without Replacement = ${}^{N}C_{n}$

Q.37. Type II errors are made while we accept a null hypothesis which is _____.

(*a*) True (*b*) False

(*c*) Doubtful (*d*) Not Defined

[Dec. 2011]

Solution : (*b*) Type II errors are made by accepting the Null Hypothesis (H_0) when it is FALSE, that is when a Null Hypothesis is false but it is accepted due to insignificant difference between observed & expected values.

Q.38. In order to test the quality of chalks the best suitable method will be_____.

(*a*) Complete enumeration

(*b*) Simple random sampling

(*c*) Systematic sampling

(*d*) Stratified sampling

[June 2012]

Solution : (*b*) The correct answer is Simple Random Sampling because the population is Homogeneous & not very large.

Q.39. In a factory there are 48 employees with employee code from 1 to 48, the employer desires to take the sample of every sixth employee under the systematic sampling technique, the sample size will be:

(*a*) 6 (*b*) 8

(*c*) 10 (*d*) 7

[June 2012]

Solution : (*b*) Under Systematic Sampling Technique, we know:

N = nk ($\because$ '*k*' < *n*)

Where N = Population size = 48

n = Sample size = ?

K = Sample interval = 6

So, $48 = n \times 6$

$n = 8$

Q.40. The statistic T is said to be consistent estimator of the population parameter 'Q' if:

(*a*) E(T) = Q

(*b*) $V(T) \to 0 as n \to \infty$

(*c*) Both (*a*) and (*b*)

(*d*) None of the above

[June 2012]

Solution : (*c*) Consistency and efficiency:

"A statistic 't' is known to be consistent estimator of the parameter '0' if the difference between T and 0 can be made smaller and smaller by taking the sample size 'n' large and large,"

Mathematically, T is consistent for 0 if

E(T) = 0

and $V(T) \to 0$ as $n \to \infty$

Q.41. Sampling is a tool which helps to know the characteristics of the ____ by examining only a small part of it:

(*a*) Population (*b*) Data

(*c*) Sample (*d*) All the above

[Dec. 2012]

Solution : (*c*) Sampling is a tool which helps to know the characteristic of the sample by examining only a small part of it.

Q.42. The criteria for an ideal estimator are:

(*a*) Unbiased and minimum variance

(*b*) Consistency and efficiency

(*c*) Sufficiency

(*d*) All of the above

[Dec. 2012]

Solution : (*d*) The criteria for an ideal estimator are unbiased and minimum variance consistency and efficiency and sufficiency.

Q.43. If N, n denote sizes of the population and its factor of finite population, correction is given by:

(a) $\sqrt{(N-n)/(N-1)}$

(b) $\sqrt{(N-1)/(N-n)}$

(c) $\sqrt{(1-N)/(N-n)}$

(d) $\sqrt{(N+n)/(N-1)}$

[Dec. 2012]

Solution : (a) Factor of finite population correction is given by $\sqrt{\frac{N-n}{N-1}}$

MODEL EXAM QUESTIONS (FOR PRACTICE)

Type - I

Select the correct alternative out of the given ones:

Q.1. Sampling errors are:

(a) caused by inaccurate measurement.

(b) the result of the chance selection of the sampling units.

(c) of no great concern.

(d) larger for a census than for a sample.

Q.2. Non-sampling errors are

(a) caused by inaccurate measurement.

(b) the result of the chance selection of the sampling units.

(c) of no great concern.

(d) always larger for a census than fen a sample.

Q.3. If μ_x w is the population mean, and σ_x^2 is the population variance, then the mean and variance of a sample are equal to

(a) μ_x and σ_x^2

(b) μ_x/n and σ_x^2/n

(c) μ_x/n and σ_x^2/n^2

(d) μ_x and σ_x^2/n.

Q.4. A sample consists of

(a) all units of the population.

(b) 50 per cent units of the population.

(c) 5 per cent units of the population.

(d) any fraction of the population.

Q.5. If we sample without replacement,

(a) it is important to consider the size of the sample relative to the size of the population.

(b) a larger sample relative to the size of the population is preferred because it will reduce the sampling error.

(c) the sample size is not important.

(d) use a smaller sample.

Q.6. If we sample without replacement and the sample IS large relative to the population,

(a) the sample variance will be small.

(b) the sample mean will be large.

(c) the sample variance will large

(d) the sample variance must be adjusted

Q.7. Probability of selection varies at each subsequent draw in:

(a) sampling without replacement.

(b) sampling with replacement.

(c) both (a) and (b).

(d) neither (a) nor (b).

Q.8. The number of possible samples of size 11 from a population of N units with replacement is:

(a) n^2 (b) N^2

(c) ∞ (d) none of these.

Q.9. A function of variates for estimating a parameter is called:

(a) an estimate

(b) an estimator

(c) a frame

(d) a statistic.

Q.10. Let the standard error of an estimator T under srswor is more than the standard error of T under stratified randomly sampling. Then T under stratified sampling as compared to T under srswor is:

(a) more reliable.

(b) equally reliable.

(c) less reliable.

(d) not comparable.

Q.11. Which of the following basis distinguishes cluster sampling from stratified sampling?

(a) A sample is always drawn from each stratum whereas no sample of elementary units is drawn from clusters.

(b) Clusters are preferably heterogeneous whareas strata are taken as homogeneous as possible.

(c) Small size clusters are better whereas there is no such restriction for stratum size.

(d) all of these.

Q.12. Non-response in surveys mean:

(a) non-return of questionnaire by the respondents.

(b) non-availability of respondents.

(c) refusal to give information by the respondents.

(d) all of these.

Q.13. Choose the pair of symbols that best completes this sentence: _____ is a parameter, whereas _____ is a static.

(a) N, μ (b) N, n

(c) σ, s (d) all of these.

Q.14. Regarding the number of strata, which statement is true?

(a) More the number of strata, poorer it is.

(b) Lesser the number of strata, better it is.

(c) More the number of strata, better it is.

(d) Not more than ten items should be there in a stratum.

Q.15. In random sampling, we can describe mathematically how objective our estimates are. Why is this?

(a) We always know the chance that a population element will be included in the sample.

(b) Every sample always has an equal chance of being selected.

(c) All the samples are of exactly the same size and can be counted.

(d) (a) and (b) but not (c).

Q.16. The magnitude of the standard error of an estimate is an index of its:

(a) accuracy (b) precision

(c) efficiency (d) all of these.

Q.17. An estimate based on a fixed set of values of a sample always possess:

(a) a single value

(b) any value

(c) a value equal to one

(d) all of these.

Q.18. If the sample values are 1, 3, 5, 7, 9, the standard error of sample mean is :

(a) S.E. = $\sqrt{2}$

(b) S.E. = $1/\sqrt{2}$

(c) S.E. = 2.0

(d) S.E. = 1/2.

Q.19. Which of the following statements does not hold good in case of stratified sampling?

(a) Stratified sampling is always good.

(b) Stratified sampling is convenient.

(c) Reduces error for fixed cost.

(d) Enables to gather information about different stratum separately.

Q.20. What precaution(s) make(s) cluster sampling more efficient?

(a) Choosing clusters having largest within variation.

(b) By taking clusters of small size.

(c) Choosing clusters having least variation clusters.

(d) All of these.

Q.21. Suppose you are performing stratified sampling on a particular population and have divided the population into strata of different sizes. How can you now make your sample selection?

(a) Select at random an equal number of elements from each stratum.

(b) Draw an equal number of elements from each stratum and give weights to the results.

(c) Draw a number of elements from each stratum proportional to its weight in the population.

(d) (b) and (c) only.

Q.22. A population is divided into clusters and it has been found that all items within a cluster are alike. Which of the following sampling procedures would you adopt?

(a) Cluster sampling.

(b) Simple random sampling.

(c) Systematic sampling

(d) Stratified sampling.

Q.23. In which of the following situations would $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$ be the correct formula to use for computing $\sigma_{\bar{x}}$?

(a) Sampling is from a finite population with replacement.

(b) Sampling is from an infinite population.

(c) Sampling is from a finite population without replacement.

(d) (a) and (b) only.

Q.24. If population variance of an infinite population is 2 Cr and a sample of n items is selected from this population, the standard error of sample mean is equal to:

(a) σ/n (b) σ^2/n

(c) $\sigma/\sqrt{n}$ (d) σ.

25. A population is perfectly homogeneous in respect of a characteristic. What size of sample would you prefer?

(a) A large sample

(b) A small sample

(c) A single item

(d) No item.

Q.26. A systematic sample does not yield good results if:

(a) variation in units is periodic.

(b) units at regular intervals are corrected.

(c) both (a) and (b).

(d) none of (a) and (b).

Q.27. Double sampling is also known as:

(a) two stage sampling.

(b) two phase sampling.

(c) two directional sampling.

(d) all of these.

Q.28. If we sample with replacement,

(a) it is important to consider the size of the sample relative to the size of the population.

(b) a larger sample is preferred.

(c) the sample variance will not be biased.

(d) a smaller sample is preferred.

Q.29. If we sample with replacement and the sample is large relative to the population.

(a) the sample mean will be biased.

(b) the sample variance will be biased.

(c) the sample mean will be large.

(d) no adjustments need to be made.

Q.30. The number of possible samples of size n out of N population units without replacement is:

(a) ${}^{N}C_{n}$ (b) $(N)^n$

(c) n^2 (d) n !.

Q.31. Probability of anyone sample of size n being drawn out of N units is:

(a) 1/N (b) n/N

(c) 1/n ! (d) $1/\binom{N}{n}$

32. Two stage sampling design is more efficient than single stage sampling if the correlation between units in the first stage is:

(a) negative (b) positive

(c) zero (d) none of these.

Q.33. The discrepancy between estimates and population parameters is known as:

(a) human error.

(b) enumeration error.

(c) sampling error.

(d) formula error.

Q.34. If larger units have greater probability of their inclusion in the sample, it is known as:

(*a*) selection with replacement.
(*b*) selection with probability proportional to size.
(*c*) probability selection.
(*d*) selection with constant probability.

Q.35. If there is a certain number of very high values in a sample, then it is preferable to calculate:

(*a*) standard deviation.
(*b*) standard error.
(*c*) variance.
(*d*) all of these.

Q.36. A population consisting of the results of the conceptually repeated trials is known as:

(*a*) hypothetical population.
(*b*) infinite population.
(*c*) finite population.
(*d*) real population.

Q.37. The dispersion among sample means is less than the dispersion among the sampled items themselves because:

(*a*) each sample is smaller than the population from which it is drawn.
(*b*) very large values are averaged down, and very small values are averaged up.
(*c*) the sampled items are all drawn from the same population.
(*d*) none of these.

Q.38. A selection procedure of a sample having no involvement of probability is known as:

(*a*) judgement sampling.
(*b*) purposive sampling.
(*c*) subjective sampling.
(*d*) all of these.

Q.39. Sampling is inevitable in the situation (s):

(*a*) when the population is infinite.
(*b*) blood test of a person.
(*c*) testing of life of dry battery cells.
(*d*) all of these.

Q.40. An unordered sample of size n can occur m:

(*a*) n ways (*b*) n ! ways
(*c*) n^2 ways (*d*) one way.

Q.41. Suppose that a population with N = 144 has $\mu = 24$. What is the mean of the sampling distribution of the mean for samples of size 25?

(*a*) 24
(*b*) 2
(*c*) 4.8
(*d*) Cannot be determined from the information given.

Q.42. In simple random sampling with replacement, the same sampling unit may be included in the sample:

(*a*) only twice
(*b*) only once
(*c*) more than once
(*d*) none of these.

Q.43. If each and every unit of a population has equal chance of being included in the sample, it is known as:

(*a*) purposive sampling

(*b*) restricted sampling.
(*c*) subjective sampling.
(*d*) unrestricted sampling.

Q.44. The errors emerging out of faulty planning of surveys are categorised as:

(*a*) non-sampling errors.
(*b*) non-response errors.
(*c*) absolute error.
(*d*) sampling errors.

Q.45. When an investigator wants a sample containing m units which possess a rare attribute, the appropriate sampling procedure is:

(*a*) stratified sampling.
(*b*) srswor.
(*c*) inverse sampling.
(*d*) all of these.

Q.46. Probability of drawing a unit at each selection remains same in :

(*a*) srswor.
(*b*) srswr.
(*c*) both (*a*) and (*b*)
(*d*) none of (*a*) and (*b*).

Q.47. The central limit theorem assures us that the sampling distribution of the mean:

(*a*) is always normal.
(*b*) is always normal for large sample Sizes.
(*c*) approaches normality as sample Size increases.
(*d*) appears normal only when N is greater than 1,000.

Q.48. Simple random, sample can be drawn with the help of:

(*a*) random number tables
(*b*) chit method
(*c*) roulette wheel
(*d*) all of these.

Q.49. Suppose that, for a certain population, $\sigma_{\bar{x}}$ is calculated as 20 when samples of size 25 are taken and as 10 when samples of size 100 are taken. A quadrupling of sample size, then, only halved $\sigma_{\bar{x}}$. We can conclude that increasing sample size is:

(*a*) always cost-effective.
(*b*) sometimes cost-effective.
(*c*) never cost-effective.
(*d*) none of these.

Q.50. Increase in reliability and accuracy of results from a sampling study with the increase in sample size is known as the principle of:

(*a*) statistical regularity.
(*b*) optimisation.
(*c*) law of increasing returns.
(*d*) inertia of large numbers.

Q.51. Suppose that, for a certain population, σ_x is calculated as 20 when samples of size 25 are taken and as 10 when samples of size 100 are taken. A quadrupling of sample size, then, only halved $\sigma_{\bar{x}}$. What must be the value of σ for this infinite population?

(*a*) 1,000 (*b*) 500
(*c*) 377.5 (*d*) 100

Q.52. A population consisting of all the items which are physically present is called:

(*a*) hypothetical population.
(*b*) real population.
(*c*) infinite population.
(*d*) none of these.

Q.53. A population consisting of all real numbers is an example of:

(*a*) an infinite population.
(*b*) a finite population.
(*c*) an imaginary population.
(*d*) none of these.

Q.54. The number of all possible samples of size two from a population of 4 units is :

(*a*) 2 (*b*) 4
(*c*) 8 (*d*) 12.

Q.55. Probability of including a specified unit in a sample of size n selected out of N units is:

(*a*) l/n (*b*) l/N
(*c*) n/N (*d*) N/n.

Q.56. What sampling design is most appropriate for cluster sampling?

(*a*) Simple random sampling without replacement.
(*b*) Stratified random sampling.
(*c*) Simple random sampling with replacement.
(*d*) Quota sampling.

Q.57. To meet requirement of the principle of validity of sampling methods, one must adopt:

(*a*) purpose sampling.
(*b*) restricted sampling.
(*c*) probability sampling.
(*d*) none of these.

Q.58. An estimator can possess :

(*a*) a fixed value
(*b*) any value
(*c*) both (*a*) and (*b*)
(*d*) none of these.

Q.59. The finite population multiplier does not have to be used when the sampling fraction is:

(*a*) greater than, 0.05.
(*b*) greater than 0.50.
(*c*) less than 0.50.
(*d*) none of these.

Q.60. If the items are destroyed under investigation, we have to go for :

(*a*) complete enumeration
(*b*) sampling studies
(*c*) both (*a*) and (*b*)
(*d*) none of these.

Q.61. What distinction exists between cluster sampling and two stage sampling ?

(*a*) In cluster sampling, one studies each unit of the selected cluster, whereas in two stage sampling one selects a sample of elementary units from each cluster.
(*b*) In two stage, sampling one draws a sample in two stages, whereas in cluster sampling only a sample of clusters is selected.
(*c*) Both (*a*) and (*b*).
(*d*) none of these.

Q.62. A population was divided into clusters and it was found that within cluster variation was less than the variation between clusters. If a sample of units was selected from each cluster, the sampling procedure used was:

(*a*) multistage sampling.
(*b*) stratified sampling.
(*c*) cluster sampling.
(*d*) none of these.

Q.63. Systematic sampling means:

(*a*) selection of n contiguous units.
(*b*) selection of n units situated at equal distances.
(*c*) selection of n largest units.
(*d*) none of these.

Q.64. The standard error of the mean for a sample size of two or more is:

(*a*) always greater than the standard deviation of the population.
(*b*) generally, greater than the standard deviation of the population.
(*c*) usually, less than the standard deviation of the population.
(*d*) none of these.

