3 PROBABILITY

TRY YOURSELF - 1

1. Three unbiased coins are tossed. Find probability of getting at least two heads

(a) $\frac{2}{3}$ (b) $\frac{1}{2}$ (c) $\frac{1}{3}$ (d) $\frac{4}{3}$

Sol. n (S) = 8

Event ∈ = at least 2 heads

$\in = HHH, HHT, HTH, THH$ n {E} = 4

$P \in = \frac{4}{8} = \frac{1}{2}$

∴ (b) is correct

2. Three unbiased coins are tossed. Find probability of getting at most two tails.

(a) $\frac{8}{3}$ (b) $\frac{7}{2}$ (c) $\frac{1}{3}$ (d) $\frac{7}{8}$

Sol. n (S) = 8

Event ∈ = atmost 2 tails

$\in =$ HTT,HHT,HTH,THH,HHH,THT,TTH

$N \in = 7$

$P \in = \frac{7}{8}$

∴ (d) is correct

3. Three unbiased coins are tossed. Find probability of getting 1^{st} and 3^{rd} coin indicating opposite result

(a) $\frac{4}{5}$ (b) $\frac{2}{3}$ (c) $\frac{1}{2}$ (d) $\frac{3}{4}$

Sol. n(S) = 8

Event ∈ = 1^{st} & 3^{rd} coin , indicate opposite result.

$\in =$ HTT,THH,TTH,HHT

$n \in = 4$

$P \in = \frac{4}{8} = \frac{1}{2}$

∴ (c) is correct

4. Three unbiased coins are tossed. Find probability of getting Exactly two tails.

(a) $3/8$ (b) $\frac{4}{3}$ (c) $\frac{3}{5}$ (d) $\frac{1}{6}$

Sol. n(S) = 8

Event = Exactly two tails

$\in$ = HTT, THT, TTH

N $\in$ = 3

P $\in$ = $3/8$

$\therefore$ (a) is correct

5. If a unbiased dice is thrown. Find the probability of getting Odd number

(a) $1/2$ (b) $\frac{3}{4}$ (c) $\frac{3}{2}$ (d) $\frac{1}{6}$

Sol. S = $1,2,3,4,5,6$ n (S) = 6

Event : odd no

$\in$ = $1,3,5$ n (E) = 3

P $\in$ = $3/6$ = $1/2$

$\therefore$ (a) is correct

6. If a unbiased dice is thrown. Find the probability of getting Prime number.

(a) $\frac{1}{4}$ (b) $\frac{3}{2}$ (c) $\frac{1}{3}$ (d) $1/2$

Sol. S = $1,2,3,4,5,6$

Event : Prime Number

$\in$ = $2,3,5$ n $\in$ = 3

P $\in$ = $3/6$ = $1/2$

$\therefore$ (d) is correct

7. Two dice are thrown. Find probability of sum of the numbers being divisible by 4.

(a) $\frac{1}{2}$ (b) $\frac{3}{2}$ (c) $1/4$ (d) $\frac{1}{3}$

Sol. n (S) = 36

Event : (Sum) divisible by 4

$\in$ = 1,3 2,2 2,6 3,1 3,5 4,4 5,3 6,2 6,6

N $\in$ = 9

P $\in$ = $9/36 = 1/4$

∴ (c) is correct

8. Two dice are thrown. Find probability of product of numbers being greater than 20.

(a) $\frac{3}{4}$ (b) $\frac{3}{2}$ (c) $\frac{1}{3}$ (d) $1/6$

Sol. n (S) = 36

Event : Product > 20

$\in$ = 4,6 , 5,5 5,6 6,4 6,5 6,6

n $\in$ = 6

P $\in$ = $6/36 = 1/6$

∴ (d) is correct

9. A card is drawn from a pack of 52 playing cards. Find the probability that the card drawn is a Diamond Card**.**

(a) $\frac{1}{3}$ (b) $1/4$ (c) $\frac{1}{2}$ (d) $\frac{1}{6}$

Sol. n(S) = 52_{c_1}

Event : Diamond card

n $\in$ = 13_{c_1} = 13

P $\in$ = $13/52 = 1/4$

∴ (b) is correct

10. A card is drawn from a pack of 52 playing cards. Find the probability that the card drawn is a Red Card.

(a) $\frac{1}{5}$ (b) $\frac{3}{2}$ (c) $1/2$ (d) $\frac{1}{4}$

Sol. n(S) = 52_{c_1}

Event : Red card

n $\in$ = 26_{c_1} = 26

P $\in$ = $26/52 = 1/2$

∴ (c) is correct

11. A bag contains 6 red balls and some blue balls. If the probability of drawing a blue ball form 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

Sol. R B

6 x

P(Blue ball) = 2 P (a red ball)

$$\frac{x}{6+x} = 2\frac{6}{6+x}$$

$\therefore$ x = 12

$\therefore$ (b) is correct

12. A box contains 2 red, 3 green and 2 blue balls. Two balls are drawn at random. What is the probability that none of the balls drawn is blue?

(a) $10/21$ (b) $\frac{11}{21}$ (c) $\frac{2}{7}$ (d) $\frac{5}{7}$

Sol. R G B

2 3 2 = 7 balls

Selection = 2 balls

N(S) = $7_{c_2} = \frac{7\times 6}{2\times 1}$ = 21

Event : None is blue

n $\in$ = $5_{c_2} = \frac{5\times 4}{2\times 1}$ = 10

P $\in$ = $10/21$

$\therefore$ (a) is correct

13. In a packet of 500 pens, 50 are found to be defective. A pen is selected at random. Find the probability that it is non defective

(a) $\frac{8}{9}$ (b) $\frac{7}{8}$ (c) $\frac{9}{10}$ (d) $\frac{2}{3}$

Sol. D N.D

50 4.50 = 500

P(non defective) = $\frac{450}{500} = \frac{9}{10}$

$\therefore$ (c) is correct

TRY YOURSELF - 2

1. The following data relates to the distribution of wages of a group of workers.

Wages in Rs.	No. of workers
50-60	15
60-70	23
70-80	36
80-90	42
90-100	17
100-110	12
110-120	5

If a worker is selected at random from the entire group of workers, what is the probability that his wage would be less than Rs. 50?

(a) 0 (b) $\frac{29}{150}$ (c) $\frac{89}{150}$ (d) 0.72

Sol. P (wage < 50) = $\frac{0}{150}$ = 0

$\therefore$ (a) is correct

2. The following data relates to the distribution of wages of a group of workers.

Wages in Rs.	No. of workers
50-60	15
60-70	23
70-80	36
80-90	42
90-100	17
100-110	12
110-120	5

If a worker is selected at random from the entire group of workers, what is the probability that his wage would be less than Rs. 80?

(a) 0 (b) $\frac{19}{75}$ (c) $\frac{37}{75}$ (d) 0.72

Sol. P(wage < 80) = $\frac{15+23+36}{150} = \frac{74}{150} = \frac{37}{75}$

$\therefore$ (c) is correct

3. If P(A) = 6/9 then the odds against the event is

(a) $3/9$ (b) 6/3 (c) 3/6 (d) 3/15

Sol. P(A) = $6/9$

$\therefore$ P(A') = 1 – P(A) = 1 - $6/9$ = $3/9$

$\therefore$ (a) is correct

4. If p:q are the odds in favour of an event, then the probability of that event is

(a) p/q (b) $\frac{p}{(p+q)}$ (c) $\frac{q}{(p+q)}$ (d) None of these

Sol. Ratio = p :q

P (odds in favour) = $\frac{p}{p+q}$

$\therefore$ (b) is correct

5. The odds in favour of one student passing a test are 3:7. The odds against another student passing at are 3:5. The probability that both pass is

(a) $\frac{7}{16}$ (b) $\frac{21}{80}$ (c) $\frac{9}{80}$ (d) $\frac{3}{16}$

Sol. P(odds in favour of one student passing) = $3/10$

P(odds against other student passing) = $5/8$

P (both passing) = $\frac{3}{10} \times \frac{5}{8} = \frac{3}{16}$

$\therefore$ (d) is correct

6. The odds in favour of one student passing a test are 3:7. The odds against another student passing at are 3:5. The probability that both fail is

(a) $\frac{7}{16}$ (b) $\frac{21}{80}$ (c) $\frac{9}{80}$ (d) $\frac{3}{16}$

Sol. P (odds in favour of passing) = $\frac{3}{10}$

$\therefore$ P (failing) = $\frac{7}{10}$

P (odds against other student passing) = $\frac{5}{8}$

P (other student failing) = $\frac{3}{8}$

P(both failing) = $\frac{7}{10} \times \frac{3}{8} = \frac{21}{80}$

$\therefore$ (b) is correct

7. The odds in favour of an event is 2:3 and odds against another event is 3:7. Find the probability that only one of the two events occurs.