Q.65. In which of the following situation(s) cluster sampling is appropriate?

(*a*) When the units are situated for apart.
(*b*) When sampling frame is not available.
(*c*) When all the elementary units are not easily identifiable.
(*d*) All of these.

Q.66. The selected items of a sample resulted into same values pertaining to a character. The variance of the sample is:

(*a*) 2 (*b*) 0
(*c*) 1 (*d*) none of these.

Q.67. A sample of 16 items from an infinite population having S.D. = 4, yielded total scores as 160. The standard error of sampling distribution of mean is:

(*a*) 1 (*b*) 20
(*c*) 30 (*d*) none of these.

Q.68. Double sampling has its utility in:

(*a*) stratified sampling.
(*b*) ratio method of estimation.
(*c*) regression method of estimation.
(*d*) all of these.

Q.69. A border patrol checkpoint which stops every passenger van is utilising:

(*a*) simple random sampling.
(*b*) systematic sampling.
(*c*) stratified sampling.
(*d*) complete enumeration.

Q.70. Selected units of a systematic sample are:

(*a*) not easily locateable.
(*b*) easily locateable.
(*c*) not representing the whole population.
(*d*) all of these.

Q.71. Greatest drawback of systematic sampling is that:

(*a*) one requires a large sample.
(*b*) data are not easily accessible.

(c) no single reliable formula for standard error of mean is available.
(d) none of these.

Q.72. In a normally distributed population, the sampling distribution of the mean:
(a) is normally distributed.
(b) has a mean equal to the population mean.
(c) has standard deviation equal to the population standard deviation divided by the square root of the simple size.
(d) all of these.

Q.73. Under proportional allocation, the size of the sample from each stratum depends on:
(a) size of the stratum.
(b) total sample size.
(c) population size.
(d) all of these.

Q.74. Which of the following statements is true?
(a) All sampling procedures involve sampling with constant probability.
(b) There exists sampling procedure in which the units are selected with varying probability.
(c) Every selection procedure of a sample involves probability.
(d) none of these.

Q.75. The central limit theorem:
(a) requires some knowledge of the frequency distribution.
(b) permits us to use sample statistics to make inferences about population parameters.
(c) relates the shape of a sampling distribution of the mean to the mean of the sample.
(d) requires a sample to contain fewer than 30 observations.

Q.76. Under equal allocation in stratified sampling, the sample from each stratum IS:
(a) proportional to stratum size.
(b) of same size from each stratum.
(c) in proportion to the per unit cost of survey of the stratum.
(d) none of these.

Q.77. The errors in a survey other than sampling errors are called
(a) planning error
(b) formula errors
(c) non-sampling error
(d) none of these.

Q.78. The most important factor in determining the size of a sample is:
(a) purpose of the survey.
(b) the availability of resources.
(c) heterogeneity of population.
(d) none of these.

Q.79. Stratified sampling belongs to the category of:
(a) subjective sampling.
(b) judgement sampling.
(c) controlled sampling.
(d) non-random sampling.

Q.80. There are more chances of non-sampling errors than sampling errors in case of:
(a) studies of large samples.
(b) complete enumeration.
(c) inefficient investigators.
(d) all of these.

Q.81. Stratified sampling comes under the category of:
(a) unrestricted sampling.
(b) subjective sampling.
(c) purposive sampling.
(d) restricted sampling.

Q.82. Which one problem out of the four is not related to stratified sampling?
(a) Fixing the number of strata.
(b) Fixing the criterion for stratification.
(c) Fixing the sample size.
(d) Fixing the points of demarcation between strata.

Q.83. In what situation, two stage sampling is better than single stage sampling?
(a) When the elements in the same stage are positively correlated.
(b) When the elements in the same stage are negatively correlated.
(c) When the elements in the same stage.
(d) none of these.

Q.84. Sampling error can be reduced by:
(a) choosing a proper probability sampling.
(b) selecting a sample of adequate size.
(c) using a suitable formula for estimation.
(d) all of these.

Q.85. Which of the following statement is correct?
(a) Simple random sample is inferior than systematic sample.
(b) Systematic sample is superior than stratified random sample.
(c) Stratified random sample is better than systematic sample.
(d) None of these.

Q.86. In what situation(s), a systematic sample is more preferred than others?
(a) When the items are in row.
(b) When the data are on cards.
(c) When the items situated at equal distances are uncorrelated.
(d) all of these.

Q.87. Which of the following advantage of systematic sampling you approve?
(a) Economical
(b) Easy selection of sample
(c) Spread of sample over the whole population
(d) all of these.

Q.88. Sampling is the process of obtaining a
(a) population (b) sample
(c) frequency (d) none of these.

Q.89. Sampling can be described as a statistical procedure
(a) to infer about the unknown universe from a knowledge of any sample.

(b) to infer about the known universe from a knowledge of a sample drawn from it.
(c) to infer about the unknown.
(d) Both (a) and (b).

Q.90. A parameter is a characteristic of
(a) Population
(b) Sample
(c) Both (a) and (b)
(d) none of these.

Q.91. Statistical decision about an unknown universe is taken on the basis of
(a) sample observations.
(b) a sampling frame.
(c) sample survey.
(d) compute enumeration.

Q.92. Statistical data may be collected by complete enumeration called
(a) census inquiry.
(b) sample inquiry.
(c) Both
(d) none

Q.93. By using sampling methods we have:
(a) the error estimation and less quality data.
(b) higher quality data and higher costs.
(c) the error estimation and higher quality data.
(d) less quality data and lower costs.

Q.94. The main object of sampling is to state the limits of accuracy of estimates base on samples.
(a) Yes.
(b) No.
(c) both (a) and (b)
(d) none of these.

Q.95. A sample survey is prone to:
(a) Non-sampling errors.
(b) Sampling errors.
(c) Either (a) or (b).
(d) Both (a) and (b).

Q.96. A sample is a selected part of the
(a) estimation (b) population
(c) both (d) none of these.

Q.97. Two basic Statistical laws concerning a population are
(a) the law of statistical irregularity and the law of inertia of large numbers.
(b) the law of statistical regularity and the law of inertia of large numbers.
(c) the law of statistical regularity and the law of inertia of small numbers.
(d) the law of statistical irregularity and the law of inertia of small numbers.

Q.98. Sampling Fluctuations may be described as:
(a) the variation in the values of a sample.
(b) the variation in the values of a sample.
(c) the differences in the values of a parameter.
(d) the variation in the values of observations.

Q.99. The Law of Statistical Regularity says that:
(a) Sample drawn from the population under discussion possesses the characteristics of the population
(b) A large sample drawn at random from the population would possess the characteristics of the population.
(c) A large sample drawn at random from the population would possess the characteristics of the population on an average.
(d) An optimum level of efficiency can be attained at a minimum cost.

Q.100. The population of roses in Salt Lake City is an example of:
(a) A hypothetical population
(b) An infinite population
(c) A finite population
(d) An imaginary population.

Q.101. Which sampling is subjected to the discretion of the sampler?
(a) Simple random sampling
(b) Systematic sampling
(c) Purposive sampling
(d) Quota sampling.

Q.102. Which sampling provides separate estimates for population means for different segments and also overall estimate?
(a) Multistage sampling
(b) Stratified sampling
(c) Systematic sampling
(d) Simple random sampling

Q.103. Which sampling adds flexibility to the sampling process?
(a) Multistage sampling
(b) Simple random sampling
(c) Stratified sampling
(d) Systematic sampling.

Q.104. The difference of the actual value and the expected value using a model is:
(a) Error in statistics
(b) Absolute error.
(c) Percentage error.
(d) Relative error.

Q.105. Which sampling is affected most if the sampling frame contains an undetected periodicity?
(a) Simple random sampling.
(b) Multistage sampling.
(c) Stratified sampling.
(d) Systematic sampling.

Q.106. Sample mean is an example of:
(a) parameter (b) statistic
(c) both (d) none.

Q.107. Large sample is that sample whose size is:
(a) greater than 30.
(b) greater than or equal to 30.
(c) less than 20.
(d) less than or equal to 30.

Q.108. Population mean is an example of:
(a) parameter
(b) statistic

(c) both (a) and (b)
(d) none.

Q.109. The finite population multiplier is ignored when the sampling fraction is:
(a) greater than 0.05.
(b) less than 0.6.
(c) less than 0.05.
(d) greater than 0.6.

Q.110. The ways of selecting a sample are:
(a) Random sampling
(b) Multi-stage sampling
(c) both (a) and (b)
(d) none of these.

Q.111. Random sampling implies
(a) Probability sampling
(b) Haphazard sampling
(c) Systematic sampling
(d) Sampling with the same probabi-lilty for each unit.

Q.112. Simple random sampling is:
(a) a probabilistic sampling
(b) a mixed sampling.
(c) a non-probabilistic sampling.
(d) Both (b) and (c).

Q.113. If random sampling with replacement is applied, then the mean of sample means will be ..... the population mean
(a) greater than
(b) less than
(c) exactly equal to
(d) none of these.

Q.114. Simple random sampling is very effective if
(a) the population is not very large.
(b) the population is not much hetero-geneous.
(c) the population is partitioned into several sections.
(d) Both (a) and (b).

Q.115. The number of types of random sampling is:
(a) 2 (b) 3
(c) 1 (d) 4.

Q.116. Random sampling is called lottery sampling.
(a) True
(b) False
(c) Both (a) and (b)
(d) none of these.

Q.117. Stratified random sampling is appropriate when the universe is not homo-geneous.
(a) True
(b) False
(c) Both (a) and (b)
(d) none of these.

Q.118. Random numbers are also called Random sampling number.
(a) True
(b) False
(c) Both (a) and (b)
(d) none of these.

Q.119. Cluster sampling is ideal in case the data are widely scattered.
(a) True

(b) False
(c) Both (a) and (b)
(d) none of these.

Q.120. In stratified sampling, the sampling is subdivided into several parts, called
(a) strata. (b) strati.
(c) start. (d) none of these.

Q.121. The Exploratory sampling is known as:
(a) Estimation sampling
(b) Acceptance sampling
(c) Discovery sampling
(d) none of these.

Q.122. Deliberate sampling is free from bias.
(a) True
(b) False
(c) Both (a) and (b)
(d) none of these.

Q.123. Single, double, multiple and sequential are several types of:
(a) Discovery sampling method
(b) Acceptance sampling method
(c) both (a) and (b)
(d) none of these.

Q.124. Purposive selection is resorted to in case of judgment sampling.
(a) True
(b) False
(c) Both (a) and (b)
(d) none of these.

Q.125. The ratio of the number of elements possessing a characteristic to the total number of elements in a sample is known as:
(a) characteristic proportion
(b) sample proportion
(c) Both (a) and (b)
(d) none of these.

Q.126. Finite population multiplier is:
(a) square of $(N-1)/(N-n)$
(b) square root of $(N-n)/(N-1)$
(c) square root of $(N-1)/(N-n)$
(d) square of $(N-n)/(N-1)$.

Q.127. Standard error can be described as:
(a) the error committed in sampling.
(b) the error committed in sample sur-vey.
(c) the error committed in estimating a parameter.
(d) Standard deviation of a statistic.

Q.128. A measure of precision obtained by sampling is given by:
(a) Standard error
(b) Expectation
(c) Sampling distribution
(d) Sampling fluctuation.

Q.129. The standard deviation in the sampling deviation is called:
(a) standard error.
(b) absolute error.
(c) relative error.
(d) none of these.

Q.130. As the sample size increases, standard error
(a) increases

(b) decreases
(c) remains constant
(d) decreases proportionately.

Q.131. The magnitude of standard error increase both by absolute and relative size of the sample.
(a) True
(b) False
(c) Both (a) and (b)
(d) none of these.

Q.132. A population comprises 5 members. The number of all possible samples of size 2 that can be drawn from it with replacement is:
(a) 100 (b) 25
(c) 125 (d) 25.

Q.133. Standard error of mean may be defined as the standard deviation in the sampling distribution of:
(a) mean (b) median
(c) mode (d) none of these.

Q.134. If from a population with 25 members, a random sample without replacement of 2 members is taken, the number of all such samples is:
(a) 300 (b) 725
(c) 150 (d) 540.

Q.135. The sample proportion is taken as an estimate of the population proportion of defectives.
(a) True
(b) False
(c) both (a) and (b)
(d) none of these.

Q.136. Standard deviation of a sampling distribution is itself the standard error.
(a) True
(b) False
(c) both (a) and (b)
(d) none of these.

Q.137. The standard error of the mean for finite population is very close to the standard error of the mean for infinite population when the sampling fraction is:
(a) small (b) moderate
(c) large (d) none of these.

Q.138. Sampling error increases with an increase in the size of the sample.
(a) True
(b) False
(c) both (a) and (b)
(d) none of these.

Q.139. Testing the assumption that an assumed population is located at a known level of significance is known as
(a) confidence testing
(b) point estimation
(c) interval estimation
(d) hypothesis testing.

Q.140. The Standard deviation of the ..... distribution is called standard error.
(a) Normal (b) Poisson
(c) Binomial (d) Sampling.

Q.141. Under ..... method selection is often based on certain predetermined criteria.

(a) Area sampling
(b) Block or Cluster sampling
(c) Quota sampling
(d) Deliberate, purposive or judgment sampling.

Q.142. Which would you prefer ..... if higher degree of confidence is desired?
(a) small sample (b) larger sample
(c) both (d) none of these.

Q.143. Which would you prefer for ..... when "The universe is large"?
(a) Full enumeration
(b) Sampling
(c) both (a) and (b)
(d) none of these.

Q.144. A ..... is a complete or whole set or possible measurements data corresponding to the entire collection of units.
(a) Sample
(b) Population
(c) both (a) and (b)
(d) none of these.

Q.145. The finite population correction factors should be used when the population is:
(a) infinite
(b) finite and large
(c) finite and small
(d) none of these.

Q.146. A statistic is a ..... variable
(a) compound (b) simple
(c) random (d) none of these

Q.147. Which would you prefer for .... "The Statistical inquiry is in depth".
(a) Full enumeration
(b) Sampling
(c) both (a) and (b)
(d) none.

Q.148. The primary object of sampling is to obtain ..... information about population with ..... effort.
(a) maximum, minimum
(b) minimum, maximum
(c) some, less
(d) none.

Q.149. The measure of divergence is ..... as the size of the sample approaches that of the population.
(a) more (b) less
(c) same (d) none of these.

Q.150. For ..... samples, the sample proportion is an unbiased estimate of the population proportion.
(a) large (b) small
(c) moderate (d) none of these.

Q.151. Value of a .....is different for different samples.
(a) statistic
(b) skill
(c) both (a) and (b)
(d) none of these.

Q.152. Sampling error is..... proportional to the square root M the number of items in the sample.
(a) inversely (b) directly
(c) equally (d) none.

Q.153. Which would you prefer for ....."Where testing destroys the quality of the product".

(*a*) Full enumeration
(*b*) Sampling
(*c*) both (*a*) and (*b*)
(*d*) none of these.

Q.154. The distribution of sample ..... is normally or approximately normally distributed about the population

(*a*) median (*b*) mode
(*c*) mean (*d*) none of these.

Q.155. The standard error of the .....is the standard deviation of sample means

(*a*) mode (*b*) median
(*c*) moderate (*d*) none of these.

Q.156. In test for means of Paired data, if the computed value is ..... then the table value the difference is considered significant.

(*a*) lesser (*b*) greater
(*c*) moderate (*d*) none of these.

Q.157. ..... sampling is the most appropriate in cases when the population is more or less homogeneous with respect to the characteristic under study.

(*a*) Stratified (*b*) Multi - stage
(*c*) Random (*d*) noneof these.

Q.158. The mean of the sampling distribution of sample proportion is ..... the population proportion.

(*a*) greater than (*b*) less than
(*c*) equal to (*d*) none of these.

Q.159. sampling is similar to cluster sampling.

(*a*) Judgment (*b*) Quota
(*c*) Area (*c*) none of these.

Q.160. Which would you prefer ..... Previous experiences reveals a low rate of error.

(*a*) Larger Sample
(*b*) Small sample
(*c*) both (A) and (B)
(*d*) none of these.

ANSWERS

1.	(*b*)	**2.**	(*a*)	**3.**	(*d*)	**4.**	(*d*)	**5.**	(*a*)	**6.**	(*d*)	**7.**	(*a*)
8.	(*d*)	**9.**	(*b*)	**10.**	(*a*)	**11.**	(*d*)	**12.**	(*b*)	**13.**	(*c*)	**14.**	(*d*)
15.	(*d*)	**16.**	(*b*)	**17.**	(*a*)	**18.**	(*a*)	**19.**	(*b*)	**20.**	(*d*)	**21.**	(*d*)
22.	(*d*)	**23.**	(*d*)	**24.**	(*c*)	**25.**	(*c*)	**26.**	(*c*)	**27.**	(*b*)	**28.**	(*c*)
29.	(*d*)	**30.**	(*a*)	**31.**	(*d*)	**32.**	(*b*)	**33.**	(*c*)	**34.**	(*b*)	**35.**	(*b*)
36.	(*a*)	**37.**	(*d*)	**38.**	(*d*)	**39.**	(*d*)	**40.**	(*b*)	**41.**	(*a*)	**42.**	(*c*)
43.	(*d*)	**44.**	(*a*)	**45.**	(*c*)	**46.**	(*b*)	**47.**	(*c*)	**48.**	(*d*)	**49.**	(*b*)
50.	(*d*)	**51.**	(*d*)	**52.**	(*b*)	**53.**	(*a*)	**54.**	(*b*)	**55.**	(*b*)	**56.**	(*a*)
57.	(*a*)	**58.**	(*c*)	**59.**	(*b*)	**60.**	(*d*)	**61.**	(*b*)	**62.**	(*c*)	**63.**	(*b*)

64.	(*b*)	**65.**	(*d*)	**66.**	(*b*)	**67.**	(*a*)	**68.**	(*d*)	**69.**	(*d*)	**70.**	(*b*)
71.	(*c*)	**72.**	(*d*)	**73.**	(*d*)	**74.**	(*b*)	**75.**	(*b*)	**76.**	(*b*)	**77.**	(*c*)
78.	(*c*)	**79.**	(*c*)	**80.**	(*d*)	**81.**	(*d*)	**82.**	(*c*)	**83.**	(*b*)	**84.**	(*d*)
85.	(*d*)	**86.**	(*d*)	**87.**	(*d*)	**88.**	(*b*)	**89.**	(*c*)	**90.**	(*a*)	**91.**	(*a*)
92.	(*a*)	**93.**	(*a*)	**94.**	(*a*)	**95.**	(*d*)	**96.**	(*b*)	**97.**	(*b*)	**98.**	(*a*)
99.	(*c*)	**100.**	(*b*)	**101.**	(*c*)	**102.**	(*b*)	**103.**	(*d*)	**104.**	(*a*)	**105.**	(*d*)
106.	(*b*)	**107.**	(*b*)	**108.**	(*a*)	**109.**	(*c*)	**110.**	(*c*)	**111.**	(*d*)	**112.**	(*a*)
113.	(*c*)	**114.**	(*d*)	**115.**	(*a*)	**116.**	(*a*)	**117.**	(*b*)	**118.**	(*a*)	**119.**	(*b*)
120.	(*a*)	**121.**	(*c*)	**122.**	(*b*)	**123.**	(*b*)	**124.**	(*a*)	**125.**	(*b*)	**126.**	(*b*)
127.	(*d*)	**128.**	(*a*)	**129.**	(*a*)	**130.**	(*b*)	**131.**	(*a*)	**132.**	(*c*)	**133.**	(*a*)
134.	(*a*)	**135.**	(*a*)	**136.**	(*a*)	**137.**	(*a*)	**138.**	(*b*)	**139.**	(*d*)	**140.**	(*d*)
141.	(*d*)	**142.**	(*c*)	**143.**	(*b*)	**144.**	(*b*)	**145.**	(*c*)	**146.**	(*c*)	**147.**	(*b*)
148.	(*a*)	**149.**	(*b*)	**150.**	(*a*)	**151.**	(*a*)	**152.**	(*a*)	**153.**	(*b*)	**154.**	(*c*)
155.	(*c*)	**156.**	(*b*)	**157.**	(*c*)	**158.**	(*c*)	**159.**	(*c*)	**160.**	(*b*)		

26 CHAPTER CORRELATION

PAST EXAM QUESTIONS WITH SOLUTIONS (MEMORY BASED)

Q.1. If 'ρ' is the simple correlation coefficient, the quantity ρ^2 is known as :

(*a*) Coefficient of determination
(*b*) Coefficient of Non-determination
(*c*) Coefficient of alienation
(*d*) None of the above.

[June 2010]

Solution : (*a*)

Q.2. If the correlation coefficient between X and Y is r, & $U = \frac{X-5}{10}$ and $V = \frac{Y-7}{2}$ then r_{uv} is

(*a*) r (*b*) -r
(*c*) (r-5)/2 (*d*) (r-7)/10

[June 2010]

Solution : (*a*) $U = \frac{X-5}{10} = \frac{X}{10} - \frac{5}{10}$ & $V = \frac{Y}{2} - \frac{7}{2}$

TRICKS : Since X & Y have same sign.

So, $r_{xy} = r_{uv} = r$

Q.3. If the sum of the product of deviations of x and y series from their mean is zero, then the coefficient of correlation will be

(*a*) 1 (*b*) -1
(*c*) 0 (*d*) None of these

[Dec. 2010]

Solution : (*c*) Given

$$\sum(X-\bar{X})(Y-\bar{Y}) = 0$$

Formula, $r = \frac{\sum(X-\bar{X})(Y-\bar{Y})}{N\times\sigma_x\times\sigma_y}$

$$= \frac{0}{N\times\sigma_x\times\sigma_y} = 0$$

Q.4. The ranks of five participants given by two judges are

	Participants				
	A	B	C	D	E
Judge 1	1	2	3	4	5
Judge 2	5	4	3	2	1

Rank correlation coefficient between ranks will be

(a) 1 (b) 0
(c) -1 (d) 1/2

[Dec. 2010]

Solution : (c) Ranks given by two Judges are in reverse order in same ratio.

$\therefore$ R = - 1 [It is always -1; No need to proof.]

Q.5. The covariance between two variables X and Y is 8.4 and their variances are 25 and 36 respectively. Calculate Karl Pearson's coefficient of correlation between them.

(a) 0.82 (b) 0.28
(c) 0.01 (d) 0.09

[June 2011]

Solution : (b) Given : Cov. (x,y) = 8.4

$\sigma_x = \sqrt{25} = 5,\ \sigma_y = \sqrt{36} = 6$

$$r = \frac{Cov.(x,y)}{\sigma_x.\sigma_y} = \frac{8.4}{5\times 6} = 0.28$$

Q.6. In Spearman's Correlation Coefficient, the sum of the differences of ranks between two variables shall be_____.

(a) 0 (b) 1
(c) -1 (d) None of them

[Dec. 2012]

Solution : (a) In Spearman's correlation coefficient the sum of the differences of ranks between two variable shall be **Zero.**

$$\sum D = \sum (R_1 - R_2) = 0$$

Q.7. The coefficient of correlation between X and Y series is - 0.38 The linear relation between U & V are 3X + 5U = 3 and -8Y - 7V = 44, what is the coefficient of correlation between U & V?

(a) 0.38 (b) -0.38
(c) 0.40 (d) None of them

[Dec. 2012]

Solution : (b) Given $r_{xy} = -0.38$

TRICKS : 3X + 5U = 3 and
-8Y - 7V = 44
8Y + 7V = 44
r = - 0.38

Q.8. Two variables X and Y are related as 4x + 3y = 7 then correlation between x and y is_____

(a) Perfect positive
(b) Perfect negative
(c) Zero
(d) None of these

[June 2013]

Solution : (b)

Since, $4x+3y=7$

$\therefore 3y = -4x + 7;\ \therefore r = -1$

$\therefore$ X and are y perfectly negative because x and y have opposite sign.

Q.9. If r is the karl pearson's coefficient of correlation in a bivariate distribution the two regression lines are at right angles when_____

(a) $r = \pm 1$ (b) r = 0
(c) $r = \pm\infty$ (d) None

[June 2013]

Solution : (b) If r = 0 ; Two Regression Lines are perpendicular to each other.

Q.10. If r = 0.28, Cov. (x,y) = 7.6, V(x) = 9 then σ_y =

(a) 8.75 (b) 9.04
(c) 6.25 (d) None

[June 2013]

Solution : (b) is correct

$$r = \frac{Cov.(x,y)}{\sigma_x.\sigma_y}$$

or; $0.28 = \frac{7.6}{3.\sigma_y}$ or; $\sigma_y = 9.04$

Q.11. Price and Demand is example for:

(a) No correlation
(b) Positive correlation
(c) Negative correlation
(d) None of these

[Dec. 2013]

Solution : (c)

Q.12. Determine the coefficient of correlation between x and y series

	X-Series	Y-Series
Number of items	15	15
Arithmetic mean	25	18
Sum of Square of deviation of mean	136	138

Sum of product deviation of X and Y series from mean = 122

(a) -0.89 (b) 0.89
(c) 0.69 (d) -0.69

[Dec. 2013]

Solution : (b) is correct

Given N = 15; $\overline{X} = 25; \overline{y} = 18$

$\sum (x-\overline{x})^2 = \sum x^2 = 136;$

$\sum (y-\overline{y})^2 = \sum y^2 = 138$

and $\sum (x-\overline{x})(y-\overline{y}) = \sum xy = 122$

$$\therefore r = \frac{\sum xy}{\sqrt{\sum x^2}\sqrt{\sum y^2}} = \frac{122}{\sqrt{136}\sqrt{138}}$$

= 0.89

Tricks : Use calculator (Without writing)

Q.13. When each individual gets the exactly opposite rank by the two judges then the rank correlation will be_____

(a) -1 (b) 0
(c) +1 (d) +1/2

[June 2014]

Solution : (a) is correct

Note :- Opposite Ranks Means r = -1

Q.14. Correlation coefficient between x and y is 1, then correlation coefficient between x - 2 and (-y/2)+1 is.

(a) 1 (b) -1
(c) -1/2 (d) 1/2

[Dec. 2014]

Solution : (b) is correct.

$\because$ r = + 1 (given)

For variables (x-2) and $\left(-\frac{y}{2}+1\right)$

r = -1 (because sign of x & y are opposite)

Q.15. When r = 1, all the points in a scatter diagram would lie:

(a) On a straight line directed from lower left to upper right
(b) On a straight line

(c) On a straight line directed from upper left to lower right
(d) Both (a) and (b)

[June 2015]

Solution : (a) is correct.

Q.16. In case 'Insurance Companies' Profits and the No. of claims they have to pay:

(a) Positive correlation
(b) Negative correlation
(c) No correlation
(d) None of these

[Dec. 2015]

Solution : (b) is correct.

Q.17. If r = 0.6 then the coefficient of non-determination is _____

(a) 0.4 (b) - 0.6
(c) 0.36 (d) 0.64

[June 2016]

Solution : (d)

co-efficient of Non-determination

$= 1 - r^2 = 1 - (0.6)^2 = 0.64$

= 64%

Q.18. If the coefficient of correlation between x and y variables is -0.90 then what will be the coefficient of determination

(a) 0.10 (b) 0.81
(c) 0.94 (d) None

[June 2016]

Solution : (b)

co-eff. of determination $= r^2$

$= (-0.90)^2 = 0.81$

Q.19. If the sum of the squares of Rank differences in the marks of 10 students in two students is 44, then the coefficient of rank correlation is _____

(a) 0.78 (b) 0.73
(c) 0.87 (d) None

[Dec. 2016]

Solution : (b) is correct.

Given, N = 10 & $\sum D^2 = 44$

$$R = 1 - \frac{6\sum D^2}{N^3 - N} = 1 - \frac{6\times 44}{10^3 - 10} = 0.73$$

Q.20. Correlation between temperature and power consumption is

(a) Positive (b) Negative
(c) Zero (d) None

[June 2017]

Solution : (a)

Q.21. Coefficient of correlation between X & Y is 0.6. If both X and Y are multiplied by -1. Then resultant coefficient of correlation is

(a) 0.6 (b) Negative
(c) 1/0.6 (d) None

[June 2017]

Solution : (a) [$\because$ r does not change with respect to the change of origin and scale]

Q.22. If r = 0.6 then the coefficient of non-determination is :

(a) 0.4 (b) -0.6
(c) 0.36 (d) 0.64

[Dec. 2017]

Solution : (d)

Co-efficient of Non-determination

$= 1 - r^2 = 1 - (0.6)^2$

= 0.64

Q.23. If there is a constant increase in the series then the obtained graph is :

(a) Convex
(b) Concave
(c) Parabola
(d) Straight line from left to right

[Dec. 2017]

Solution : (d)

Q.24. If r = 0.58, correlation coefficient of u = -5x + 3 and v = y + 2 is _____:

(a) 0.58 (b) -0.58
(c) 0.62 (d) None

[June 2018]

Solution : (b)

The value of "r" does not change with respect to the change of origin and scale but sign may change.

So $r_{uv} = -0.58$

[Note : Here; sign of x & y in both eqns. are opposite, so sign of "r" changes].

Q.25. If the sum of squares of deviations of ranks of 8 students is 50 then the rank correlation coefficient is _____ :

(a) 0.40 (b) 0.45
(c) 0.5 (d) 0.8

[June 2018]

Solution : (a)

Given, N = 8 ; $\sum D^2 = 50$

$$R = 1 - \frac{6\sum D^2}{N^3 - N} = 1 - \frac{6\times 50}{8^3 - 8} = 0.40$$

Q.26. If the plotted points in a scatter diagram are evenly distributed, then the correlation is

(a) Zero (b) Negative
(c) Positive (d) (a) or (b)

[May 2018]

Solution : (a)

Q.27. The covariance between two variables is

(a) Strictly positive
(b) Strictly negative
(c) Always Zero
(d) Either positive or negative or zero

[May 2018]

Solution : (d)

Q.28. The coefficient of determination is defined by the formula

(a) $r^2 = \frac{1 - \text{unexplained variance}}{\text{total variance}}$

(b) $r^2 = \frac{\text{explained variance}}{\text{total variance}}$

(c) both (a) and (b)
(d) None

[May 2018]

Solution : (c)

Q.29. In the method of Concurrent Deviations, only the directions of change (Positive direction/Negative direction) in the variables are taken into account for calculation of

(a) Coefficient of S.D
(b) Coefficient of regression
(c) Coefficient of correlation
(d) None

[May 2018]

Solution : (c)

Q.30. Correlation coefficient is _____ of the units of measurement.

(*a*) dependent (*b*) independent
(*c*) both (*d*) None

[May 2018]

Solution : (*b*)

Q.31. In case speed of an automobile and the distance required to stop the car after applying brakes correlation is.....

(*a*) Positive (*b*) Negative
(*c*) Zero (*d*) None

[May 2018]

Solution : (*a*)

Q.32. A relationship $r^2 = 1 - \frac{500}{300}$ is not possible

(*a*) True (*b*) False
(*c*) Both (*d*) None

[May 2018]

Solution : (*a*) Given :

$r^2 = 1 - \frac{500}{300} = \frac{-200}{300}$ is not possible

[$\because$ r^2 is always positive.]

Q.33. Rank correlation coefficient lies between

(*a*) 0 to 1
(*b*) -1 to +1 inclusive of these values
(*c*) -1 to 0
(*d*) Both

[May 2018]

Solution : (*b*)

Q.34. If the correlation coefficient between the variables X and Y is 0.5, then the correlation coefficient between the variables $2x - 4$ and $3 - 2y$ is

(*a*) 0.5 (*b*) 1
(*c*) –0.5 (*d*) 0

[Nov. 2018]

Solution : (*c*)

Tricks : See Quicker BMLRS

Chapter : Correlation.

r = -0.5 (Sign. of X & Y in both are opposite).

Q.35. A.M. of regression coefficient is

(*a*) Equal to r
(*b*) Greater than or equal to r
(*c*) Half of r
(*d*) None

[June 2019]

Solution : (*b*)

Q.36. Given that

X	-3	-3/2	0	3/2	3
Y	9	9/4	0	9/4	9

Then Karl Pearson's coefficient of correlation is

(*a*) Positive (*b*) Zero
(*c*) Negative (*d*) None

[June 2019]

Solution : (*b*)

If graph of this data is drawn then it will make a curvilinear relation. In this case r = 0

Hence Karl Pearson's Coefficient of Correlation = r = "Zero". Because it is equally distributed.