(a) $\frac{27}{50}$ (b) $\frac{17}{50}$ (c) $\frac{37}{50}$ (d) $\frac{47}{50}$

Sol. A : one event

B : another event

P(A) = $\frac{2}{5}$ = P(A') = $\frac{3}{5}$

P(B) = $\frac{7}{10}$ = P(B') = $\frac{3}{10}$

P(Only one event occurs) = P(only A) or P(only B)

$= P(A \cap B' + A' \cap B)$

= P(A) P(B') + P(A') P(B)

$= \frac{2}{5} \times \frac{3}{10} + \frac{3}{5} \times \frac{7}{10}$

$= \frac{6}{5} + \frac{21}{10}$

$= \frac{27}{50}$

$\therefore$ (a) is correct

TRY YOURSELF - 3

1. If P(A)=3/8, P(B)=1/3 and P(Bc)=2/3 then P(AC) is equal to
(a) 5/8 (b) 3/8 (c) 1/8 (d) None

Sol. $P(A) = 3/8$ $P(B) = 1/3$ $P(B^C) = 2/3$

$P(A^c) = 1 - P(A) = 1 - 3/8 = 5/8$

$\therefore$ (a) is correct

2. If $P(A) = \frac{1}{2}$, $P(B) = \frac{1}{3}$, $P(A \cup B) = \frac{2}{3}$ then the events $P(A \cap B)$?
(a) 1/4 (b) 1/6 (c) 2/3 (d) ½

Sol. $P(A) = 1/2$ $P(B) = 1/3$ $P(A \cup B) = 2/3$

$P(A \cap B) = P(A) + P(B) - P(A \cup B)$

$$= \frac{1}{2} + \frac{1}{3} - \frac{2}{3} =$$

$$= \frac{3+2-4}{6}$$

$$= 1/6$$

$\therefore$ (b) is correct

3. If P(A) = 1/2, P(B) = 3/5 and the events A & B are independent then $P(A \cap B)$ is -
(a) 7/10 (b) 3/10 (c) 5/10 (d) 9/10

Sol. $\because$ A and B are Independent Events

$P(A \cap B) = P(A)\ P(B)$

$$= \frac{1}{2} \times \frac{3}{5}$$

$$= 3/10$$

$\therefore$ (b) is correct

4. If $P(A \cap B) = 0.60$ and $P(A \cup B) = 0.70$ for two events A and B, then P(A) + P(B) is
(a) 1.30 (b) 0.90 (c) 1.00 (d) 0.75

Sol. $P(A \cap B) = 0.6$ $P(A \cup B) = 0.7$

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$\therefore$ $P(A) + P(B) = P(A \cup B) + (A \cap B)$

$= 0.7 + 0.6$

$= 1.30$

$\therefore$ (a) is correct

5. If for two independent events A and B, P(A∪B) = 2/3 and P(A) = 2/5, what is P(B)?

(a) 4/15 (b) $4/9$ (c) 5/9 (d) 7/15

Sol. $\because$ A and B are Independent Events

$P(A \cup B) = P(A) + P(B) \rightarrow$ (1)

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$$\frac{2}{3} = \frac{2}{5} + P(B) - P(A)\,P(B)$$

$$\frac{2}{3} - \frac{2}{5} = P(B) - \frac{2}{5}P(B)$$

$$\frac{10-6}{15} = \frac{5P(B) - 2P(B)}{5}$$

$$\frac{4}{15} = \frac{3P(B)}{5}$$

$$P(B) = \frac{4}{5} \times \frac{5}{3}$$

$$P(B) = 4/9$$

$\therefore$ (b) is correct

6. A and B are two events such that P(A) = 1/2 , P(B)=1/4 and P(A ∩B)=1/5. Find P(A ∪ B).

(a) 4/5 (b) 11/20 (c) 3/5 (d) None of these.

Sol. $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$$= \frac{1}{2} + \frac{1}{4} - \frac{1}{5}$$

$$= \frac{10+5-4}{20}$$

$$= 11/20$$

$\therefore$ (b) is correct

7. If $P(\overline{A} \cup B) = 5/6$, $P(A)=1/2$ and $P(\overline{B}) = 2/3$, What is $P(A \cup B)$?

(a) 1/3 (b) 5/6 (c) 2/3 (d) 4/9

8. If P(A)=a, P(B)=b and $P(A \cap B) = c$ then the expression of $P(A' \cap B')$ in terms of a, b and c is

(a) 1-a-b-c (b) a+b-c (c) 1+a-b-c (d) 1-a-b+c

Sol. $P(A' \cap B') = P(A \cup B)'$

$= 1 - [P(A \cup B)]$

$= 1 - [P(A) + P(B) - P(A \cap B)]$

$= 1 - [a + b - c]$

$= 1 - a - b + c$

$\therefore$ (d) is correct

9. If $P(A-B) = \frac{1}{5}$, $P(A) = \frac{1}{3}$ and $P(B) = \frac{1}{2}$, what is the probability that out of the two events A and B, only B would occur?

(a) 11/30 (b) 13/30 (c) 17/30 (d) ½

Sol. P(only B occur) = $P(A' \cap B)$

$= P(B) - P(A \cap B) \rightarrow (1)$

$P(A - B) = P(A) - P(A \cap B)$

$\frac{1}{5} = \frac{1}{3} - P(A \cap B)$

$P(A \cap B) = \frac{1}{3} - \frac{1}{5} = \frac{5-3}{15} = \frac{2}{15}$

From (1)

$P(\text{only B occurs}) = \frac{1}{2} - \frac{2}{15} = \frac{15-4}{30} = \frac{11}{30}$

$\therefore$ (a) is correct

10. If P(A)=1/5, P(B)=1/2 and A and B are mutually exclusive then P(AB) is

(a) 7/10 (b) 3/10 (c) 1/5 (d) 0

Sol. $\because$ A and B are mutually exclusive events

$P(A \cap B) = 0$

P(AB) = 0

$\therefore$ (d) is correct

11. A, B, C are three mutually independent with probabilities 0.3, 0.2 and 0.4 respectively. What is $P(A \cap B \cap C)$?

(a) 0.400 (b) 0.240 (c) 0.024 (d) 0.500

Sol. $P(A) = 0.3$

$P(B) = 0.2$

$P(C) = 0.4$

$P(A \cap B \cap C) = P(A)\,P(B)\,P(C)$

$= (0.3)\,(0.2)\,(0.4)$

$= 0.024$

[$\because$ A,B,C are Independent variable]

12. $P(B) = \frac{3}{4}, P(\bar{A} \cap B \cap \bar{c}) = \frac{1}{3} P(A \cap B \cap \bar{c}) = \frac{1}{3}$ **then P(B ∩ C):**

(a) 1/12 (b) 3/4 (c) 5/12 (d) 23/36

13. A, B and C are three mutually exclusive and exhaustive events such that P(A) = 2 P(B) = 3 P(C). What is P(B)?

(a) 6/11 (b) 6/22 (c) 1/6 (d) 1/3

14. If A, B and C are mutually exclusive and exhaustive events, then P(A) + P(B) + P(C) equals to

(a) 1/3 (b) 1 (c) -1 (d) Any value between 0 and 1

TRY YOURSELF – 4

1. The conditional probability of an event B on the assumption that another event A has actually occurred is given by
   (a) P(B/A) = P(AB)/P(A) (b) P(A/B) = P(AB)/P(B)
   (c) P(B/A) = P(AB) (d) P(A/B) = P(AB)/P(A).P(B)

Sol. (a) is correct

2. If P(A∩ B) = P(A I B)×P(B), then it implies that:
   (a) Both events are statistically dependent and independent
   (b) Both events are statistically dependent
   (c) Both events are statistically independent
   (d) None of the above.

Sol. (a) is correct

3. If P(A/B) = P(A), then
   (a) A is independent of B (b) B is independent of A
   (c) B is dependent of A (d) Both (a) and (b)

Sol. (d) is correct

4. P(B/A) is defined only when
   (a) A is a sure event (b) B is a sure event
   (c) A is not an impossible event (d) B is an impossible event

Sol. $P(B/A) = \dfrac{P(A \cap B)}{P(A)}$

$\therefore$ $P(A) \neq 0$

$\therefore$ A is not an Impossible event

$\therefore$ (c) is correct

5. In formula P(B/A), P(A) is
   (a) Greater than 0 (b) Less than 0
   (c) Equal to 0 (d) Greater than or equal to 0

Sol. $P\left(B/A\right) = \dfrac{P(A \cap B)}{P(A)}$

$\therefore$ $P(A) > 0$

$\therefore$ (a) is correct

6. P(A/B') is defined only when
   (a) B is not a sure event (b) B is a sure event
   (c) B is an impossible event (d) B is not an impossible event

Sol. $P\left(A/B'\right) = \frac{P(A \cap B')}{P(B')}$

$\because \quad P(B') \neq 0$

$1 - P(B) \neq 0$

$\therefore$ P (B) $\neq$ 1

$\therefore$ B is not a sure event

$\therefore$ (a) is correct

7. The Theorem of Compound Probability states that for any two events A and B.
(a) P(A ∩ B) = P(A) × P(B/A) (b) P(A ∪ B) = P(A) × P(B/A)
(c) P(A ∩ B) = P(A) × P(B) (d) P(A ∪ B)= P(A) + P(B) - P(A∩B)