Q.37. Find the probable error if $r = \frac{2}{\sqrt{10}}$ and N = 36

(*a*) 0.6745 (*b*) 0.067
(*c*) 0.5287 (*d*) None

[June 2019]

Solution : (*b*)

$r = \frac{2}{\sqrt{10}}$, N= 36, P.E = ?

Probable Error $P.E = 0.6745\frac{1-r^2}{\sqrt{N}}$

$= 0.6745\left[\frac{1-\left(\frac{2}{\sqrt{10}}\right)^2}{\sqrt{36}}\right] = 0.6745\frac{\left(1-\frac{4}{10}\right)}{6}$

$= 0.06745 = 0.067$

Q.38. Given the following series :

X	10	13	12	15	8	15
Y	12	16	18	16	7	18

The rank correlation coefficient R =

(*a*) $1 - \frac{6\sum d^2 + \sum_{i=1}^{2} \frac{m_i(m_i^2-1)}{12}}{N(N^2-1)}$

(*b*) $1 - \frac{6\left[\sum d^2 + \sum_{i=1}^{2} \frac{m_i(m_i^2-1)}{12}\right]}{N(N^2-1)}$

(*c*) $1 - 6\sum d^2 + \sum_{i=1}^{2} \frac{m_i(m_i^2-1)}{12 N(N^2-1)}$

(*d*) $1 - 6\sum d^2 + \sum_{i=1}^{3} \frac{m_i(m_i^2-1)}{12 N(N^2-1)}$

[June 2019]

Solution : (*b*)

Here two observations 15 & 16 has been repeated two times. So, we use the formula of the Rank Correlation Coefficient.

$$R = 1 - \frac{6\left[\sum d^2 + \sum_{i=1}^{2} \frac{m_i(m_i^2-1)}{12}\right]}{N(N^2-1)}$$

Q.39. Determine Spearman's rank correlation coefficient from the given data $\sum D^2 = 30$, N = 10

(*a*) R = 0.82 (*b*) R = 0.32
(*c*) R = 0.40 (*d*) None of these

[June 2019]

Solution : (*a*)

Here, $\sum D^2 = 30$, $N = 10$

Spearman's rank correlation

$R = 1 - \frac{6\sum D^2}{N(N^2-1)}$

$= 1 - \frac{6\times 30}{10(10^2-1)} = 1 - \frac{180}{990} = 1 - \frac{2}{11} = \frac{9}{11}$

$= 0.82$

Q.40. Find correlation coefficient

X	5	4	3	2	1
Y	1	2	3	4	5

(*a*) 1 (*b*) -1
(*c*) 0 (*d*) None of these

[Dec. 2019]

Solution : (*b*)

Tricks: Each observation of X decreased by 1 but that of Y increase by 1.

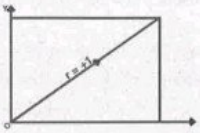
So; r = -1. (Inverse relation)

Q.41. If scatter diagram from a line move from lower left to upper right corner then the correlation is.

(*a*) Perfect positive
(*b*) Perfect negative
(*c*) Simple positive
(*d*) No correlation

[Dec. 2019]

Solution : (*a*)



Q.42. If correlation coefficient between x and y is 0.5, then find the correlation coefficient between 2x-3 and 3-5y is

(*a*) 0.5 (*b*) -0.5
(*c*) 2.5 (*d*) -2.5

[Dec. 2019]

Solution : (*b*)

The value of "r" does not change if a constant quantity is added to or subtracted from all observation.

The value of "r" also does not change if all observations are multiplied or divided by a constant quantity. X has been multiplied by +2 but Y by -"5" *i.e.* X & Y have opposite sign. So; only sign of "r" will change not its value.

$\therefore$ r = - 0.5

Q.43. If the equation of the two regression lines are 2x - 3y = 0 and 4y -5x = 8 then the correlation coefficient between x and y is equal to

(*a*) $\sqrt{\frac{15}{8}}$ (*b*) $\sqrt{\frac{8}{15}}$
(*c*) $\sqrt{\frac{6}{15}}$ (*d*) $\sqrt{\frac{1}{15}}$

[Dec. 2019]

Solution : (*b*)

$2X - 3Y = 0 \Rightarrow 2X = 3Y$

$-5X + 4Y = 8 \Rightarrow 5X = 4Y + 8$

$r = +\sqrt{\frac{2\times 4}{3\times 5}}$ $\because$ (Put + Sign because X & Y have same sign in both equation.)

[Do cross - product. Write smaller in numerator and larger in denominator]

Q.44. Which of the following is spurious correlation?

(*a*) Correlation between two variables having no causal relationship
(*b*) Negative Correlation
(*c*) Bad relation between two variables
(*d*) Very low correlation between two variables *[Dec. 2020]*

Solution : (*a*)

Q.45. Scatter diagram does not help us to

(*a*) Find the type of correlation
(*b*) Identify whether variables correlated or not
(*c*) Determine the linear (or) non-linear correlation
(*d*) Find the numerical value of correlation coefficient *[Dec. 2020]*

Solution : (*d*)

Q.46. The Covariance between two variables is

(*a*) Strictly Positive
(*b*) Strictly Negative
(*c*) Always Zero
(*d*) Either positive (or) Negative (or) Zero *[Dec. 2020]*

Solution : (*d*)

Q.47. For the set of observations {(1, 2), (2, 5), (3, 7), (4, 8), (5, 10)} the value of karl-person's coefficient of correlation is approximately given by

(*a*) 0.755 (*b*) 0.655 (*c*) 0.525 (*d*) 0.985

[Jan. 2021]

Solution : (*d*) is correct

[Do these on calculator. No need of this Table]

X	Y	XY	X^2	Y^2
1	2	2	1	4
2	5	10	4	25
3	7	21	9	49
4	8	32	16	64
5	10	50	25	100
$\Sigma x = 15$	$\Sigma Y = 32$	$\Sigma xy = 115$	$\Sigma x^2 = 55$	$\Sigma Y^2 = 242$

Coefficient of correlation

$$= r = \frac{N\sum XY - \sum X \cdot \sum Y}{\sqrt{N\sum X^2 - (\sum X)^2}\cdot\sqrt{N\sum Y^2 - (\sum Y)^2}}$$

$$= \frac{5\times 115 - 15\times 32}{\sqrt{5\times 55 - (15)^2}\cdot\sqrt{5\times 242 - (32)^2}}$$

$$= \frac{575 - 480}{\sqrt{275 - 225}\cdot\sqrt{1210 - 1024}}$$

$$= \frac{+95}{\sqrt{50}\cdot\sqrt{186}} = +0.985$$

Q.48. The coefficient of correlation between *x* and *y* is 0.5 the covariance, is 16 and the standard deviation of *y* is if S.D. of *x* is 4.

(*a*) 4 (*b*) 8
(*c*) 16 (*d*) 64

[Jan. 2021]

Solution : (*b*) is correct

Formula $r = \frac{\text{cov.}(x;\ y)}{\sigma_x \cdot \sigma_y}$

or $0.5 = \frac{16^4}{4.\sigma_y}$

or $\sigma_y = \frac{4}{0.5} = 8$

Q.49. If the sum of the product of the deviation of and Y from their means is zero, the correlation coefficient between X and is:

(a) Zero (b) Positive
(c) Negative (d) 10

[July 2021]

Solution : (a) is correct.

Given that

$\Sigma(X - \bar{X})(Y - \bar{Y}) = 0$

Coefficient of correlation

$= r = \frac{\sum(X-\bar{X})(Y-\bar{Y})}{N.\sigma_x.\sigma_y}$ (Formula)

$= \frac{0}{N.\sigma_x.\sigma_y} = 0$

Q.50. If the data points of (X, Y) series on a scatter diagram lie along a straight line that goes downwards as X-values move from left to right, then the data exhibit _____ correlation.

(a) Direct
(b) Imperfect indirect
(c) Indirect
(d) Imperfect direct

[Dec. 2021]

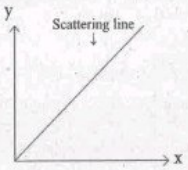
Solution : (c)

Q.51. If the plotted points in a scatter diagram lie from lower left to upper right, then the correlation is

(a) Negative
(b) Perfect Negative
(c) Zero
(d) Positive

[June 2022]

Solution :



This line shows positively corrected.

∴ (d) is correct.

Q.52. For finding correlation between two qualitative characteristics, we use

(a) Coefficient of rank correlation
(b) Scatter diagram
(c) Coefficient of concurrent deviation
(d) Product moment correlation coefficient

[June 2022]

Solution :

(a) is correct

For Qualitative Nature; Rank correlation coefficient is used.

Q.53. Karl Pearson's coefficient is defined from

(a) Grouped data
(b) Ungrouped data
(c) Any data
(d) Scattered data

[June 2022]

Solution : (b)

Karl Pearson's correlation Coefficient is defined for ungrouped data.

Q.54. For n pairs of observations, the coefficient of concurrent deviation is calculated as $\frac{1}{\sqrt{5}}$ If there are six concurrent deviations, then n =

(a) 11 (b) 10
(c) 9 (d) 8

[June 2022]

Solution : Given : $r_c = \frac{1}{\sqrt{5}}$ & c = 6.

Formula

$r_c = \pm\sqrt{\pm\frac{2c-n}{n}}$

or $\frac{1}{\sqrt{5}} = +\sqrt{\frac{+2\times6-n}{n}}$

Squaring on both sides; we get

$\frac{1}{5} = \frac{12-n}{n}$

or n = 60 – 5n

or n+5n = 60

or 6n = 60 ∴ n =10

∴N = No. of observation = n + 1

= 10 + 1 = 11

∴ (b) is correct.

Q.55. The coefficient of rank correlation between the ranking of following 6 students in two subjects.

Mathematics and Statistics is :

Mathematics	3	5	8	4	7	10
Statistics	6	4	9	8	1	2

(a) 0.25 (b) 0.35 (c) 0.38 (d) 0.20

[Dec. 2022]

Solution:

Mathematics (X)	Statistics (Y)	R_1	R_2	$D^2 = (R_1 - R_2)^2$
3	6	1	4	9
5	4	3	3	0
8	9	5	6	1
4	8	2	5	9
7	1	4	1	9
10	2	6	2	16
				$\sum D^2 = 44$

$\therefore R = 1 - \frac{6\sum D^2}{N^3 - N}$

$= 1 - \frac{6\times44}{6^3-6}$

$= 1 - 1.257$

$= -0.257$

No option

Q.56. Pearson's Correlation co-efficient between *x* and *y* is:

(a) $\frac{\text{cov}(x^1, y)}{S_x S_y}$ (b) $\frac{\text{cov}^2(x_2, y)}{S_x S_y}$

(c) $\frac{(S_x S_y)^3}{\text{cov}(x,y)}$ (d) $\frac{S_x S_y}{\text{cov}(x,y)}$

[Dec. 2022]

Solution: (a) is correct.

Karl Pearson's correlation co-efficient

$= r = \frac{Cov.(x;y)}{\sigma_x.\sigma_y} = \frac{Cov.(x;y)}{Sx.Sy}$

Where $\sigma_x = s_x$ = SD of *x*

$\sigma_y = s_y$ = SD of *y*

Q.57. Given that *r* = 0.4 and *n* = 81, determine the limits for the population correlation coefficient.

(a) (0.333, 0.466)
(b) (0.367, 0.433)
(c) (0.337, 0.463)
(d) (0.373, 0.427)

[June 2023]

Solution: $PE = 0.6745\frac{1-r^2}{\sqrt{N}}$

$= 0.06745\left(\frac{1-(0.4)^2}{\sqrt{81}}\right)$

$= 0.06295$

$= 0.063$

Lower Limit = r – PE

= 0.4 – 0.063

= 0.337

Upper Limit = r + PE

= 0.4 + 0.063

= 0.463

∴ (c) is correct.

Q.58. Spearman's rank correlation co-efficient r_R is given by:

(a) $1 - \frac{6\sum d_i^2}{n(n^2+1)}$

(b) $1 + \frac{6\sum d_i^2}{n(n^2-1)}$

(c) $1 + \frac{6\sum d_i^2}{n(n^2+1)}$

(d) $1 - \frac{6\sum d_i^2}{n(n^2-1)}$

[June 2023]

Solution: Formula.

$R = 1 - \frac{6\sum D^2}{N^3 - N}$

$= 1 - \frac{6\sum D^2}{N(N^2-1)}$

∴ (d) is correct.

27 CHAPTER REGRESSION ANALYSIS

PAST EXAM QUESTIONS WITH SOLUTIONS (MEMORY BASED)

Q.1. _____ of the regression Coefficient is greater than the correlation coefficient

(a) Combined mean
(b) Harmonic mean
(c) Geometric mean
(d) Arithmetic mean.

[June 2010]

Solution : (d) $r = \pm\sqrt{b_{xy}.b_{yx}}$ = GM of Regression Coefficients.

∵ AM > GM > HM

∴ AM of regression coefficients is greater than correlation coefficient.

Q.2. Regression coefficient are_____

(a) dependent of change of origin and of scale.
(b) independent of both change of origin and of scale.
(c) dependent of change of origin but not of scale.
(d) independent of change of origin but not of scale

[Dec. 2010]

Solution : (d) Regression coefficient are independent of change of origin but changes with respect to scale. [Properties of regression co-efficients]

Q.3. Given :

$\bar{X} = 16,\ \sigma_X = 4.8,$

$\bar{Y} = 20,\ \sigma_Y = 9.6$

The coefficient of correlation between x and y is 0.6. What will be the regression coefficient of 'x' on 'y' ?

(a) 0.03 (b) 0.3
(c) 0.2 (d) 0. 05

[Dec. 2010]

Solution : (b) $b_{xy} = r \times \frac{\sigma_x}{\sigma_y}$

$b_{xy} = 0.6 \times \frac{4.8}{9.6} = 0.3$

Q.4. If the two line of regression are x + 2y - 5 = 0 and 2x + 3y - 8 =0. The regression line of y on x is

(a) x + 2y - 5 = 0
(b) 2x + 3y - 8 = 0

(c) Any of the two line

(d) None of the two line

[Dec. 2010]

Solution : (a) Let $x + 2y - 5 = 0$ be Regression equation of Y on X .

$$b_{yx} = \frac{-\text{coeff. of } x}{\text{coff. of } y} = \frac{-1}{2} = -0.5$$

Let $2x + 3y - 8 = 0$ be Regression equation of X on Y.

$$b_{xy} = -\frac{3}{2} = -1.5$$

$b_{xy}.b_{xy}$

$=(-0.5).(-1.5)$

$= 0.75$

$\therefore b_{yx}.b_{xy} < 1$

$\therefore$ 1st line is Y on X.

Q.5. For a bivariate data two lines of regression are 40x - 18y = 214 and 8x - 10y + 66 = 0, then find the values of x and y

(a) 17 and 13 (b) 13 and 17

(c) 13 and –17 (d) –13 and 17

[June 2011]

Solution : (b) **TRICKS :** Go by choices, X = 13 and Y = 17; satisfy both Regression Lines.

$\therefore \overline{X} = 13$ and $\overline{Y} = 17$

Q.6. Out of the following which one affects the regression co-efficient.

(a) Change of origin only

(b) Change of scale only

(c) Change of scale & origin both

(d) Neither change of origin nor change of scale *[Dec. 2011]*

Solution : (b) The regression coefficients does not change due to a shift of origin but changes due to a shift of scale.

Q.7. For a bivariate data, the line of regression of Y on X, and of X on Y are respectively 2.5Y - X = 35 and 10 X - Y = 70, then correlation coefficient r is equal to:

(a) 0.2 (b) - 0.2

(c) 0.5 (d) - 0.5

[Dec. 2011]

Solution : (a) The equation of regression line Y on X

is 2.5 Y - X = 35

$$b_{yx} = -\left(\frac{-1}{2.5}\right) = \frac{1}{2.5} = 0.4$$

The equation of Regression line X on Y is 10x – y = 70

$$b_{xy} = -\left(\frac{-1}{10}\right) = \frac{1}{10} = 0.1$$

Both Regression Coefficients are positive.

$$r = +\sqrt{b_{xy} \times b_{yx}} = \sqrt{(0.4).(0.1)} = 0.2$$

Q.8. If one of regression coefficient is _____ unity, the other must be____unity.

(a) more than, more than

(b) Less than, Less than

(c) more than, less than

(d) Positive, Negative

[Dec. 2011]

Solution : (c) If one regression coefficient is more than unity, the other must be less than unity.

Q.9. If Y is dependent variable and X is Independent variable and the S.D of X and Y are 5 and 8 respectively and Co-efficient of co-relation between X and Y is 0.8. Find the Regression co-efficient of Y on X.

(a) 0.78 (b) 1.28

(c) 6.8 (d) 0.32

[Dec. 2011]

Solution : (b) Given , $\sigma_x = 5$; $\sigma_y = 8$; r = 0.8

Regression Co- eff. of Y on X

$$b_{yx} = r.\frac{\sigma_y}{\sigma_x} = \frac{0.8 \times 8}{5} = \frac{6.4}{5} = 1.28$$

Q.10. If the regression lines are 8x – 10y + 66 = 0 and 40x – 18y = 214, the correlation coefficient between 'x' and 'y' is :

(a) 1 (b) 0.6

(c) –0.6 (d) –1

[June 2012]

Solution : (b) 8x - 10y + 66 = 0 be the Regression eqn. of Y on X

$$b_{yx} = -\frac{8}{-10} = 0.8$$ and

40x – 18y = 214; be Regression eqn. of X on Y.

$$b_{xy} = -\frac{-18}{40} = 0.45$$

$r = \pm\sqrt{b_{yx} \times b_{xy}}$ [Both Regr. Coef. are + ve.]

$= +\sqrt{0.8 \times 0.45} = +0.6$

[r is also +ve.]

Q.11. The coefficients of correlation between two variables X and Y is the simple _____ of the two regression.

(a) Arithmetic Mean

(b) Geometric Mean

(c) Harmonic Mean

(d) None of the above

[June 2012]

Solution : (b) The coefficient of correlation between two variables X and Y is the simple geometric mean of the two regression coefficient.

Q.12. If 2 variables are uncorrelated, their regression lines are:

(a) Parallel

(b) Perpendicular

(c) Coincident

(d) Inclined at 45 degrees

[June 2012]

Solution : (b) If two variables are uncorrelated, (it means r = 0). Hence regression lines are perpendicular

Q.13. If x, y denote the arithmetic means, $\sigma_x ; \sigma_y$ denote the standard the deviations, b_{xy} ; b_{yx} denote the regression coefficients of the variables 'x' and 'y' respectively, then the point of intersection of regression lines X on Y & Y on X is _____.

(a) $(\overline{X}; \overline{Y})$ (b) (σ_x, σ_y)

(c) (σ_x, σ_y) (d) (σ_x^2, σ_y^2)

[June 2012]

Solution : (a) $\because$ Two lines of regression pass through the point of intersection of Regression lines $(\overline{X}, \overline{Y})$.

Q.14. For certain x and y series which are correlated, the two line of regression are

$5x - 6y + 9 = 0$

$15x - 8y - 130 = 0$

The correlation coefficient is

(a) 4/5 (b) 3/4

(c) 2/3 (d) 1/2

[Dec. 2012]

Solution : (c) Let $5x - 6y + 9 = 0$; be a Regression eqn. of Y on X .

$$b_{yx} = -\frac{5}{-6} = \frac{5}{6}$$

And $15x - 8y - 130 = 0$, be a Regression eqn. of X on Y

$$b_{xy} = \frac{8}{15}$$

$$r = \pm\sqrt{b_{yx} \times b_{xy}} = +\sqrt{\frac{5}{6} \times \frac{8}{15}} = +\frac{2}{3}$$

(r is positive because regression coefficients are positive).

Q.15. The coefficient of correlation between X and Y series is – 0.38. The linear relation between X & V are 3X + 5U = 3 and -8Y – 7V = 44, what is the coefficient of correlation between U & V ?

(a) 0.38 (b) –0.38

(c) 0.40 (d) None of these

[Dec. 2012]

Solution : (b) Given $r_{xy} = -0.38$

TRICKS : 3X + 5U = 3 and –8Y – 7V = 44

8Y + 7V = 44

r = – 0.38

Note :- See QUICKER BMLRS Examples .

Q.16. If Y = 18X + 5 is the regression line of X on Y ; The value of b_{xy} is

(a) 5/18 (b) 18

(c) 5 (d) 1/18

[Dec. 2012]

Solution : (d) If Y = 18 X + 5

18 X – Y – 5 = 0

$$b_{xy} = -\left(\frac{-1}{18}\right) = \frac{1}{18}$$

Q.17. 8x - 3y + 7 = 0, 14x - 7y + 6 = 0 are two regression equation then the correlation coefficient , r =

(a) 0.86 (b) –0.86

(c) 0.45 (d) –0.45

[June 2013]

Solution : (a) is correct

Let $8x - 3y + 7 = 0$; be Regression Eqn. of y on x

$$\therefore b_{yx} = -\frac{8}{-3} = \frac{8}{3}$$

and $14x - 7y + 6 = 0$; the Regression Eqn. of x on y

$$\therefore b_{xy} = -\frac{-7}{14} = \frac{7}{14} = \frac{1}{2}$$

$$b_{xy}.b_{xy} = \frac{8}{3} \times \frac{1}{2} = \frac{4}{3} > 1$$

:-Our Assumption is wrong

So; $b_{xy} = \frac{2}{1} = 2$ & $b_{yx} = \frac{3}{8}$

$$\therefore r^2 = b_{xy}.b_{yx} = 2.\frac{3}{8} = \frac{3}{4} = 0.75$$

:- r = + 0.86

Q.18. If r = + 1 or – 1 then the two regression lines_____

(a) Have 30% angle between them

(b) Have 45% angle between them

(c) Coincide

(d) Perpendicular to each other

[Dec. 2013]

Solution : (c) For r = + 1 or – 1

Regression Lines Coincide.

Q.19. If mean of X and Y variables is 20 and 40 respectively and the regression coefficient Y on X is 1.608 then the regression line of Y on X is:

(a) Y = 1.608 X + 7.84

(b) Y = 1.56 X + 4.84

(c) Y = 1.608 X + 4.84

(d) Y = 1.56 X + 7.84 *[Dec. 2013]*

Solution : (a) is correct

check which option is correct

for x = 20 ; y = 40

For (a); $\overline{y} = 1.608 \times 20 + 7.84 = 40$ which is correct

Q.20. The equations two lines of regression for x & y are 5x = 22 + y and 64x = 24 + 45y, then the value of regression coefficient of y on x will be_____

(a) 5 (b) $\frac{1}{5}$

(c) $\frac{64}{45}$ (d) $\frac{45}{64}$

[June 2014]

Solution : (c) is correct

Let $5x = 22 + y$ be a regression Eqn. of X on Y

$$\therefore b_{xy} = \frac{1}{5}$$

and $64x = 24 + 45y$ be a Regression Eqn. of y on x

$\therefore 45y = -24 + 64x$

$$b_{yx} = \frac{64}{45}$$

$$\therefore r^2 = b_{xy}.b_{yx} = \frac{1}{5}.\frac{64}{45} = \frac{64}{225} < 1$$

$\therefore$ Our assumption is correct

$$\therefore b_{yx} = \frac{64}{45}$$

Q.21. Two regression lines for a bivariate data are 2x – 5y + 6 = 0 and 5x – 4y + 3 = 0. Then the coefficient correlation shall be___.

(a) $\frac{-2\sqrt{2}}{5}$ (b) $\frac{2}{5}$

(c) $\frac{+2\sqrt{2}}{5}$ (d) $\frac{\sqrt{2}}{5}$

[June 2014]

Solution : (c) is correct

Let $2x - 5y + 6 = 0$ be a Regression Eqn. of x on y

$$b_{xy} = -\frac{(-5)}{2} = \frac{5}{2}$$

and $5x - 4y + 3 = 0$ be a Regression Eqn. of y on x

$$b_{yx} = -\frac{-5}{-4} = \frac{5}{4}$$

$$r^2 = b_{xy}.b_{yx} = \frac{5}{2}.\frac{5}{4} = \frac{25}{8} > 1$$

$\therefore$ Our assumption is incorrect

$\therefore$ Correct $b_{xy} = \frac{4}{5}$ and $b_{yx} = \frac{2}{5}$

$\therefore r^2 = b_{xy} b_{yx} = \frac{4}{5} \cdot \frac{2}{5}$

$\therefore r = +\frac{2\sqrt{2}}{5}$

Q.22. If the mean of two variables x & y are 3 and 1 respectively. Then the equation of two regression lines are_____

(a) 5x+7y-22=0 & 6x+2y-20=0

(b) 5x+7y-22=0 & 6x+2y+20=0

(c) 5x+7y+22=0 & 6x+2y-20=0

(d) 5x+7y+22=0 & 6x+2y+20=0

[June 2014]

Solution : (a) is correct

Tricks : Go by choices

For (a) x = 3; y = 1 Satisfy eqns. of (a)

As LHS = 5 × 3+7-22 = 0 (RHS)

and LHS = 6 × 3+2 × 1-20=0 (RHS)

∴ (a) is correct.

Q.23. Two regression equations are x + y = 6 and x + 2y = 10 then correlation coefficient between X any Y is

(a) –1/2 (b) 1/2

(c) $-\frac{1}{\sqrt{2}}$ (d) $\frac{1}{\sqrt{2}}$

[Dec. 2014]

Solution : (c) is correct

Tricks : See Quicker QA book

$1x + 1y = 6 \Rightarrow y = -x + 6$

$1x + 2y = 10 \Rightarrow 2y = -x + 10$

$r = -\sqrt{\frac{1\times1}{1\times2}} = -\frac{1}{\sqrt{2}}$ (x & y have opposite signs.)

Q.24. Correlation coefficient between x and y is zero the two regression lines are

(a) Perpendicular to each other

(b) Coincide to each other

(c) Parallel to each other

(d) None of these *[Dec. 2014]*

Solution : (a) is correct.

Q.25. The two regression lines are 16x – 20y + 132 = 0 and 80x – 30y – 428 = 0, the value of correlation coefficient is

(a) 0.6 (b) –0.6

(c) 0.54 (d) 0.45

[June 2015]

Solution : (c) is correct

Tricks $r = +\sqrt{\frac{16\times30}{20\times80}} = 0.547$

Q.26. Which of the following is true:

(a) $b_{xy} = r.\frac{\sigma_y}{\sigma_x}$

(b) $b_{xy} = r.\frac{\sigma_x}{\sigma_y}$

(c) $b_{xy} = \pi.\frac{\sum xy}{\sigma_x}$

(d) $b_{xy} = \pi.\frac{\sum xy}{\sigma_y}$

[Dec. 2015]

Solution : (b) is correct.

Q.27. The regression are as follows

Regression equation of X on Y : 6X - Y = 28

Regression equation of Y on X : 64X - 45Y = 24

What will be the mean X and Y ?

(a) $\overline{X} = 8, \overline{Y} = 6$ (b) $\overline{X} = 6, \overline{Y} = 6$

(c) $\overline{X} = 6, \overline{Y} = 8$ (d) $\overline{X} = 8, \overline{Y} = 8$

[June 2016]

Solution : (c) is correct.

Tricks: Go by Choices

X = 6 and Y = 8 satisfy both Regression Eqns.

$\therefore \overline{X} = 6; \overline{Y} = 8$ is correct

Q.28. The two lines of regression become identical when

(a) r = 1 (b) r = –1

(c) r = 0 (d) (a) or (b)

[June 2016]

Solution : (d) is correct.

Q.29. Regression coefficients are affected by _____

(a) Change of origin

(b) Change of Scale

(c) Both origin & scale

(d) Neither origin nor scale

[Dec. 2016]

Solution : (b) is correct.

Q.30. Regression lines are passes through the_____ points

(a) Mean

(b) Standard deviation

(c) Both (a) & (b)

(d) None

[Dec. 2016]

Solution : (a) is correct.

Q.31. If the regression line of x on y is 3x + 2y = 100, then find the value of b_{xy} ?

(a) $\frac{-2}{3}$ (b) $\frac{10}{3}$

(c) $\frac{3}{2}$ (d) $\frac{2}{3}$

[Dec. 2016]

Solution : (a) is correct.

$b_{xy} = -\frac{2}{3}$

Q.32. If the two regression lines are x + y = 1 and x - y = 1 then $\overline{x}$ and $\overline{y}$ are

(a) 1, 0 (b) 0, 1

(c) 1, 1 (d) None

[June 2017]

Solution : (d) is correct.

Sign of both Regression lines x + y = 1 and x – y = 1 are different. It means ; x & y are not correlated ∴ $(\overline{x}\ ;\ \overline{y})$ cannot be determined.

Q.33. The correlation coefficient is the _____ of the two regression coefficients b_{yx} and b_{xy} :

(a) AM (b) GM

(c) HM (d) None of these

[Dec. 2017]

Solution : (b)

Q.34. Regression coefficient are independent of _____ :

(a) Change of origin

(b) Change of scale

(c) Both (a) & (b)

(d) None of these

[Dec. 2017]

Solution : (a)

Q.35. 5y = 9x – 22 & 20x = 9y + 350 are two regression lines. Find the correlation coefficient between x & y :

(a) 0.9 (b) 0.1

(c) –0.9 (d) –0.1

[Dec. 2017]

Solution : (a)

$9x - 5y = 22$

$20x - 9y = 350$

$\therefore r = +\sqrt{\frac{81}{100}} = \frac{9}{10} = 0.9$

Q.36. Regression lines are parallel then r = :

(a) ±1 (b) –1/2

(c) 0 (d) None

[June 2018]

Solution : (a)

Q.37. The two lines of regression intersect at the point:

(a) Mean

(b) Median

(c) Mode

(d) None of the these

[Nov. 2018]

Solution : (a)

Q.38. If the two lines of regression are x + 2y – 5 = 0 and 2x + 3y – 8 = 0, then the regression line of y on x is

(a) x + 2y – 5 = 0

(b) x + 2y = 0

(c) 2x + 3y – 8 = 0

(d) 2x + 3y = 0

[Nov. 2018]

Solution : (a) Let $x + 2y - 5 = 0$ is the Regression Eqn. of y on x then $2x + 3y - 8 = 0$ should be the Regression Eqn. of x on y.

$\therefore b_{yx} = -\frac{1}{2}$

and $b_{xy} = -\frac{3}{2}$

Here

$b_{xy} \cdot b_{yx} = \left(-\frac{1}{2}\right)\cdot\left(-\frac{3}{2}\right) = \frac{3}{4} < 1$

∴ Our assumption is correct.

So ; $x + 2y - 5 = 0$ is the Regression Eqn. of y on x.

Q.39. If the two regression lines are 3X = Y and 8Y = 6X, then the value of correlation coefficient is

(a) – 0.5 (b) 0.5

(c) 0.75 (d) –0.80

[Nov. 2018]

Solution : (b)

Regr. Eqns. are

$3x - y = 0$

& $6x - 8y = 0$

$r = +\sqrt{\frac{1\times6}{3\times8}} = +\sqrt{\frac{1}{4}} = +\frac{1}{2} = 0.5$

"+" Sign because X & Y have same sign.

Q.40. The regression coefficient is independent of the change of

(a) Origin

(b) Scale

(c) Scale and origin both

(d) None of these

[Nov. 2018]

Solution : (a)

Q.41. A.M of regression coefficient is

(a) Equal to r

(b) Greater than or equal to r

(c) Half of r

(d) None

[June 2019]

Solution : (b)

Q.42. If the regression line of Y on X is given by Y = X + 2 and Karl Pearson's coefficient of correlation is 0.5 then $\frac{\sigma_y^2}{\sigma_x^2} =$ ____.

(a) 3 (b) 2

(c) 4 (d) None

[June 2019]

Solution : (c) The regression line of y on x is given by y = x + 2 [It is in the form Y = a + bX]

b_{yx} = Coefficient of X = 1

Coeff. of correlation (r) = 0.5

then Regression coefficient Y on X

$= b_{yx} = r\frac{\sigma_y}{\sigma_x}$

$1 = 0.5\frac{\sigma_y}{\sigma_x}$

$\frac{\sigma_y}{\sigma_x} = \frac{1}{0.5} = \frac{10}{5} = 2$

$\left(\frac{\sigma_y}{\sigma_x}\right)^2 = (2)^2$

$\frac{\sigma_y^2}{\sigma_x^2} = 4.$

Q.43. Consider to regression line 3x + 2y = 26, 6x + y = 31. Find the correlation coefficient between x and y

(a) 0.5 (b) –0.5

(c) 0.25 (d) –0.25

[Dec. 2019]

Solution : (b)

$3X + 2Y = 26 \Rightarrow 3X = -2Y + 26$

$6X + 1.Y = 31 \Rightarrow 6X = -Y + 31.$

Doing Cross-Multiplication

$3\times1 = 3$ is smaller than $6\times2 = 12$

So; $r = -\sqrt{\frac{3\times1}{6\times2}} = -\sqrt{\frac{1}{4}} = -\frac{1}{2}$

$= -0.5$

[Put sing "–" because X and Y have opposite sign in both Regression Eqn.]