Sol. (a) is correct

8. Let A & B are two events with P(A) = 2 / 3 , P(B) = 1/4 and P(A ∩ B) = 1/12 then P(A / B) is equal to
(a) 2/3 (b) 1/3 (c) 1/8 (d) 7/8

Sol. $P\left(A/B\right) = \frac{P(A \cap B)}{P(B)} = \frac{1/12}{1/4} = \frac{4}{12} = \frac{1}{3}$

$\therefore$ (b) is correct

9. 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 not exclusive

Sol. $P(A) = 2/3$ $P(B) = 3/8$

$P(A)\,P(B) = 2/3 \times 3/8 = 2/8 = 1/4$

$= P(A \cap B)$

$\therefore$ (b) is correct

10. Given P(A) = 1/2, P(B) = 1/3, P(AB) = 1/4, the value of P(A/B) is
(a) 1 (b) 1/2 (c) 1/15 (d) ¾

Sol. $P\left(A/B\right) = \frac{P(A \cap B)}{P(B)} = \frac{1/4}{1/3} = 3/4$

∴ (d) is correct

11. In connection with a random experiment, it is found that P(A)=$\frac{2}{3}$ P(B) =$\frac{3}{5}$and P(A ∪ B)= $\frac{5}{6}$. Find P(B/A).

(a) 13/18 (b) 1/2 (c) 13/20 (d) 5/18

Sol. $P(A \cap B)$ = P(A) + P(B) + P(C)

$$= \frac{2}{3} + \frac{3}{5} - \frac{5}{6}$$

$$= \frac{20+18-5}{30}$$

$$= 13/30$$

$$P(B/A) = \frac{P(A \cap B)}{P(A)} = \frac{13/30}{2/3} = \frac{39}{60} = \frac{13}{20}$$

∴ (c) is correct

12. If P(A∩ B) = 0.10 and $P(\overline{B})$ = 0.80, then P(A | B) is

(a) 0.25 (b) 0.40 (c) 0.50 (d) 0.75

Sol. $P(A/B) = \frac{P(A \cap B)}{P(B)} = \frac{P(A \cap B)}{[1 - P(B')]}$

$$= \frac{0.1}{1-0.8} = \frac{0.1}{0.2} = 1/2$$

= 0.5

∴ (c) is correct

13. A and B are two events such that P(A)=1/3, P(B)=1/4, P(A+B)=1/2, then P(B/A) is equal to

(a) 1/4 (b) 1/3 (c) 1/2 (d) None

Sol. $P(A \cap B)$ = P(A) + P (B) – P (A + B)

$$= \frac{1}{3} + \frac{1}{4} - \frac{1}{2}$$

$$= \frac{4+3-6}{12}$$

$$= 1/12$$

$$P\left(B/A\right) = \frac{P\left(A\cap B\right)}{P\left(A\right)} = \frac{1/12}{1/3} = \frac{3}{12} = \frac{1}{4}$$

∴ (a) is correct

14. In connection with a random experiment, it is found that P(A) $=\frac{2}{3}$ P(B) $=\frac{3}{5}$ and P(A ∪ B)$=\frac{5}{6}$. Find P (A'/B).

(a) 13/18 (b) 1/2 (c) 13/20 (d) $5/18$

Sol. $P\left(A\cap B\right) = P(A) + P(B) - P\left(A\cup B\right)$

$$= \frac{2}{3}+\frac{3}{5}-\frac{5}{6}$$

$$= \frac{20+18-25}{30} = 13/30$$

$$= \frac{P\left(A\right) - P\left(A\cap B\right)}{\left[1-P\left(B\right)\right]}$$

$$P\left(A'/B\right) = \frac{P\left(A'\cap B\right)}{P\left(B\right)} = \frac{P\left(B\right) - P\left(A\cap B\right)}{P\left(B\right)}$$

$$= \frac{\left(\frac{3}{5}-\frac{13}{30}\right)}{3\ \ 5)}$$

$$= \left(\frac{\frac{18-30}{30}}{3/5}\right)$$

$$= \frac{5}{30}\times\frac{5}{3}$$

$$= 5/18$$

∴ (d) is correct

15. In connection with a random experiment, it is found that P(A) $=\frac{2}{3}$ P(B) $=\frac{3}{5}$ and P (A ∪ B) = $\frac{5}{6}$. Find P(A/B').

(a) 1/3 (b) 5/12 (c) $7/12$ (d) 11/12

Sol. $P(A \cap B) = P(A) + P(B) - P(A \cup B)$

$$= \frac{2}{3} + \frac{3}{5} - \frac{5}{6}$$

$$= \frac{20+18-25}{30}$$

$$= 13/30$$

$$P(A/B') = \frac{P(A \cap B')}{P(B')} = \frac{P(A) - P(A \cap B)}{[1 - P(B)]}$$

$$= \frac{2/13 - 13/30}{[1 - 3/5]} = \left(\frac{\frac{20-13}{30}}{2/5}\right)$$

$$= \frac{7}{30} \times \frac{5}{2} = 7/12$$

$\therefore$ (c) is correct

16. In connection with a random experiment, it is found that P(A)=2/3 P(B) =3/5 and P(A ∪ B)= 5/6. Find P(A'/B').

(a) $\frac{1}{3}$ (b) $5/12$ (c) $\frac{7}{12}$ (d) $\frac{5}{12}$

Sol. $P(A \cap B) = P(A) + P(B) - P(A \cup B)$

$$= \frac{2}{3} + \frac{3}{5} - \frac{5}{6}$$

$$= \frac{20+18-25}{30}$$

$$= 13/30$$

$$P(A'/B') = \frac{P(A' \cap B')}{P(B')} = \frac{P(A \cup B)'}{[1 - P(B)]}$$

$$= \frac{1/6}{[1 - 3/5]} = \frac{1/6}{2/5}$$

$$= 5/12$$

∴ (b) is correct

TRY YOURSELF – 5

1. Value of a random variable are
   (a) Always positive numbers (b) Always positive real numbers
   (c) Real numbers (d) Natural numbers

Ans. (c) is correct

2. Expected value of a random variable
   (a) Is always positive (b) May be positive or negative
   (c) May be positive or negative or zero (d) Can never be zero.

Ans. (c) is correct

3. If all the values taken by a random variable are equal then
   (a) Its expected value is zero (b) Its standard deviation is zero
   (c) Its standard deviation is positive (d) Its standard deviation is a real number

Ans. (b) is correct

4. If x and y are independent, then
   (a) E(xy) = E(x) × E(y) (b) E(xy) = E(x) + E(y)
   (c) E(x+y) = E(x) + E(y) (d) E(x-y) = E(x) - x E(y)

Ans. (a) is correct

5. If a Random Variable x assumes the values x_1, x_2, x_3, x_4 with corresponding probabilities p_1, p_2, p_3, p_4, then the Expected Value of x is
   (a) $p_1 + p_2 + p_3 + p_4$ (b) $x_1/p_1 + x_2/p_2 + x_3/p_3 + x_4/p_4$
   (c) $p_1 x_1 + p_2 x_2 + p_3 x_3 + p_4 x_4$ (d) None of these

Ans. (c) is correct

6. Mean is the Expected Value of x for a
   (a) Correlation (b) Statistics
   (c) Dispersion (d) Probability Distribution.

Ans. (d) is correct

7. Variance of a 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)

Ans. (d) is correct

8. f(x), the probability mass function of a random variable x satisfies
   (a) f(x) > 0 (b) $\sum_x f(x) = 1$
   (c) Both (a) and (b) (d) $f(x) \geq 0$ and $\sum_x f(x) = 1$

Ans. (d) is correct

9. Which of the following is the characteristic of the probability distribution of a random variable?
   (a) $0 \le P(Aj) \le 1$, for all i.
   (b) $\sum P(Ai) = 1$,for all I
   (c) The outcomes of each trial are independent.
   (d) All of these

Ans. (d) is correct

10. The Integral of the probability density function $\int_{-\infty}^{+\infty} f(x)dx$ is is equal to
   (a) Unity (b) Infinity (c) Finity (d) Zero.