Q.44. The interesting point of the two regression lines: y on x and x on y is

(a) (0, 0) (b) $(\overline{x}, \overline{y})$

(c) (b_{yx}, b_{xy}) (d) (1, 1)

[Jan. 2021]

Solution : (b) is correct

Q.45. Given that the variance of x is equal to the square of standard deviation x and the regression line of y on x is $y = 40 + 0.5(x - 30)$.

Then regression line of x on y is

(*a*) $y = 40 + 4(x - 30)$

(*b*) $y = 40 + (x - 30)$

(*c*) $y = 40 + 2(x - 30)$

(*d*) $x = 30 + 2(y - 40)$

[Jan. 2021]

Solution : (*d*) is correct

Given

Regression Eqn. of

y on x is

$$Y = 40 + 0{\cdot}5(x - 30)$$

or $$y - 40 = 0{\cdot}5(x - 30)$$

Comparing it with standard Form.

$$y - \bar{y} = b_{yx}(x - \bar{x})$$

We get $\bar{X} = 30$; $\bar{y} = 40$ and $b_{yx} = 0.5$

We know that

$$r^2 = b_{xy}.b_{yx} = 1 \quad [\because \text{For one regression linc, } r = \pm 1]$$

or $$b_{xy}(0.5) = 1$$

or $$b_{xy} = \frac{1}{0.5} = 2$$

Regression Eqn. of X on Y is

$$X - \bar{X} = b_{xy}(Y -)$$

$$x - 30 = 2(y - 40)$$

or $$x = 30 + 2(y - 40)$$

$\therefore$ (*d*) correct

Q.46. The regression coefficients remain unchanged due to

(*a*) A shift of scale

(*b*) A shift of origin

(*c*) Replacing x - values by $\frac{1}{x}$

(*d*) Replacing y values by $\frac{1}{y}$

[Jan. 2021]

Solution : (*b*) is correct

Since, Regression co-efficient does not change with respect to the change of origin but changes with respect to scale.

Q.47. If the slope of the regression line is calculated to be 5.5 and the intercept 15 then the value of Y when X is 6 is

(*a*) 88 (*b*) 48

(*c*) 18 (*d*) 78

[July 2021]

Solution : (*b*) is correct.

Regression Eqn. of Y on X is

$$Y = a + bX$$

where a = Y intercept = 15 (given)

b = slope = 5.5 (given)

Regression Eqn. of Y on X is

$$Y = 15 + 5.5X$$

when X = 6 Then

$$Y = 15 + 5.5(6) = 48.$$

Q.48. If Y = 9X and X = 0.01Y, then r is equal to:

(*a*) –0.1 (*b*) 0.1

(*c*) 0.3 (*d*) –0.3

[July 2021]

Solution : (*c*) is correct.

$\therefore Y = 9X \Rightarrow b_{yx} = 9$

and $X = 0.01Y \Rightarrow b_{xy} = 0.01$

$$r = \sqrt{b_{xy}b_{yx}} = +\sqrt{0.01 \times 9}$$

$$= +0.3$$

Because b_{xy} & b_{yx} are positive.

Q.49. The straight-line graph of the linear equation Y = a + b X, slope is horizontal if:

(*a*) b = 1 (*b*) b ≠ 0

(*c*) b = 0 (*d*) a = b ≠ 0

[July 2021]

Solution : (*c*) is correct.

$\because$ $Y = a + bX$

Slope = b.

If b = 0 then Y = a.

So, its graph is parallel to X – axis.

Q.50. If $b_{yx} = -1.6$ and $b_{xy} = -0.4$, then r_{xy} will be

(*a*) 0.4 (*b*) -0.8

(*c*) 0.64 (*d*) 0.8

[July 2021]

Solution : (*b*) is correct

$$r_{xy} = \sqrt{b_{xy} \cdot b_{yx}} = -\sqrt{(-1.6)(-0.4)}$$

$$= -\sqrt{0.64} = -0.8$$

Q.51. For any two variables x and y the regression equations are given as $2x + 5y - 9 = 0$ and $3x - y - 5 = 0$. What are the A.M. of x and y?

(*a*) 2, 1 (*b*) 1, 2

(*c*) 4, 2 (*d*) 2, 4

[Dec. 2021]

Solution : (*a*)

Trick Go by choices (GBC)

(A) If $\bar{X} = 2$, $\bar{Y} = 1$

$2 \times 2 + 5 \times 1 - 9 = 0$ (True)

2nd eqn. $3 \times 2 - 1 - 5 = 0$ (Also True)

(*a*) is correct.

Q.52. The intersecting point of two regression lines falls at X-axis. If the mean of X-values is 16, the standard devaluation of X and Y are respectively, 3 and 4, then the mean of Y-values is

(*a*) 16/3 (*b*) 4 (*c*) 0 (*d*) 1

[Dec. 2021]

Solution : (*c*)

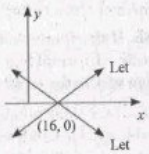
Intersecting point lies on x-axis.

So y Co-ordinate = 0

Hence, Mean Point is (16 ; 0)

$\Rightarrow \bar{X} = 16$; $\bar{Y} = 0$

(Clearly)



Q.53. The regression coefficients remain unchanged due to

(*a*) Shift of origin

(*b*) Shift of scale

(*c*) Always

(*d*) Never

[Dec. 2021]

Solution : (*a*)

Regression Coefficient does not change with respect to the change of origin but changes with respect to scale

Q.54. For positive and perfectly correlated random variables, one of the regression coefficient is 1.3 and the standard deviation of X is 2, the variance of Y is

(*a*) 2.66 (*b*) 6.76

(*c*) 6.56 (*d*) 3.16

[June 2021]

Solution : Given : $b_{yx} = r.\frac{\sigma_y}{\sigma_x} = 1.3$

$\because$ It is perfectly positively correlated

$\therefore r = 1$

$\therefore$ by $x = 1.\frac{\sigma_y}{2} = 1.3$

$\therefore \sigma_y = 2.6$

$\therefore$ (*a*) is correct

Q.55. The equations of the two lines of regression are $4x + 3y + 7 = 0$ and $3x + 4y + 8 = 0$. Find the correlation coefficient between x and y.

(*a*) – 0.75 (*b*) 0.25

(*c*) – 0.92 (*d*) 1.25

[Dec. 2022]

Solution: Two regression eqns. are

$4x + 3y + 7 = 0 \Rightarrow 4x = -3y - 7$

(–vely correlated)

$3x + 4y + 8 = 0$

Tricks :

$$r = -\sqrt{\frac{3 \times 3}{4 \times 4}} = -\frac{3}{4} = -0.75$$

(*a*) is correct.

[Note : See cross product, smaller in numerator and larger in denominator]

Q.56. If the regression equations are $2x + 3y + 1 = 0$ and $5x + 6y + 1 = 0$, then Mean of x and y respectively are

(*a*) –1, –1 (*b*) –1, 1

(*c*) 1, –1 (*d*) 2, 3

[Dec. 2022]

Solution: Go by choices

(*c*) For $2x + 3y + 1 = 0$

$2 \times 1 + 3(-1) + 1 = 3 - 3 = 0$ (True)

and $5x + 6y + 1 = 0$

$\Rightarrow 5 \times 1 + 6(-1) + 1 = 6 - 6 = 0$ (True)

(1, – 1) satisfies both eqns.

$\therefore$ (*c*) is correct

Q.57. If $b_{yx} = 0.5$, $b_{xy} = 0.46$ then the value of correlation coefficient r is:

(*a*) 0.23 (*b*) 0.25

(*c*) 0.39 (*d*) 0.48

[Dec. 2022]

Solution: $r = \pm\sqrt{b_{xy}.b_{yx}}$

$r = +\sqrt{(0.5).(0.46)}$

$= 0.479 = 0.48$

(*d*) is correct.

Q.58. For variables X and Y, we collect the four observations with $\Sigma X = 10$; $\Sigma Y = 14$; $\Sigma X^2 = 65$; $\Sigma Y^2 = 5$ and $\Sigma XY = 3$. What is the regression line of Y on X?

(*a*) $Y = -0.8X - 5.5$

(*b*) $Y = 0.8X - 5.5$

(*c*) $Y = -0.8X + 5.5$

(*d*) $Y = 0.8X + 5.5$

Solution:

$$b_{YX} = \frac{N\Sigma XY - \Sigma X \Sigma Y}{N\Sigma X^2 - (\Sigma X)^2}$$

$$= \frac{4 \times 3 - 10 \times 14}{4 \times 65 - (10)^2}$$

$$= -0.8$$

$$\bar{X} = \frac{\Sigma X}{N} = \frac{10}{4} = 2.5$$

$$\bar{Y} = \frac{\Sigma Y}{N} = \frac{14}{4} = 3.5$$

Regression line of Y on X is

$$Y - \bar{Y} = b_{YX}(X - \bar{X})$$

$\therefore Y - 3.5 = -0.8(X - 2.5)$

$Y = -0.8x + 5.5$

$\therefore$ (*c*) is correct.

Q.59. The regression lines will be perpendicular to each other when the value of r is:

(*a*) 1 (*b*) –1

(*c*) 1/2 (*d*) 0

Solution: (*d*) is correct.

Q.60. If the regression equations are $x + 2y - 5 = 0$ and $2x + 3y - 8 = 0$, then the mean of x and the mean of y are _____, respectively:

(a) –3 and 4
(b) 2 and 4
(c) 1 and 2
(d) 2 and 1

Solution:

Tricks

GBC (Go by Choices)

(c) For $\overline{X} = 1; \overline{Y} = 2$

$x + 2y - 5 = 0$

$1 + 2 \times 2 - 5 = 0$ (True)

and $2 \times 1 + 3 \times 2 - 8 = 0$ (Also True)

$\therefore$ (c) is correct.

28 CHAPTER INDEX NUMBERS

PREVIOUS YEAR EXAM QUESTIONS (MEMORY BASED)

Q.1. In the data group Bowley's and Laspeyre's index number is as follows. Bowley's index number = 150, Laspeyre's index number = 180 then Paasche's index number is

(a) 120 (b) 30
(c) 165 (d) None of these

[June 2010]

Solution : (a) $\because$ Dorbish and Bowley's Index No. =

$$\frac{\text{Laspeyere's} + \text{Paasche's I.No.}}{2}$$

$$\therefore 150 = \frac{180 + \text{Paasche's}}{2}$$

$\Rightarrow 180 + \text{Paasche's} = 300$

$\therefore$ Paasche's Index No. = 120

Q.2. Consumer price index is commonly known as

(a) Chain Based index
(b) Ideal index
(c) Wholesale price index
(d) Cost of living index.

[June 2010]

Solution : (d)

Q.3. Find the Paasche's index number for prices from the following data taking 1970 as the base year.

Commodity	1970		1975	
	Price	quantity	Price	quantity
A	1	6	3	5
B	3	5	8	5
C	4	8	10	6

(a) 261.36 (b) 265.48 (c) 274.32 (d) 282

[June 2010]

Solution : (a)

P_0	Q_0	P_1	Q_1	P_1Q_1	P_0Q_1
1	6	3	5	15	5
3	5	8	5	40	15
4	8	10	6	60	24
				$\sum P_1Q_1 = 115$	$\sum P_0Q_1 = 44$

$$\text{Paasche's Index No.} = \frac{\sum P_1Q_1}{\sum P_0Q_1} \times 100 = \frac{115}{44} \times 100 = 261.36$$

Q.4. The life expectancy, E of male is a linear function of time (year). It is given that in 1980 the life expectancy was 70 years and in 2000 it was 75 years. Make a prediction of life expectancy in 2012.

(a) 78 (b) 80
(c) 82 (d) 84

[June 2010]

Solution : (a) Given $E = at + c$

Where t = Deviation of time from base year 1980

(E being a liner function of time t)

In 1980, t = 1980 - 1980 = 0

The eqn. is

$E = a.0 + c = 70$, So, $c = 70$

In year 2000, t =2000 - 1980 = 20

$E = a.20 + c = 75$

So, $20a + 70 = 75$

$a = 5/20 = 0.25$

The Eqn. is $E = 0.25t + 70$

For year 2012, t = 2012 - 1980 = 32

$E = (0.25).(32) + 70 = 78$

Q.5. If Laspeyre's index number is 90 and Paasche's index number is 160 then Fisher's index number will_____.

(a) 144 (b) 120
(c) 125 (d) None of these

[Dec. 2010]

Solution : (b) Fisher's index No.=

$$\sqrt{\text{Laspeyre's I.No.} \times \text{Paasche's I.No.}}$$

Fisher's index no. = $\sqrt{90 \times 160} = 120$

Q.6. Wholesale Price Index (WPI) is given by:

(a) Marshall-Edgeworth Index
(b) Laspeyre's Index
(c) Paasche's Index
(d) None

[June 2011]

Solution : (b)

Q.7. Fisher's Ideal index is obtained by:

(a) Arithmetic Mean of Laspeyre's & Paasche's index
(b) Geometric Mean of Laspeyre's & Paasche's index
(c) Sum of Laspeyre's & Paasche's index
(d) None of them

[June 2011]

Solution : (b)

Fisher ideal index = $\sqrt{\text{Laspeyre's Price Index} \times \text{Paasche's Price Index}}$

Q.8. The index number of prices at a place in the year 2008 is 225 with 2004 as the base year then there is:

(a) average 125% increase in prices
(b) average 225% increase in prices.
(c) average 100% increase in prices
(d) None of the above. ***[June 2011]***

Solution : (a) Let the price of base year 2004 = 100

$\therefore$ the Price of current year 2008 = 225

% Increase in Price = 225 - 100 = 125 %

Q.9. Fishers Ideal Index Number not satisfies_____

(a) Unit Test
(b) Time Reversal Test
(c) Circular Test
(d) Factor Reversal Test

[Dec. 2011]

Solution : (c) Fishers Ideal index Number does not satisfies Circular Test.

Q.10. If the price of all commodities in a place has increased 20% in Comparison to the base period prices, then the index number of prices for the place is now_____

(a) 100 (b) 120
(c) 20 (d) 150

[Dec. 2011]

Solution : (b)

Index No. of current year = 100 + 20 = 120

Q.11. If $\sum P_0Q_0 = 116, \sum P_0Q_1 = 140 \sum P_1Q_0 = 97, \sum P_1Q_1 = 117$ then Fisher's ideal index number is.....

(a) 184 (b) 83.59 (c) 119.66 (d) 120

[June 2012]

Solution : (b)

$$\therefore \text{Fisher's index formula} = \sqrt{\frac{\sum P_1Q_0}{\sum P_0Q_0} \cdot \frac{\sum P_1Q_1}{\sum P_0Q_1}} \times 100 = \sqrt{\frac{97 \times 117}{116 \times 140}} \times 100 = 83.59$$

Q.12. Find the Paasche's Index number for price from the following data taking 1970 as the base year.