Ans. (a) is correct

11. Probability mass function is always
   (a) 0 (b) Greater than 0 (c) Greater than or equal to 0 (d) Less than 0

Ans. (c) is correct

12. The sum of probability mass function is equal to
   (a) -1 (b) 0 (c) 1 (d) None

Ans. (c) is correct

13. When X is a continuous function f(x) is called
   (a) Probability mass function (b) Probability density function
   (c) Both (d) None

Ans. (b) is correct

14. If x and y are random variables having expected values as 4.5 and 2.5 respectively, then the expected value of (x-y) is
   (a) 2 (b) 7 (c) 6 (d) 0

Sol. $\in X = 4.5 \in y = 2.5$

$\therefore \in X - y = \in X - \in y$

$= 4.5 - 2.5$

$= 2$

$\therefore$ (a) is correct

15. X is a random variable taking the values 5, 6 and 7 with probabilities 1/3, ¼ and 5/12, then Find E(X) and E(2x + 5), E(x2)
   (a) 5,28,25 (b) 6, 17.17, 37.75, (c) 7,19,49 (d) 3,12,9

Sol.

xi	pi	$pixi$	$pixi^2$
5	$1/3$	$5/3$	$25/3$
6	$1/4$	$6/4$	$36/4$
7	$5/12$	$35/12$	$245/12$
		$73/12$	$453/12$

$$\in(x) = \in(\text{pi}\,x\text{i}) = \frac{73}{12} = 6.08$$

$$\in\ x^2 = \in(\text{pi}\,x\text{i}^2) = 453/12 = 37.75$$

$$\in\ 2x+5 = 2\in(x) + 5$$

$= 2\ (6.08) + 5$

$= 17.17$

$\therefore$ (b) is correct

HOME WORK

1. 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) $P(A \cup B) = P(A) \times P(B) - P(A \cap B)$

Sol. $(a)\ P(A \cap B) = P(A).P(B/A)$

2. 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/

Sol. 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 $q = P(A^1) = 1 - P(A) = 1 - \frac{3}{4} = \frac{1}{4}$

$$\therefore P(X=0) = 3c_0.p^0q^3$$

$$= 1.1.\left(\frac{1}{4}\right)^3 = \frac{1}{64}$$

∴ (a) is correct

3. 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

Sol. 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.)}

$\therefore n(E) = 2$

$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{2}{7}$

$\therefore$ (c) is correct

4 .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 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]**

Sol.

	Males	Females
Total	20	15
Service holder	12	8
Non-Service holder	8	7

Probability of male service holder

$$= \frac{12}{20} = 0.60$$

$\therefore$ (b) is correct

5. For any two dependent events A and B, P(A) = 5/9 and P(B) = 6/11 and = 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

Sol. $P(A/B) = \frac{P(A \cap B)}{P(B)} = \frac{10/33}{6/11} = \frac{10}{33} \times \frac{11}{6} = \frac{5}{9}$

$$P(B/A) = \frac{P(A \cap B)}{P(A)} = \frac{10/33}{5/9} = \frac{10}{33} \times \frac{9}{5} = \frac{6}{11}$$

$\therefore$ (a) is correct

6.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) ½ **[July. 2021]**

Sol. Let A = Event of studying Mathematics

B= Event of Studying Science.

Given

$$p(A \cap B) = 60\% = 0.60$$

and $$p(B) = 90\% = 0.90$$

$$p(A/B) = \frac{p(A \cap B)}{p(B)} = \frac{0.60}{0.90}$$

$$= \frac{6}{9} = \frac{2}{3}$$

$\therefore$ (b) is correct

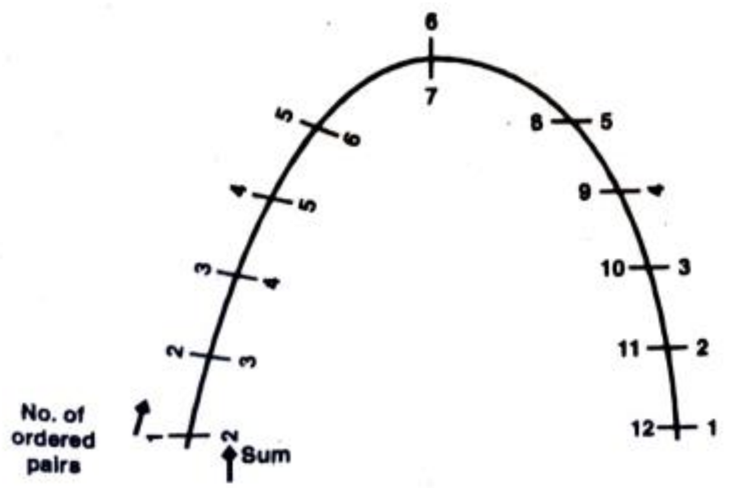
7. An event that can be sub-divided into further events is called as.
   (a) A composite event (b) A complex event
   (c) A mixed event (d) A simple event [**Jan. 2021**]

Sol. (a) is correct

8. 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

Sol. **Tricks :**

Remember this diagram.



$n(s) = 6^2 = 36$

Let E = Sum 7 or 11

$n(E) = 6 + 2 = 8$

$P(E) = \frac{n(E)}{n(s)} = \frac{8}{36} = \frac{2}{9}$

$\therefore$ (c) is correct

9.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

Sol. (b) is correct

10. If Y ≥ x then mathematical expectation is
   (a) E (X) > E(Y) (b) E (X)≤ E(Y)
   (c) E (X) = E (Y) (d) E (X). E(Y)=1

Sol. If $y \geq x$
   then $E(y) \geq E(x)$
   $E(x) \leq E(y)$
   $\therefore$ (b) is correct

11. 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

Sol. $P(A\cap B)=P(A)+P(B)-P(A\cap B)$

or ; 0.8= P(A) + (B) -0.3

or ; P(A) + P(B) = 0.8 + 0.3 =1.1

$\therefore P(\overline{A})+P(\overline{B})=1-P(A)+1-P(B)$

$=2-[P(A)+P(B)]$

$=2-1.1=0.9$

$\therefore$ (c) is correct

12.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) $\frac{1}{6}$

Sol. $P(A\cup B)=P(A)+P(B)-P(A\cup B)$

$$=\frac{1}{2}+\frac{1}{3}-\frac{1}{4}=\frac{6+4-3}{12}=\frac{7}{12}$$

$\therefore$ (b) is correct

13.Sum of all probabilities of mutually exclusive and exhaustive events is equal to

(a) 0 (b) 1/2 (c) 1/4 (d) 1

Sol. If events are mutually exclusive and exhaustive events then Sum of all probabilities = 1.

$\therefore$ (d) is correct

14.The term "chance" and probability are synonyms:

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

Sol. (a) is correct

15.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

Sol. $P(A/B)=\frac{P(A\cap B)}{P(B)}=\frac{1/4}{1/3}=\frac{3}{4}$

$\therefore$ (d) is correct

16. The probability of occurrence of at least one of the 2 events A and B (which may not be mutually exclusive) is given by

(a) P(A+B) = P(A) - P(B)
(b) P(A+B) = P(A) + P(B) - P(AB)
(c) P(A+B) = P(A) - P(B) + P(AB)
(d) P(A+B) = P(A) + P(B) + P(AB)

Sol. (b) is correct

17. If P(A-B) = P(B-A), then the two events A and B satisfy the condition

(a) P(A) = P(B) (b) P(A)+P(B) = 1 (c) $P(A\cap B) = 0$ (d) $P(A\cup B) = 1$

Sol. P(A – B) = P (B – A)

$\therefore$ $P(A) - P(A\cap B) = P(B) - P(A\cap B)$

$\therefore$ P (A) = P(B)

$\therefore$ (a) is correct

18. For any two events A and B,

(a) $P(A)+P(B) > P(A\cap B)$
(b) $P(A)+P(B) < P(A\cap B)$
(c) $P(A)+P(B) \geq P(A\cap B)$
(d) $P(A)+P(B) \leq P(A\cap B)$

Sol. (c) is correct

19. For any two events A and B,

(a) P(A-B) = P(A) - P(B)
(b) $P(A-B) = P(A) - P(A\cap B)$
(c) $P(A-B) = P(B) - P(A\cap B)$
(d) $P(B-A) = P(B) + P(A\cap B)$

Sol. (b) is correct

20. Three events A, B, and C are mutually exclusive, exhaustive and equally likely. What is the probability of complementary event of A?

(a) $\frac{1}{3}$ (b) $\frac{2}{3}$ (c) $\frac{1}{4}$ (d) $\frac{3}{4}$

Sol. $P(A\cup B\cup C) = 1$ [$\because$ Exhaustive events]

$\therefore$ P(A) + P(B) + P(C) = 1 [$\because$ Mutually likely events]

$\therefore$ $P(A) = 1/3$ [$\because$ Equally likely events]

$\therefore$ $P(A^1) = 2/3$

$\therefore$ (b) is correct

21. A bag contains 20 discs numbered 1 to 20. A disc is drawn from the bag. The probability that the number on it is a multiple of 3 is

(a) 5/10 (b) 2/5 (c) 1/5 (d) 3/10

Sol.S = $1,2,3,....20$ n (S) = 20

E : Multiple of 3

E = $3,6,9,12,15,18$ n $\in$ = 6

P $\in$ = $6/20$ = $3/10$

$\therefore$ (d) is correct

22. Find the probability that a four digit number comprising the digits 2, 5, 6 and 7 would be divisible by 4.

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

Sol. 2,5,6,7

n (S) = $^4P_4$ = 4! = 24

E : No divisible by 4 . [Last 2 digit divisible by 4]

I) $\underbrace{\quad}_{^2P_2}$ 5 2 = $^2P_2\,{}^1P_1\,{}^1P_1 = 2$

II) $\underbrace{\quad}_{^2P_2}$ 5 6 = $^2P_2\,{}^1P_1\,{}^1P_1 = 2$

III) $\underbrace{\quad}_{^2P_2}$ 7 2 = $^2P_2\,{}^1P_1\,{}^1P_1 = 2$

IV) $\underbrace{\quad}_{^2P_2}$ 7 6 = $^2P_2\,{}^1P_1\,{}^1P_1 = 2$

N $\in$ = 2+ 2 + 2 + 2 = 4

P $\in$ = $8/24$ = $1/3$

$\therefore$ (b) is correct

23. A number is selected from the set S = {1, 2, 3, 4 ….25}. The probability, that it would be divisible by 4 or 7, is

(a) 0.26 (b) 0.46 (c) 0.36 (d) None of these

Sol. S = { 1, 2 3 , …. 25} n (S) = 25

Divisible by 4 or 7

E = $4,8,12,16,20,24,7,14,21$ n $\in$ = 9

P $\in$ = $\frac{n \in}{n\ S}$ = $\frac{9}{25}$ = 0.36

$\therefore$ (c) is correct

24. A bag contains 30 balls numbered from 1 to 30. One ball is drawn at random. The probability that the number of the drawn ball will be multiple of 3 or 7 is

(a) 7/15 (b) 13/30 (c) 1/2 (d) None of these.

Sol. S = (1,2,3,……….30} n (S) = 30

Divisible by 3 or 7

∈ = {3,6,9,12,15,18,21,24,27,30 , 7,14,28}

n ∈ = 13

p ∈ = $^{13}\!/_{30}$

∴ (b) is correct

25. A bag contains 6 green and 5 red balls. One ball is drawn at random. The probability of getting a red ball is

(a) 5/11 (b)6/11 (c) 6/5 (d) None of these.

Sol. G R

6 5 = 11 balls

P (Red ball) = $^{5}\!/_{11}$

∴ (a) is correct

26. Out of numbers 1 to 120, one is related at random what is the probability that it is divisible by 8 or 10.

(a)23/120 (b) 18/125 (c) 32/120 (d) 25/120

Sol. S = {1,2,3,…………120} n (S) = 120

Divisible by 8 or 10

∈ = {8,16,24,32,40,48,56,64,72,80,88,96,104,112,120,10,20,30,50,60,70,90,100,110

n ∈ = 24

P ∈ = $^{24}\!/_{120}$ = $^{1}\!/_{5}$

∴ (d) is correct

27. There are 10 balls numbered from 1 to 10 in a box. If one of them is selected at random, what is the probability that the number printed on the ball would be an odd number greater that 4?

(a) 0.50 (b) 0.40 (c) 0.60 (d) 0.30

Sol. S = {1,2,3, ….. 10} n (S) = 10

∈ : odd no > 4

∈ = {5,7,9} n ∈ = 3

P ∈ = $^{3}\!/_{10}$ = 0.30

∴ (d) is correct

28. If the letters of the word ATTEMPT are written down at random, the chance that all Ts are consecutive is

(a) 1/42 (b) 6/7 (c) 1/7 (d) 1/2

Sol. ATTEMPT = 7 letters

TTT = 3, A,E,M,P = 4 = 7 letters

1 + 4 = 5 sets

n(S) = ${}^7P_7$ = 7!

n (A) = ${}^5P_5\ {}^3P_3$ = 5! 3!

P(A) = $\dfrac{5!3!}{7!} = \dfrac{5!\times 6}{7\times 6\times 5!} = {}^1\!/_7$

∴ (c) is correct

29. 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

Sol. HOME = 4 letters

N (S) = ${}^4P_2 = 4\times 3$ = 12 letters

None is a Vowel

O , E H,M = 4 letters

n $\in$ = ${}^2P_2$ = 2

P $\in$ = $\dfrac{2}{12} = \dfrac{1}{6}$

∴ (a) is correct

30. If a coin is tossed twice, then the events 'occurrence of one head', 'occurrence of 2 heads' and 'occurrence of no head' are

(a) Independent (c) Not equally likely

(b) Equally likely (d) Both (a) and (b)

Sol. S = {HH,HT,TH,TT}

$$\left.\begin{array}{l} \text{P \{occurrence of 1 head\}} = {}^2\!/_4 = {}^1\!/_2 \\ \text{P \{occurrence of 2 head\}} = {}^1\!/_4 \\ \text{P(occurrence of no head\}} = {}^1\!/_4 \end{array}\right\} \text{Not equal}$$

∴ (c) is correct

31. If an unbiased coin is tossed twice, the probability of obtaining at least one tail is

(a) 0.25 (b) 0.50 (c) 0.75 (d) 1.00

Sol. S = {HH,HT,TH,TT} n (S) = 4

$\in$: atleast one tail

$\in$: {HT , TH,TT} n $\in$ = 3

P $\in$ = $3/4$ = 0.75

$\therefore$ (c) is correct

32. A coin is tossed two times. The toss resulted in one head and one tail. What is the probability that the first throw resulted in tail?

(a) 1/3 (b) 1/4 (c) 1/2 (d) None of these

Sol. S = {HT , TH} N (s) = 2

$\in$: First throw is tail

$\in$ = {TH} n $\in$ = 1

P $\in$ = $1/2$

$\therefore$ (c) is correct

33. Two unbiased coins are tossed. The probability of obtaining one head and one tail is

(a) 1/4 (b) 2/4 (c) 3/4 (d) None

Sol. S = {HH , HT,TH,TT} n (S) = 4

$\in$ = 1 head & 1 tail

$\in$ = {HT, TH} n $\in$ = 2

P $\in$ = $2/4 = \frac{1}{2}$

$\therefore$ (b) is correct

34. Two unbiased coins are tossed. The probability of obtaining atleast one head is

(a) 1/4 (b) 2/4 (c) 3/4 (d) 0

Sol. S = {HH,HT,TH,TT} n (S) = 4

$\in$ = atleast one head

$\in$ = {HH,HT,TH} N $\in$ = 3

$\in$ = $3/4$

$\therefore$ (c) is correct

35. When two unbiased coins are tossed, the probability of getting both heads or both tails is

(a) 1/2 (b) 3/4 (c) 1/4 (d) 0

Sol. $S = \{HH, HT, TH, TT\}$ $n(S) = 4$

$\in$: Both Heads or Both tails

$\in$: $\{HH, TT\}$ $n(\in) = 2$

$P(\in) = 2/4 = 1/2$

$\therefore$ (a) is correct

36. When 3 unbiased coins are tossed. The probability of obtaining not less than 3 heads is

(a) 2/4 (b) 1/4 (c) 3/4 (d) 1/8

Sol. $S = \{HHH, HHT, HTH, HTT, THH, TTH, THT, TTT\}$ $n(S) = 8$

$\in$: Not less than 3 heads

$\in$: $\{HHH\}$ $n(\in) = 1$

$P(\in) = 1/8$

$\therefore$ (d) is correct

37. Three coins are tossed together. The probability of getting exactly two heads is

(a) 5/8 (b) 3/8 (c) 1/8 (d) None

Sol. $S = \{HHH, HHT, HTH, HTT, THH, TTH, THT, TTT\}$ $n(S) = 8$

$\in$: Exactly 2 heads

$\in$: $\{HHT, HTH, THH\}$ $n(\in) = 3$

$P(\in) = 3/8$

$\therefore$ (b) is correct

38. The probability that atleast one head appears in a single throw of three fair coins is

(a) 1/8 (b) 7/8 (c) 1/3 (d) None

Sol. $S = \{HHH, HHT, HTH, TTH, THH, THT, HTT, TTT\}$ $n(S) = 8$

$\in$: atleast 1 head

$\in$: $\{HHH, HHT, HTH, TTH, THH, THT, HTT\}$ $n(\in) = 7$

$$P(\in) = \frac{n(\in)}{n(s)} = 7/8$$

$\therefore$ (b) is correct

39. 4 coins are tossed. The probability that there are 2 heads is

(a) 1/2 (b) 3/8 (c) 1/8 (d) None

Sol. Coin 1 = {H,H,H,H,H,H,T,T,T,T,T,T}

Coin 2 = {H,H,H,H,T,T,T,T,H,H,H,H,T,T,T,T

Coin 3 = {H,H,T,T,H,H,T,T,H,H,T,T,H,H,T,T}

Coin 4 = {H,T, H,T,H,T,H,T,H,T,H,T,H,T,H,T}

n(S) = 16

∈ : 2 heads

∈: {HHTT,HTHT,HTTH,THHT,THTH,TTHH}

n ∈ = 6

$P\ \in\ = 6/10 = 3/8$

∴ (b) is correct

40. Probability of throwing an even number with an ordinary six faced die is -

(a) 1/2 (b) 1 (c) 0 (d) -1/2

Sol. S = {1, 2 ,3 , 4 , 5,6} n(S) = 6

∈ :Even number ∈ : {2,4,6} n ∈ = 3

$P\ \in\ = 3/6 = 1/2$

∴ (a) is correct

41. The probability of throwing more than 5 in a single throw from an ordinary die is -

(a) 5/6 (b) 1 (c) 1/6 (d) 0

Sol. S = {1,2,3,4,5,6} n(S) = 6

∈ : more than 5 ∈ : {6} n ∈ = 1

$P\ \in\ = 1/6$

∴ (c) is correct

42. If two unbiased dice are rolled, what is the probability of getting points neither 6 nor 9?

(a) 0.25 (b) 0.50 (c) 0.75 (d) 0.80

Sol. S = {(1,1) , (1,2) , (1,3) , (1,4) , (1,5) , (1,6) (2,1) ,(2,2) , (2,3) , (2,4) , (2,5) , (2,6) (3,1) (3,2),(3,3) , (3,4) , (3,5) , (3,6) , (4,1), (4,2) , (4,3), (4,4), (4,5), (4,6), (5,1) , (5,2) , (5,3) , (5,4) , (5,5) , (5,6) , (6,1) , (6,2) , (6,3) , (6,4) , (6,5) , (6,6)}

n(S) = 36

∈ : neither 6 nor 9

∈: {(1,1) , (1,2) , (1,3) , (1,4) , (1,6)