[June 2012]

Solution : (*a*) Given :

Commodity	1970 Price (P_0)	1970 Qty (Q_0)	1975 Price (P_1)	1975 Qty (Q_1)	P_1Q_1	P_0Q_1
A	1	6	3	5	15	5
B	3	5	8	5	40	15
C	4	8	10	6	60	24
					$\sum P_1Q_1 = 115$	$\sum P_0Q_1 = 44$

$$\therefore \text{Paasche's index} = \frac{\sum P_1Q_1}{\sum P_0Q_1} \times 100 = \frac{115}{44} \times 100 = 261.36$$

Q.13. If Fisher's index = 150 and Paasche's Index = 144, then Laspeyre's index is_____

(*a*) 147 (*b*) 156.25
(*c*) 104.17 (*d*) 138

[Dec. 2012]

Solution : (*b*) Given Fisher's index = 150 and Paasche's index = 144

$\therefore$ Fisher's index = $\sqrt{\text{Laspeyre's} \times \text{Paasche's}}$

$150 = \sqrt{\text{Laspeyre's} \times 144}$

Squaring on both sides; we get

$150 \times 150 = \text{Laspeyre's} \times 144$

$$\text{Laspeyre's index} = \frac{150 \times 150}{144} = 156.25$$

Tricks : GBC

Q.14. Net monthly of an employees was ₹ 3,000. The consumer price index number in 1985 is 250 with rightly compensated then the additional dearness allowance to be paid to the employee is:

(*a*) ₹ 4,000 (*b*) ₹ 4,800
(*c*) ₹ 5,500 (*d*) ₹ 4,500

[Dec. 2012]

Solution : (*d*) Given,

Net monthly salary = ₹3,000 in 1980

Consumer price index in 1985 with 1980 as the base year = 250

$\therefore$ In 1985 then his monthly salary will be $= \frac{250 \times 3,000}{100} =$ ₹ 7,500

$\therefore$ The Dearness allowance to be paid to the employee

= ₹ (7,500 - 3,000) = ₹ 4,500

Q.15. Time Reversal Test is satisfied by_____

(*a*) Fisher's ideal index
(*b*) Dorbish Bowley's index
(*c*) Laspeyre's index
(*d*) None of these

[June 2013]

Solution : (*a*) is correct

Q.16. Bowley's Index Number = 150, Laspeyre's index = 180 then Paasche's index number is_

(*a*) 120 (*b*) 130
(*c*) 105 (*d*) None

[June 2013]

Solution : (*a*) is correct

Tricks : Go by choices

$$\text{Bowley's Index No.} = \frac{L+P}{2}$$

$$= \frac{120+180}{2} = 150$$

$\therefore$ (*a*) is correct.

Q.17. In 2005 price index is 286 with base 1995 then how much price increased in 2005 with base 1995?

(*a*) 286% (*b*) 386%
(*c*) 86% (*d*) 186%

[June 2013]

Solution : (*d*) is correct

% Increase in price = 286 - 100 = 186%

Q.18. What is the formula for calculating the deflated index:

(*a*) $\frac{\text{Current Value}}{\text{Price Index of current year}} \times 100$

(*b*) $\frac{\text{Current Value}}{\text{Price Index of Last year}} \times 100$

(*c*) $\frac{\text{Current Value}}{\text{Price Index of current year}} \times 100$

(*d*) $\frac{\text{Current Value}}{\text{Price Index of Last year}} \times 100$

[Dec. 2013]

Solution : (*c*) is correct

Q.19. The index number for the year 2012 taking 2011 as base using simple average of price relatives method from data given below is:

Commodity	A	B	C	D	E	
Price in 2011 (P_0)	115	108	95	80	90	$\Sigma P_0 = 488$
Price in 2012 (P_1)	125	117	108	95	95	$\Sigma P_1 = 540$

(*a*) 112 (*b*) 117
(*c*) 120 (*d*) 111

[Dec. 2013]

Solution : (*d*) is correct

$$P_{01} = \frac{\sum p_1}{\sum p_0} \times 100 = \frac{540}{488} \times 100$$

= 110.65 = 111

Q.20. An index time series is a list of ___numbers for two or more periods of time

(*a*) Index (*b*) absolute
(*c*) Relative (*d*) None

[Dec. 2013]

Solution : (*a*) is correct.

Q.21. Circular test is satisfied by which index number?

(*a*) Laspeyre's
(*b*) Paasche's
(*c*) Fisher's
(*d*) None of the above

[June 2014]

Solution : (*d*) is correct

Note:- Circular test is satisfied by Simple Geometric mean of price Relatives and the aggregative with Fixed weights.

Q.22. Fisher's index number is_____ of Laspayre's and Paasche's index numbers

(*a*) A.M. (*b*) G.M.
(*c*) H.M. (*d*) None

[June 2014]

Solution : (*b*) is correct.

Q.23. Which of the following statement is true?

(*a*) Paasche's index number is based on base year quantity
(*b*) Fisher's index satisfies the circular test
(*c*) Arithmetic mean is the most appropriate average for constructing the index number
(*d*) Splicing means constructing one continuous series from two different indices on the basis of common base

[June 2014]

Solution : (*d*) is correct

Q.24. Monthly salary of an employee was ₹10,000 in the year 2000 and it was increased to ₹20,000 in the year 2013 while the consumer price index number is 240 in year 2013 with the base year 2000, what should be his salary in comparison of consumer price index in the year 2013?

(*a*) 2,000 (*b*) 16,000
(*c*) 24,000 (*d*) None

[June 2014]

Solution : (*c*) is correct

$p_0 = 10,000$

Let Salary in yr. 2013 = p_1

$$\because \text{C.L.I} = \frac{p_1}{p_0} \times 100;$$

$$\text{or } 240 = \frac{p_1}{10,000} \times 100;$$

$\therefore$ $p_1 =$ ₹ 24,000.

Q.25. $\sum p_1q_0 = 1180, \sum p_0q_0 = 1170, \sum p_1q_1 = 1064, \sum p_0q_1 = 1100$, then Fisher ideal index number is

(*a*) 96.73 (*b*) 98.795 (*c*) 98.77 (*d*) 100.86

[Dec. 2014]

Solution : (*c*) is correct

$$P_{01} = \sqrt{\frac{\sum p_1q_0}{\sum p_0q_0} \times \frac{\sum p_1q_1}{\sum p_0q_1}} \times 100$$

$$= \sqrt{\frac{1180}{1170} \times \frac{1064}{1100}} \times 100 = 98.769 = 98.77$$

Q.26. When the prices are decreased by 30% then the index number is now

(*a*) 50 (*b*) 60
(*c*) 70 (*d*) 30

[Dec. 2014]

Solution : (*c*) is correct

New I. No = . 100 – 30 = 70.

Q.27. _____play a very important role in the construction of index number.

(*a*) Weights (*b*) Classes
(*c*) Estimate (*d*) None

[June 2015]

Solution : (*a*) is correct

Q.28. Factor reversal test is

(*a*) $\frac{\sum p_1q_1}{\sum p_0q_0}$

(*b*) $\frac{\sum p_1q_1}{\sum p_0q_0} \times \frac{\sum p_1q_1}{\sum p_0q_1}$

(*c*) $\frac{\sum p_1q_1}{\sum p_0q_1}$

(*d*) $\frac{\sum q_1p_0}{\sum q_0p_0} \times \frac{\sum q_1p_1}{\sum q_0p_1}$

[June 2015]

Solution : (*a*) is correct

Q.29. If with a rise of 10% in prices the wages are increased by 20% the real wage increases by

(*a*) 10%
(*b*) More than 10%
(*c*) 20%
(*d*) Less than 10%

[June 2015]

Solution : (*d*) is correct

$$\text{Real wage} = \frac{100+20}{100+10} \times 100 = 109.09$$

$\therefore$ Real wage increases by 9.09% *i.e.* less than 10%

Q.30. Consumer Price index number for the year 1957 was 313 with 1940 as the base year. The Average Monthly wages in 1957 of the workers in to factory be ₹ 160/- their real wages is:

(*a*) ₹ 48.40 (*b*) ₹ 51.12
(*c*) ₹ 40.30 (*d*) None of these

[Dec. 2015]

Solution : (*b*) is correct.

$$\text{Real Wage} = \frac{160}{313} \times 100 = 51.12$$

Q.31. Purchasing power of money is

(*a*) Reciprocal of price index number
(*b*) Equal to price index number
(*c*) Unequal to price index number
(*d*) None of these

[June 2016]

Solution : (*a*)

Q.32. In the year 2010 the monthly salary was ₹24,000. The consumer price index number was 140 in the year 2010 which rises to 224 in the year 2016. If he has to be rightly compensated what additional monthly salary to be paid to him

(a) ₹14,400 (b) ₹38,400
(c) ₹7,200 (d) None of these

[June 2016]

Solution : (a)

Required salary in 2016 = $\frac{224}{140}\times 24000$ = ₹ 38,400.

∴ Additional monthly salary = 38400 - 24000 = ₹14,400/-

Q.33. The suitable index numbers for the comparison of every year is _____

(a) Fixed base index number
(b) Fisher's ideal index number
(c) Chain base index number
(d) Both (a) or (c)

[June 2016]

Solution : (c)

Q.34. Index numbers are used in

(a) Economics
(b) Statistics
(c) Both (a) & (b)
(d) None

[Dec. 2016]

Solution : (c) is correct

Q.35. From the following data

	Commodity	A	B	C	D
1992 Base	Price	3	5	4	1
year	Quantity	18	6	20	14
1993 Current	Price	4	5	6	3
year	Quantity	15	9	26	15

The Paasche's price index number is :

(a) 146.41 (b) 148.25 (c) 144.25 (d) None

[Dec. 2016]

Solution : (a) is correct.

Q.36. The time reversal test is satisfied by _____ Index number.

(a) Laspeyre's (b) Paasche's
(c) Fisher's (d) None

[Dec. 2016]

Solution : (c) is correct.

Q.37. Fisher's index number does not satisfy

(a) Unit test
(b) Circular test
(c) Time reversal test
(d) Factor reversal test

[June 2017]

Solution : (b)

Q.38. If Laspeyre's index is L and Paasche's index is P then Fisher's index F is

(a) $F = L \times P$
(b) $F^2 = L \times P$
(c) $F^2 = \sqrt{L+P}$
(d) $F = \frac{1}{L\times P}$

[June 2017]

Solution : (b)

$F = \sqrt{L.P} \Rightarrow F^2 = L.P$

Q.39. The monthly income of a person in the year 2014 was ₹8,000 and CPI was 160. The CPI is 200 in the year 2017. What will be the additional dearness allowance for the year 2017?

(a) 2400 (b) 2750
(c) 2500 (d) None

[June 2017]

Solution : (d)

Monthly Income in 2017 = $\frac{200}{100}\times 8000$ = ₹ 16,000

∴ DA = 16000 - 8000 = ₹ 8000

Q.40. For knowing consumers price index number we want to collect data from :

(a) Retail shop prices
(b) Wholesale shop prices
(c) Fair Prices
(d) Government depots

[Dec. 2017]

Solution : (a)

Q.41. The circular test is an extension of :

(a) The time reversal test
(b) The factor reversal test
(c) The unit test
(d) None of these

[Dec. 2017]

Solution : (a)

Q.42. Fisher's ideal index number is :

(a) The arithmetic mean of Laspeyre's and Paasche's index
(b) The median of Laspeyre's and Paasche's index
(c) The mode of Laspeyre's and Paasche's index
(d) None of these

[Dec. 2017]

Solution : (d)

Q.43. Price relative is equal to :

(a) $\frac{\text{Price in the given year}}{\text{Price in the base year}}\times 100$

(b) $\frac{\text{Price in the base year}}{\text{Price in the given year}}\times 100$

(c) Price in the given year × 100
(d) Price in the base year × 100

[Dec. 2017]

Solution : (a)

Q.44. GM of Laspeyre's and Paasche's Price Index number is ____price index number :

(a) Kelly's (b) Fisher's
(c) Bowley's (d) None

[June 2018]

Solution : (b)

Q.45. Paasche's index number is expressed in terms of :

(a) $\frac{\sum p_n q_n}{\sum p_o q_n}$

(b) $\frac{\sum p_o q_o}{\sum p_n q_n}$

(c) $\frac{\sum p_n q_n}{\sum p_o q_n}\times 100$

(d) $\frac{\sum p_n q_o}{\sum p_o q_o}\times 100$

[June 2018]

Solution : (c)

Q.46. To overcome the disadvantage of a simple average of relative method, we can use _____ :

(a) Weighted average of relative method
(b) Chain base index number
(c) Simple aggregative method
(d) Fixed base index number

[June 2018]

Solution : (a)

Q.47. Time reversal & factor reversal are :

(a) Quantity Index
(b) Ideal Index
(c) Price Index
(d) Test of consistency

[May 2018]

Solution : (d)

Q.48. A series of numerical figures which show the relative position is called

(a) Index number
(b) Relative number
(c) Absolute number
(d) None

[May 2018]

Solution : (a)

Q.49. The number of test of Adequacy is

(a) 2 (b) 5
(c) 3 (d) 4

[May 2018]

Solution : (d)

Q.50. P_{01} is the index for time

(a) 1 on 0 (b) 0 on 1
(c) 1 on 1 (d) 0 on 0

[May 2018]

Solution : (a) P_{01} is the index number of 1 on 0.

Q.51. The circular test is an extension of

(a) The time is reversal test
(b) The factor reversal test
(c) The unit test
(d) None of these

[May 2018]

Solution : (a)

Q.52. If $\sum P_0 Q_0 = 1360$, $\sum P_n Q_0 = 1900$, $\sum P_0 Q_n = 1344$, $\sum P_n Q_n = 1880$ then the Laspeyre's Index Number is

(a) 0.71 (b) 1.39 (c) 1.75 (d) None of these

[May 2018]

Solution : (b)

Laspeyre's Index No. = $\frac{\sum P_n Q_0}{\sum P_0 Q_0} = \frac{1900}{1360} = 1.3970$ [In Decimal form]

Q.53. Price Relative is expressed in term of

(a) $P = \frac{P_n}{P_0}$ (b) $P = \frac{P_0}{P_n}$

(c) $P = \frac{P_n}{P_0}\times 100$ (d) $P = \frac{P_0}{P_n}\times 100$

[May 2018]

Solution : (c) Price Relative $(P) = \frac{P_n}{P_0}\times 100$

Q.54. Circular test is satisfied by

(a) Laspeyre's Index Number
(b) Paasche's Index Number
(c) The Simple Geometric Mean of Price Relatives and the Weighted Aggregative with fixed weights.
(d) None of these

[May 2018]

Solution : (c)

Q.55. If the 1970 index with base 1965 is 200 and 1965 index with base 1960 is 150, the index 1970 on base 1960 will be :

(a) 700 (b) 300 (c) 500 (d) 600

[May 2018]

Solution : (b)

Year	Link Relative	Chain Base Index Number (CBI)
1960	100	100
1965	150	$\frac{150\times 100}{100} = 150$
1970	200	$\frac{200\times 150}{100} = 300$

CBI = FBI = Index Number of 1970 on Base 1960 = 300

Note : - Chain Base Index Number =

$$\frac{\text{Link relative of current year} \times \text{Chain Index of Previous Year}}{100}$$

Q.56. Which of the following statement is true?

(a) Paasche's Index Number is based on the base year quantity
(b) Fisher's Index Number is the Arithmetic Mean of Laspeyre's Index Number and Paasche's Index Numbers

(c) Arithmetic Mean is the most appropriate average for constructing the index number

(d) Fisher's Index Number is an Ideal Index Number

[Nov. 2018]

Solution : (d)

Q.57. If Laspeyre's Index Number is 250 and Paasche's Index Number is 160. Then Fisher's index number is:

(a) 40000 (b) $\frac{25}{16}$

(c) 200 (d) $\frac{16}{25}$

[Nov. 2018]

Solution : (c)

Fisher's I. No. $= \sqrt{L.P} = \sqrt{250 \times 160}$

$= 200$

Q.58. The simple average method is used to calculate:

(a) Trend Variation

(b) Cyclical Variation

(c) Seasonal Variation

(d) Irregular Variation

[Nov. 2018]

Solution : (c)

Q.59. If $\sum P_0 Q_0 = 240$, $\sum P_1 Q_1 = 480$, $\sum P_1 Q_0 = 600$, and $\sum P_0 Q_1 = 192$, then Laspeyre's Index Number is:

(a) 250 (b) 300 (c) 350 (d) 200

[Nov. 2018]

Solution : (a)

$$\text{Laspeyre's I. No.} = \frac{\sum P_1 Q_1}{\sum P_0 Q_0} \times 100$$

$$= \frac{480}{192} \times 100 = 250$$

Q.60. Which one is called an ideal index number

(a) Laspeyre's index number

(b) Paasche's index number

(c) Fisher's index number

(d) Marshall Edgeworth index number

[June 2019]

Solution : (c) Fisher's Index No. is called an Ideal Index Number.

Q.61. Which is not satisfied by Fisher's Ideal index number ?

(a) Factor Reversal Test

(b) Time Reversal Test

(c) Circular Test

(d) None of the above

[June 2019]

Solution : (c)

Q.62. The prices and quantities of 3 commodities in base and current years are as follows :

p_0	p_1	q_0	q_1
12	14	10	20
10	8	20	30
8	10	30	10

The Laspeyre's Price Index Number is

(a) 118.13 (b) 107.14 (c) 120.10 (d) None

[June 2019]

Solution :

(b) Here

p_0	p_1	q_0	q_1	p_0q_0	p_1q_0
12	14	10	20	120	140
10	8	20	30	200	160
8	10	30	10	240	300

$\sum p_0 q_0 = 560 \quad \sum p_1 q_0 = 600$

$$\text{Lespeyre's Price Index No. } (P_{01}) = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$$

$$= \frac{600}{560} \times 100$$

$$= 107.14$$

Q.63. The cost of living index numbers in years 2015 and 2018 were 97.5 and 115 respectively. The Salary of a worker in 2015 was ₹ 19500. How much additional salary was required for him in 2018 to maintain the same standard of living as in 2015?

(a) 3000 (b) 4000

(c) 3500 (d) 4500

[June 2019]

Solution : (c)

Here

Yrs.	CLI	Salary
2015	97.5	19,500
2018	115	?

Salary Required in year 2018 =

$$\frac{\text{CLI of 2018}}{\text{CLI of 2015}} \times \text{Salary in 2015}$$

$$= \frac{115}{97.5} \times 19500 = ₹\ 23000$$

Addition Salary Required = 23,000 - 19,500 = ₹ 3,500

Q.64. For year 2015, price index was 267% with base year 2005. The percentage increase in price index over base year 2005 is:

(a) 267% (b) 67%

(c) 167% (d) None of these

[Dec. 2019]

Solution : (c)

Percentage increase

= 267 - 100 = 167%

Q.65. The value of the base time period serves as a standard point of comparison.

(a) True (b) False

(c) Both (d) None of these

[Dec. 2019]

Solution : (a)

Q.66. Fisher's ideal formula does not satisfy _____ test?

(a) Unit test

(b) circular test

(c) Time reversal test

(d) None of these

[Dec. 2019, Dec. 2020]

Solution : (b) Circular test

Q.67. Index Number are expressed as .....

(a) Squares (b) Ratios

(c) Percentages (d) Combinations

[Dec. 2020]

Solution : (c)

Q.68. If Laspeyre's index number is 110 and Fisher's ideal Index number is 109. Then Paasche's Index number is

(a) 108 (b) 110

(c) 109 (d) 118

[Dec. 2020]

Solution : (a)

$$\text{Fisher's I. No} = \sqrt{\text{Laspeyre's I. No.} \times \text{Paasche's I. No}}$$

$$\Rightarrow \quad 109 = \sqrt{110 \times \text{Paasche's I. No.}}$$

$$\Rightarrow \quad 109^2 = 110 \times \text{Paasche's I. No.}$$

$$\therefore \quad \text{Passche's I. No} = \frac{109 \times 109}{110} = 108$$

Q.69. The cost of living index is always

(a) Price index number

(b) Quantity index number

(c) Weighted index number

(d) Value index number

[Jan. 2021]

Solution : (c) Cost of living Index Number is nothing but weighted Index No.

Q.70. Fisher's index number does not satisfy

(a) Unit test

(b) Circular test

(c) Time reversal test

(d) Factor reversal test

[Jan. 2021]

Solution : (b) Fisher's Index Number satisfies all the three tests except circular test.

Q.71. When the prices for quantities consumed of all commodities are changing in the same ratio, then the index numbers due to Laspeyre's and Paasche's will be

(a) Equal

(b) Unequal

(c) Reciprocal of Marshall Edge worth Index Number

(d) Reciprocal of Fisher Index Number

[Jan. 2021]

Solution : (a) is correct

Let $\frac{Q_1}{Q_0} = x$

or; $Q_1 = xQ_0$

Now Laspeyre's I. No.

$$= P_{01} = \frac{\sum P_1 Q_0}{\sum P_0 Q_0} \times 100$$

And Paasche's I. No.

$$= P_{01} = \frac{\sum P_1 Q_1}{\sum P_0 Q_1} \times 100$$

$$= \frac{\sum P_1 x Q_0}{\sum P_0 x Q_0} \times 100$$

$$= \frac{x \sum P_1 Q_0}{x \sum P_0 Q_0} \times 100$$

$$= \frac{\sum P_1 Q_0}{\sum P_0 Q_0} \times 100$$

$\therefore$ Paasche's I. No. = Laspeyre's I. No.

Q.72. The consumer price Index goes up from 120 to 180 when salary goes up from 240 to 540, what is the increase in real terms?

(a) 80 (b) 150

(c) 120 (d) 240

[July 2021]

Solution : (c) is correct

Actual Salary $= \frac{180}{120} \times 240 = 360$

Salary increase in real terms

$= 360 - 240 = 120$

Q.73. The weighted aggregative price index numbers for 2001 with 2000 as the base year using Paasche's Index Number is

Commodity	Price (in ₹)		Quantities	
	2000	2001	2000	2001
A	10	12	20	22
B	8	8	16	18
C	5	6	10	11
D	4	4	7	8

(a) 112.32 (b) 112.38 (c) 112.26 (d) 112.20

[July 2021]

Solution : (*d*) is correct

Commodity	Price (in ₹)		Quantities			
	2000	2001	2000	2001		
	p_0	p_1	q_0	q_1	$p_1 q_1$	$p_0 q_1$
A	10	12	20	22	264	220
B	8	8	16	18	144	144
C	5	6	10	11	66	55
D	4	4	7	8	32	32
					$\Sigma p_1 q_1 = 506$	$\Sigma p_0 q_1 = 451$

Paasche's Index No.

$$P_{01} = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100$$

$$= \frac{506}{451} \times 100 = 112.195 = 112.20$$

[Note : Never make Table like above in exam. Roughly Do on Calculator as:

For $\Sigma p_1 q_1$ = Type $12 \times 22 =$ button

$8 \times 18 =$ button

$6 \times 11 =$ button

$4 \times 8 =$ button

Then press GT button.

Similarly do for $\Sigma p_0 q_1$ and Then apply paasche's Formula].

Q.74. The weighted aggregative price index numbers for 2001 with 2000 as the base year using Marshal - Edgeworth Index Number is

Commodity	Price (in ₹)		Quantities	
	2000	2001	2000	2001
A	10	12	20	22
B	8	8	16	18
C	5	6	10	11
D	4	4	7	8

(*a*) 112.26 (*b*) 112.20 (*c*) 112.32 (*d*) 112.38

[July 2021]

Solution : (*a*) is correct.

Commodity	Price (in ₹)		Quantities			
	2000	2001	2000	2001		
	(p_0)	(p_1)	(q_0)	(q_1)	$p_1(q_0 + q_1)$	$p_0(q_0 + q_1)$
A	10	12	20	22	504	420
B	8	8	16	18	272	272
C	5	6	10	11	126	105
D	4	4	7	8	60	60
					$\Sigma p_1(q_0 + q_1) = 962$	$\Sigma p_0(q_0 + q_1) = 557$

Marshal Edgeworth Formula

$$P_{01} = \frac{\sum p_1 (q_0 + q_1)}{\sum p_0 (q_0 + q_1)} \times 100 = \frac{962}{857} \times 100$$

$$= 112.25 \approx 112.26$$

[Note : – Never make table like above. Time will loss. On calculator find $\Sigma p_1(q_0 + q_1)$ on calculator as

$(20 + 22) \times 12 =$

$(16 + 18) \times 8 =$

$(10 + 11) \times 6 =$

$(7 + 8) \times 4 =$ GT button (Press).

It will give $\Sigma p_1(q_0 + q_1) = 962$.

Do again as above for $\Sigma p_0(q_0 + q_1)$ by calculator. Then use Formula].

Q.75. The weighted aggregative price index number for 2001 with 2000 as the base year using Fisher's Index Number is

Commodity	Price (in ₹)		Quantities	
	2000	2001	2000	2001
A	10	12	20	22
B	8	8	16	18
C	5	6	10	11
D	4	4	7	8

(*a*) 112.32 (*b*) 112.20 (*c*) 112.38 (*d*) 112.26

[July 2021]

Solution : (*d*) is correct.

Fisher's Index No. $= \sqrt{\frac{\sum p_1 q_0}{\sum p_0 q_0} \times \frac{\sum p_1 q_1}{\sum p_0 q_1}} \times 100$

Calculator work.

Find $\Sigma p_1 q_0$ as $= 12 \times 20 =$; $8 \times 16 =$;

$6 \times 10 =$; $4 \times 7 =$ button Then press GT button. We get $\Sigma p_1 q_0 = 456$, Similarly find rest.

$\Sigma p_0 q_0 = 406$; $\Sigma p_1 q_1 = 506$; $\Sigma p_0 q_1 = 451$

$$\therefore \quad P_{01} = \sqrt{\frac{456}{406} \times \frac{506}{451}} \times 100$$

$$= 112.26$$

Q.76. If P_{10} and P_{01} are index for 1 on 0 and 0 on 1 respectively then formula $P_{01} \times P_{10} = 1$ is used for

(*a*) Unit Test

(*b*) Time Reversal Test

(*c*) Factor Reversal Test

(*d*) Circular Test

[Dec. 2021]

Solution : (*b*)

Q.77. The weighted averaged of price relatives of commodities, when the weights are equal to the value of commodities in the current year, yields _____ index number.

(*a*) Fisher's ideal

(*b*) Laspeyres's

(*c*) Paasche's

(*d*) Marshall-Edgeworth

[Dec. 2021]

Solution : (*c*)

Q.78. From the following data base year:

Commodity	Base year		Current year	
	Price	Quantity	Price	Quantity
A	4	3	6	2
B	5	4	6	4
C	7	2	9	2
D	2	3	1	5

Fisher's Ideal Index is

(*a*) 117.30 (*b*) 115.43 (*c*) 118.35 (*d*) 116.48

[Dec. 2021]

Solution : (*a*)

Commodities	Base year		Current year					
	P_0	q_0	P_1	q_1	$P_0 q_0$	$P_1 q_1$	$P_1 q_0$	$P_0 q_1$
A	4	3	6	2	12	12	18	8
B	5	4	6	4	20	24	24	20
C	7	2	9	2	14	18	18	14
D	2	3	1	5	6	5	3	10
					$\Sigma P_0 q_0 = 52$	$\Sigma P_1 q_1 = 59$	$\Sigma P_1 q_0 = 63$	$\Sigma P_0 q_1 = 52$

Fisher's Index No.

$$P_{01} = \left\{\sqrt{\frac{\sum P_1 q_0}{\sum P_0 q_0} \times \frac{\sum P_1 q_1}{\sum P_0 q_1}}\right\} \times 100$$

$$= \left(\sqrt{\frac{63}{52} \times \frac{59}{52}}\right) \times 100$$

$$= 117.244 \cong 117.30$$

Q.79. Index numbers are not helpful in

(*a*) Framing economic policies

(*b*) Revealing trend

(*c*) Forecasting

(*d*) Identifying errors

[Dec. 2021]

Solution : (*d*)

Q.80. The three index numbers, namely, Laspeyre, Paasche and Fisher do not satisfy _____ test.

(*a*) Time reversal

(*b*) Factor reversal

(*c*) Unit

(*d*) Circular

[Dec. 2021]

Solution : (*d*)

Q.81. The test of shifting the base is called

(*a*) Unit (*b*) Circular

(*c*) Time reversal (*d*) Factor reversal

[June 2022]

Solution : (*b*) is correct

Q.82. Let P_0 and P_1 be prices of a commodity in the base and current years respectively. The price relative with respect to base year is

(*a*) P_1/P_0 (*b*) P_0/P_1

(*c*) $\frac{P_1 - P_0}{P_0}$ (*d*) $\frac{P_1 - P_0}{P_1}$

[June 2022]

Solution : (*a*) is correct

Price relative = I. No. $= \frac{P_1}{P_0} \times 100$ (In %)

$= \frac{P_1}{P_0}$ (In decimal form)

Q.83. Laspeyre's index number is a weighted aggregate method by taking_____ as weights.

(a) Quantity consumed in the base year
(b) Quantity consumed in the current year
(c) value of items consumed in the base year
(d) Value of items consumed in the current year

[June 2022]

Solution : (a) is correct

$$P_{01} = \frac{\sum P_1 q_0}{\sum P_0 q_0} \times 100$$

Here q_0 = base year quantity.

Q.84. Which one of the following method is based on geometric mean for calculating index number?

(a) Fishers' method
(b) Kelley's method
(c) Paasche's method
(d) Laspeyre's method

[June 2022]

Solution :

∴ (a) is correct

Fisher's Index No. is the GM of Laspeyre's Index No. and Paasche's Index No.

Q.85. Which one of the following test is not applied for selecting an appropriate index number?

(a) Time reversal
(b) Price Relative
(c) Factor Reversal
(d) Circular

[June 2022]

Solution : (b) is correct

Test of Adequacy are:-
(i) Unit Test
(ii) Time Reversal Test
(iii) Factor Reversal Test
(iv) Circular Test

Q.86. From the following data extract the Index number by Laspeyre's method

$\Sigma P_1Q_1 = 99$, $\Sigma P_0Q_1 = 76$, $\Sigma P_0Q_0 = 73$, $\Sigma P_1Q_0 = 96$

(a) 130.36 (b) 131.51
(c) 130.88 (d) 76.04

[Dec. 2022]

Solution : *Given :*

$\sum P_0Q_0 = 73$; $\sum P_1Q_0 = 96$

$$\text{Laspeyre's Index No.} = \frac{\sum P_1Q_0}{\sum P_0Q_0} \times 100$$

$$= \frac{96}{73} \times 100 = 131.5068$$

$= 131.51$

∴ (b) is correct

Q.87. Which of the following index measures the change from month to month in the cart of a representative "basket" of goods and services of the type bought by a typical household?

(a) Retail Price Index
(b) Laspeyre's Index
(c) Fisher's Index
(d) Paasche's Index

[Dec. 2022]

Solution : (a)

Q.88. Fisher's index number is called an ideal index number because it is satisfying

(a) Fector reversal test
(b) Time reversal Test
(c) Both factor and time reversal test
(d) Circular test

[Dec. 2022]

Solution : (c)

Q.89. If Laspeyre's Index is 119 and Paasche's Index is 112 then Fisher's Index number will be:

(a) 113.99 (b) 115.45
(c) 115.89 (d) 151.98

[Dec. 2022]

Solution : L = Laspeyre's I. No. = 119

P = Paasche's I. No. = 112

∴ Fisher's I. No. = $\sqrt{L.P}$

$= \sqrt{119 \times 112} = 115.446$

$= 115.45$

(b) is correct.

Q.90. In price index, when a new commodity is required to be added which of the following index is used?

(a) Shifted price index
(b) Splicing price index
(c) Deflating price index
(d) Value price index

[Dec. 2022]

Solution : (b) is correct.

Q.91. Which of the following index is computed by taking the average of base year and current year?

(a) Marshall-Edgeworth index
(b) Paasche's Index
(c) Laspeyre's Index
(d) Fisher's Index

Solution : (a) is correct.

Q.92. Consider the data:

Year	Base year		Current year	
Commodities	Price	Quantity	Price	Quantity
A	10	5	20	2
B	15	4	25	8
C	40	2	60	6
D	25	3	40	4

Laspeyre's index is:

(a) 166.04
(b) 166.40
(c) 164.04
(d) 164.40

Solution :

Commodities	P_0	Q_0	P_1	Q_1	P_0Q_0	P_1Q_0
A	10	5	20	2	50	100
B	15	4	25	8	60	100
C	40	2	60	6	80	120

Commodities	P_0	Q_0	P_1	Q_1	P_0Q_0	P_1Q_0
D	25	3	40	4	75	120
					$\Sigma P_0Q_0 = 265$	$\Sigma P_1Q_0 = 440$

Laspeyre's Index No.

$$\frac{\sum P_1Q_0}{\sum P_1Q_0} \times 100 = \frac{440}{265} \times 100$$

$= 166.0377 = 166.04$

(a) is correct.

Q.93. The index number of prices for a country at a given date is 250. In comparison to the base period price, the price of all commodities in the country has increased by _____ _____times.

(a) 1.25
(b) 1.5
(c) 2
(d) 2.5

Solution :

$$\text{Index No.} = \frac{250}{100} \times 100 = 250$$

= (2.5) times of 100 base price

(d) is correct.

Q.94. Weighted geometric mean of relative formula satisfies _____ _____ test while Factor Reversal test is satisfied by _____.

(a) Time Reversal, Fisher's Ideal Index
(b) Time Reversal, Laspeyre's Index
(c) Factor Reversal, Paasche's Index
(d) Factor Reversal, Fisher's Ideal Index

Solution : (a) is correct.