(2,1) , (2,2) , (2,3) , (2,5) , (2,6)

(3,1) , (3,2) , (3,4) , (3,5)

(4,1) , (4,3) , (4,4) , (4,6)

(5,2) , (5,3) , (5,5) , (5,6)

(6,1) , (6,2) , (6,4) , (6,5) , (6,6)}

n ∈ = 27

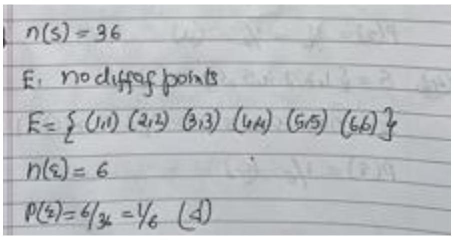
$P(\in) = {}^{27}\!/_{36} = {}^{3}\!/_{4} = 0.75$

$\therefore$ (c) is correct

43. If two unbiased dice are rolled together, what is the probability of getting no difference of points?

(a) 1/2 (b) 1/3 (c) 1/5 (d) 1/6

Sol.



$n(s) = 36$

E: no diff of points

$E = \{(1,1)\ (2,2)\ (3,3)\ (4,4)\ (5,5)\ (6,6)\}$

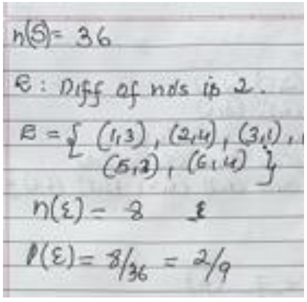
$n(E) = 6$

$P(E) = 6/36 = 1/6$ (d)

44. Two dice are thrown together. The probability that 'the event the difference of nos shown is 2' is

(a) 2/9 (b) 5/9 (c) 4/9 (d) 7/9

Sol.



$n(S) = 36$

E: Diff of nos is 2.

$E = \{(1,3), (2,4), (3,1), \ldots (5,3), (6,4)\}$

$n(E) = 8$

$P(E) = 8/36 = 2/9$

45. Two dice are thrown together. The probability of the event that the sum of nos. shown is greater than 5 is

(a) 13/18 (b) 15/18 (c) 1 (d) None

Sol. n(s) = 36

$\in$ = {(1,5) , (1,6) , (2,4) , (2,5) , (2,6)
(3,3) , (3,4) , (3,5) , (3,6)
(4,2) , (4,3) , (4,4) , (4,5) , (4,6)
(5,1) , (5,2) , (5,3) , 5,4) , (5,5) , (5,6)
(6,1) , (6,2) , (6,3) , (6,4) , (6,5) , (6,6)}

$n(\in) = 26$

$$P(\in) = \frac{26}{36} = \frac{13}{8}$$

$\therefore$ (a) is correct

46. In a single throw with two dice the probability of getting a sum of five on the two dice is

(a) 1/9 (b) 5/36 (c) 5/9 (d) None of these.

Sol. n (s) = 36

$\in$ = {(1,4) , (2,3) , (3,2) , (4,1)} n $\in$ = 4

$$P \in = \frac{4}{36} = 1/9$$

$\therefore$ (a) is correct

47. What is the chance of throwing atleast 7 in a single cast with 2 dice?

(a) 5/12 (b) 7/12 (c) 1/4 (d) 17/36

Sol. n(s) = 36

$\in$ = {(1,6) , (2,5) , (2,6)

(3,4) , (3,5) , (3,6)

(4,3) , (4,4) , (4,5) , (4,6)

(5,2) , (5,3) , (5,4) , (5,5) , (5,6)

(6,1) , (6,2) , (6,3) , (6,4) , (6,5) , (6,6)}

n $\in$ = 21

$$P \in = \frac{21}{36} = \frac{7}{12}$$

$\therefore$ (b) is correct

48. The chance of getting a sum of 10 in a single throw with two dice is

(a) 10/36 (b) 1/12 (c) 5/36 (d) None

Sol. n(s) = 36

$\in$ = {(4,6) , (5,5) , (6,4)}

n $\in$ = 3

$$P \in = 3/36 = 1/12$$

$\therefore$ (b) is correct

49. Two dice with face marked 1, 2, 3, 4, 5, 6 are thrown simultaneously and the points on the dice are multiplied together. The probability that product is 12 is

(a) 4/36 (b) 5/36 (c) 12/36 (d) None

Sol. n(s) = 36

$\in$ = {(2,6) , (3,4) , (4,3) , (6,2)}

n $\in$ = 4

$$P \in = 4/36 = \frac{1}{9}$$

$\therefore$ (a) is correct

50. A card is drawn from a well-shuffled pack of playing cards. The probability that it is a spade is

(a) 1/13 (b) 1/4 (c) 3/13 (d) None

Sol. n(s) = ${}^{52}C_1$ = 52

n(A) = ${}^{13}C_1$ = 13

P(A) = $\frac{13}{52}$ = $1/4$

∴ (a) is correct

51. A card is drawn from a well-shuffled pack of playing cards. The probability that it is a king is

(a) 1/13 (b) 1/4 (c) 4/13 (d) None

Sol. n(s) = ${}^{52}C_1$ = 52

n(A) = ${}^{4}C_1$ = 4

P(A) = $\frac{4}{52}$ = $\frac{1}{13}$

∴ (a) is correct

52. The probability that a card drawn at random from the pack of playing cards may be either a queen or an ace is

(a) 2/13 (b) 11/13 (c) 9/13 (d) None

Sol. n(s) = ${}^{52}C_1$ = 52

n(A) = ${}^{4}C_1$ + ${}^{4}C_1$ = 4 + 4 = 8

P(A) = $\frac{8}{52}$ = $\frac{2}{13}$

∴ (a) is correct

53. A card is drawn from a pack of 52 cards. What is the probability that it is neither a black card nor a king?

(a) 6/13 (c) 1/6

(b) 5/13 (d) None of these.

Sol. n(s) = ${}^{52}C_1$ = 52

n(A) = ${}^{24}C_1$ = 24

P(A) = $\frac{24}{52}$ = $6/13$

∴ (a) is correct

54. What is the chance of picking a heart or a queen not of heart from a pack of 52 cards?

(a) 17/52 (b) 1/3 (c) 4/13 (d) 3/13

Sol. n(s) = ${}^{52}c_1$ = 52

n(A) = ${}^{13}c_1 + {}^{3}c_1$ =13 + 3 = 16

P(A) = $16/52 = 4/13$

$\therefore$ (c) is correct

55. Two cards are drawn from a well shuffled pack of playing cards. Find the probability that both are ace.

(a) 1:221 (b) 2:221 (c) 10:21 (d) None of these

Sol.

$n(S) = {}^{52}C_2 = \frac{52 \times 51}{2 \times 1} = (26 \times 51)$

A: 2 Ace cards

$n(A) = {}^{4}C_2 = \frac{4 \times 3}{2 \times 1} = 6$

$P(A) = \frac{\cancel{6}^{\,3,\,1}}{\underset{13}{\cancel{26}} \times \underset{17}{\cancel{51}}} = \frac{1}{221}$ (a)

56. Two cards are drawn from a well shuffled pack of 52 cards. Find the probability that they are both kings if the first is replaced.

(a) 1/13 (b) 1/169 (c) 1/221 (d) None of these.

Sol. P(Both Kings) = P(1st King card) $\times$ P(2nd King card)

$= \frac{4}{52} \times \frac{4}{52}$ [$\because$ 1st Card is replaced]

$= \frac{1}{13} \times \frac{1}{13}$

$= \frac{1}{169}$

$\therefore$ (b) is correct

57. A card is drawn from a pack of playing cards and then another card is drawn without the first being replaced. What is the probability of getting two kings?

(a) 7/52 (b) 1/221 (c) 3/221 (d) None of these.

Sol. P (Both king) = P (1st King card) $\times$ P(2nd king card)

$= \frac{4}{52} \times \frac{3}{51}$ [$\because$ 1st card is not replaced]

$= \frac{1}{13} \times \frac{1}{17}$

$= \frac{1}{221}$

∴ (b) is correct

58. A card is drawn from a pack of playing cards and then another card is drawn without the first being replaced. What is the probability of getting two hearts?

(a) 1/17 (b) 1/4 (c) 2/17 (d) None of these.

Sol. P(Two heart card) = P (1st heart card) × P(2nd Heart card)

$= \frac{13}{52} \times \frac{12}{51}$ [1st card is not replaced

$= \frac{1}{4} \times \frac{4}{17}$

$= \frac{1}{17}$

∴ (a) is correct

59. If probability of drawing a spade from a well- shuffled pack of playing cards is 1/4 then the probability that of the card drawn from a well- shuffled pack of playing cards is 'not a spade' is

(a) 1 (c) 1/4

(b) 1/2 (d) 3/4 .

Sol.

$P(\text{spade}) = 1/4$

$P(\text{not a spade}) = 1 - 1/4 = 3/4 \Rightarrow (d)$

60. A card is drawn from each of two well-shuffled packs of cards. The probability that atleast one of them is an ace is

(a)10/169 (b) 25/169 (c) 1/169 (d) 8/169

Sol. P(No Ace) = $\frac{48}{52} \times \frac{48}{52} = \frac{12}{13} \times \frac{12}{13}$

P(at least one Ace) = 1 – P(no Ace)

$= 1 - \frac{144}{169}$

$= \frac{25}{169}$

∴ (a) is correct

61. If a card is drawn at random form a pack of 52 cards, what is the chance of getting a Spade or an ace?

(a) 4/13 (b) 5/13 (c) 0.25 (d) 0.20

Sol.

$n(S) = {}^{52}C_1 = 52.$

E : Space or Ace

$n(E) = {}^{13}C_1 + {}^{3}C_1 = 13+3 = 16$

$P(E) = \frac{16}{52} = \frac{4}{13}$ (a)

62. The probability of drawing a black ball from a bag containing 8 white and 5 black balls

(a) 5/13 (b) 8/13 (c) 1/2 (d) 1

Sol.

W B
8 5 = 13 Balls

Selection = 1 Ball

$n(S) = {}^{13}C_1 = 13$

A : Black ball

$n(A) = {}^{5}C_1 = 5$

$P(A) = 5/13 \Rightarrow$ (a)

(d) 1

63. A bag contains 10 red and 10 green balls. A ball is drawn from it. The probability that it will be green is

(a) 1/10 (b) 1/3 (c)1/2 (d) None of these.

Sol.

R G
10 10 = 20 Balls.

$P(\text{Green Ball}) = \frac{10}{20} = \frac{1}{2}$ (c)

64. A bag contains 5 red and 3 yellow balls. Two balls are drawn at random one after the other without replacement. The probability that both balls drawn are yellow is

(a) 9/64 (b) 3/28 (c) 1/7 (d) None of these.

Sol.

R Y
5 3 = 8

$P(\text{2 yellow Balls}) = P(\text{1st yellow Ball})\, P(\text{2nd yellow Ball})$

$= \frac{3}{8} \times \frac{2}{7}$ [∵ without replacement]

$= \frac{3}{28}$ (b)

65. A bag contains 3 red, 6 white, and 7 blue balls. If two balls are drawn at random, then the probability of getting both white balls is:

(a) 5/40 (b) 6/40 (c) 7/40 (d) 14/40

Sol.

R W B
3 6 7 = 16 Balls

$P(\text{2 White Balls}) = \frac{{}^6C_2}{{}^{16}C_2} = \frac{6\times5}{16\times15} = \frac{1}{8}$

$= \frac{5}{40}$ (a)

66. A box contains 6 red, 7 white and 4 blue balls. The number of ways in which the selection of three balls can be made so that none is red is-

(a) 561 (b) 156 (c) 165 (d) 651

Sol.

R W B
6 7 4 = 17 Balls
Selection = 3 Balls
None is Red

No. of ways $= {}^{11}C_3 = \frac{11\times10\times9}{3\times2\times1} = 165$ (c)

67. There are two boxes containing 5 white and 6 blue balls and 3 white and 7 blue balls respectively. If one of the boxes is selected at random and a ball is drawn from it, then the probability that the ball is blue is
(a) 115/227 (b) 83/250 (c) 137/220 (d) 127/250

Sol.

Box 1 Box 2
W B W B
5 6 = 11 3 7 = 10

1ST Box is Selected and Blue Ball is drawn

$P\left(\begin{matrix}\text{Box 1 is selected} \\ \text{and Blue Ball is drawn}\end{matrix}\right) = \frac{1}{2}\times\frac{6}{11} = \frac{6}{22}$

2nd Box is Selected and Blue Ball is drawn

$P\left(\begin{matrix}\text{Box 2 is selected} \\ \text{and Blue Ball is drawn}\end{matrix}\right) = \frac{1}{2}\times\frac{7}{10} = \frac{7}{20}$

$\therefore P\left(\begin{matrix}\text{Box is selected} \\ \text{and blue ball is drawn}\end{matrix}\right) = \frac{6}{22}+\frac{7}{20}$

$= \frac{120+154}{(22)(20)} = \frac{274}{(22)(20)}$

$= \frac{137}{220} \Rightarrow$ (c)

68. 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) 11/21 (b) 5/7 (c) 10/21 (d) 2/7

Sol.

R G B
2 3 2 = 7 Balls
Selection = 2 Balls

$P(\text{none is blue}) = \frac{{}^5C_2}{{}^7C_2} = \frac{5\times4}{7\times6} = \frac{10}{21}$ (c)

69. A box contains 5 white and 7 black balls. Two successive draws of 3 balls are made (i) with replacement (ii) without replacement. The probability that the first draw would produce white balls and the second draw would produce black balls are respectively

(a) 6/321 and 3/926
(c) 35/144 and 35/108
(b) 1/20 and 1/30
(d) 7/968 and 5/264

Sol.

i) With Replacement

W B
5 7 = 12 Balls

$$P\left(\begin{matrix}1^{st}\text{ White \&}\\ 2^{nd}\text{ Black}\end{matrix}\right) = \frac{{}^5C_3}{{}^{12}C_3} \times \frac{{}^7C_3}{{}^{12}C_3}$$

$$= \frac{5\times4\times3}{12\times11\times10} \times \frac{7\times6\times5}{12\times11\times10}$$

$$= \frac{1}{22} \times \frac{7}{44} = \frac{7}{968} \Rightarrow (d)$$

ii) Without Replacement

W B
5 7 = 12 Balls

$$P\left(\begin{matrix}1^{st}\text{ white \&}\\ 2^{nd}\text{ Black}\end{matrix}\right) = \frac{{}^5C_3}{{}^{12}C_3} \times \frac{{}^7C_3}{{}^{9}C_3}$$

$$= \frac{5\times4\times3}{12\times11\times10} \times \frac{7\times6\times5}{9\times8\times7}$$

$$= \frac{1}{22} \times \frac{5}{12}$$

$$= \frac{5}{264} \Rightarrow (d).$$

70.8 identical balls are placed at random in three bags. What is the probability that the first bag will contain 3 balls?

(a) 0.2731 **(b) 0.3256** **(c) 0.1924** **(d) 0.3443**

Sol.

71. There are two urns containing 5 red and 6 white balls and 3 red and 7 white balls respectively. If two balls are drawn from the first urn without replacement and transferred to the second urn and then a draw of another two balls is made from it, what is the probability that both the balls are red?

(a) $\frac{55}{726}$ (b) $\frac{65}{726}$ (c) $\frac{75}{726}$ (d) $\frac{85}{126}$

Sol. URN 1 URN 2

R W R W

5 6 = 11 Balls 3 7 = 10 Balls

I) Red Ball is drawn from URN I transferred to URN 2 and 2 Red balls are drawn from URN 2

$$= \frac{5c_2}{11c_2} \times \frac{5c_2}{12c_2}$$

$$= \frac{5\times4}{11\times10}\times\frac{5\times4}{12\times11}$$

$$= \frac{2}{11}\times\frac{5}{3}$$

$$= \frac{10}{363}$$

II) White ball is drawn from URN 1 transferred to URN 2 and 2 Red balls are drawn from URN 2

$$= \frac{6c_2}{11c_2}\times\frac{3c_2}{12c_2}$$

$$= \frac{6\times5}{11\times10}\times\frac{3\times2}{12\times11}$$

$$= \frac{3}{11}\times\frac{1}{22} = \frac{3}{242}$$

∴ Required Probability = Case I + Case II

$$= \frac{10}{363} + \frac{3}{242}$$

$$= \frac{20+9}{121\quad 3\quad 2 \Rightarrow \text{LCM}}$$

$$= \frac{29}{726}$$

∴ (b) is correct

72. If one ball is drawn at random from each of that three boxes containing 3 white and 1 black, 2 white and 2 black, 1 white and 3 black balls then the probability that 2 white and 1 black balls will be drawn, is -

(a) 13/32 (b) 1/4 (c) 1/32 (d) 3/16

Sol.

(72) Box 1: W B, 3 1 = 4 Balls
Box 2: W B, 2 2 = 4 Balls
Box 3: W B, 1 3 = 4

	Box 1	Box 2	Box 3	
Case (I)	1 W	1 W	1 B	$= \frac{3}{4}\times\frac{2}{4}\times\frac{3}{4} = \frac{18}{64}$
Case II	1 W	1 B	1 W	$= \frac{3}{4}\times\frac{2}{4}\times\frac{1}{4} = \frac{6}{64}$
Case III	1 B	1 W	1 W	$= \frac{1}{4}\times\frac{2}{4}\times\frac{1}{4} = \frac{2}{64}$

Total ways $= \frac{26}{64}$

$= \frac{13}{32}$ (a)

73. There are two urns. The first urn contains 3 red and 5 white balls whereas second contains 4 red and 6 white balls. A ball is taken at random from the first urn and is transferred to the second urn. Now another ball is selected at random from the second urn. The probability that the second ball would be red is

(a) 7/20 (b) 35/88 (c) 17/52 (d) 3/20

Sol.

(73) URN 1 — R W: 3 5 = 8 Balls; URN 2 — R W: 4 6 = 10 Balls

Case I: Red Ball is selected from 1st URN, transfered to 2nd URN and a Red ball is selected from URN 2.

$$= \frac{3}{8} \times \frac{5}{11} = \frac{15}{88}$$

Case II: White Ball is selected from URN 1, transfered to URN 2 and a Red ball is selected from URN 2.

$$= \frac{5}{8} \times \frac{4}{11} = \frac{20}{88}$$

∴ Required Probability = Case I + Case II

$$= \frac{15}{88} + \frac{20}{88} = \frac{35}{88} \Rightarrow (b)$$

74. A bag contains 8 red and 5 white balls. Two successive draws of 3 balls are made without replacement. The probability that the first draw will produce 3 white balls and the second 3 red balls is

(a) 5/223 (b) 6/257 (c) 7/429 (d) 3/54

Sol.

R W: 8 5 = 13 Balls

P(3 white and 3 Red) = P(1st draw of 3 white Balls) × P(2nd draw of 3 Red Balls)

$$= \frac{^5C_3}{^{13}C_3} \times \frac{^8C_3}{^{10}C_3} \quad \boxed{\because \text{without Replacement}}$$

$$= \frac{5\times4\times3}{13\times12\times11} \times \frac{8\times7\times6}{10\times9\times8}$$

$$= \frac{7}{429} \Rightarrow (c)$$

75. There are three boxes with the following composition:

Box I: 5 Red + 7 White + 6 Blue balls

Box II: 4 Red + 8 White + 6 Blue balls

Box III: 3 Red + 4 White + 2 Blue balls

If one ball is drawn at random, then what is the probability that they would be of same colour?

(a) 89/729 (b) 97/729 (c) 82/729 (d) 23/32

Sol.

Box1	Box2	Box3
R W B	R W B	R W B
5 7 6 = 18	4 8 6 = 18	3 4 2 = 9

$$P(\text{same colour}) = P(\text{Red colour}) + P(\text{White colour}) + P(\text{Blue colour})$$

$$= \frac{5}{18}\times\frac{4}{18}\times\frac{3}{9} + \frac{7}{18}\times\frac{8}{18}\times\frac{4}{9} + \frac{6}{18}\times\frac{6}{18}\times\frac{2}{9}$$

$$= \frac{60}{2916} + \frac{224}{2916} + \frac{72}{2916}$$

$$= \frac{356}{2916} = \frac{89}{729} \Rightarrow (a)$$

76. There are three boxes with the following compositions:

Colour → Box↓	**Blue**	**Red**	**White**	**Total**
I	5	8	10	23
II	4	9	8	21
III	3	6	7	16

One ball is drawn from each box. What is the probability that they would be of the same colour?

(a) $\frac{1052}{7728}$ (b) $\frac{1897}{7728}$ (c) $\frac{3356}{7728}$ (d) $\frac{4856}{7728}$

Sol.

$$\text{Required Probability} = P(\text{Blue}) + P(\text{Red}) + P(\text{White})$$

$$= \frac{5}{23}\times\frac{4}{21}\times\frac{3}{16} + \frac{8}{23}\times\frac{9}{21}\times\frac{6}{16} + \frac{10}{23}\times\frac{8}{21}\times\frac{7}{16}$$

$$= \frac{60}{7728} + \frac{432}{7728} + \frac{560}{7728}$$

$$= \frac{1052}{7728} \Rightarrow (a)$$

77. A packet of 10 electronic components is known to include 2 defectives. If a sample of 4 components is selected at random from the packet, what is the probability that the sample does not contain more than 1 defective?

(a) 1/3 (b) 2/3 (c) 13/15 (d) 3/15

Sol. Defective Non defective

2 8 = 10

Selection= 4

n(S) = $^{10}C_4 = \dfrac{10\times9\times8\times7}{4\times3\times2\times4}$ = 210

E : Not more than 1 defective [i.e. 0 defective or 1 defective]

I) Defective Non defective

0 4 = 4 selection

$= {}^2C_0\,{}^8C_4 = (1)\,\dfrac{8\times7\times6\times5}{4\times3\times2\times1} = 70$

II) Defective Non defective

1 3 = 4 selection

$= {}^2C_1\ {}^8C_2 = (2)\,\dfrac{8\times7\times6}{3\times2\times1} = 112$

$\therefore$ n $\in$ = 70 + 112 = 182

P $\in$ = $\dfrac{182}{210} = \dfrac{13}{15}$

$\therefore$ (c) is correct

78. What is the chance of getting at least one defective item if 3 items are drawn randomly from a lot containing 6 items of which 2 are defective item?

(a) 0.30 (b) 0.20 (c) 0.80 (d) 0.50

Sol.

Def Non-Def

2 4 = 6

Selection = 3

$n(S) = {}^6C_3 = \dfrac{6\times5\times4}{3\times2\times1} = 20$

atleast one defective

E' : No defective

Def NonDef

0 3 = 3 selection

$n(E') = {}^2C_0\,{}^4C_3 = (1)\,{}^4C_1 = 4$

$P(E') = \dfrac{4}{20} = 1/5$

P(atleast 1 Def) = 1 − P(no. defective)

= 1 − P(E')

= 1 − 1/5

= 4/5

= 0.80 (c)

79. The independent probabilities that the three sections of a costing department will encounter a computer error are 0.2, 0.3 and 0.1 per week respectively. What is the probability that there would be one and only one computer error per week?

(a) 0.25 (b) 0.60 (c) 0.40 (d) 0.65

Sol.

ERROR : A, B, C
NO ERROR : A', B', C'

$P(A) = 0.2$ $P(A') = 0.8$
$P(B) = 0.3$ $P(B') = 0.7$
$P(C) = 0.1$ $P(C') = 0.9$

$$P(\text{only one Error}) = P(A \cap B' \cap C') + P(A' \cap B \cap C') + P(A' \cap B' \cap C)$$

$$= P(A)P(B')P(C') + P(A')P(B)P(C') + P(A')P(B')P(C) \quad [\because \text{Independent Events}]$$

$$= (0.2)(0.7)(0.9) + (0.8)(0.3)(0.9) + (0.8)(0.7)(0.1)$$

$$= 0.126 + 0.216 + 0.056$$

$$= 0.398 \approx 0.40 \ (c).$$

80. The independent probabilities that the three sections of a costing department will encounter a computer error are 0.2, 0.3 and 0.1 per week respectively. What is the probability that there would be at least one computer error per week?

(a) 0.25 (b) 0.50 (c) 0.94 (d) 0.65

Sol.

Error : A, B, C
No. Error : A', B', C'

$P(A) = 0.2$ $P(A') = 0.8$
$P(B) = 0.3$ $P(B') = 0.7$
$P(C) = 0.1$ $P(C') = 0.9$

$$P(\text{atleast one Error}) = 1 - P(\text{no Error})$$

$$= 1 - P(A' \cap B' \cap C')$$

$$= 1 - P(A')P(B')P(C') \quad [\because \text{Independent Events}]$$

$$= 1 - (0.8)(0.7)(0.9)$$

$$= 1 - 0.504$$

$$= 0.496$$

$$\approx 0.50 \ (b).$$

81. It is given that a family of 2 children has a girl, what is the probability that the other child is also a girl?

(a) 0.50 (b) 0.75 (c) 1/3 (d) 2/3

Sol.

$S = \{BG, GB, GG\}$

$n(S) = 3$

E: Other child also girl

$E = \{GG\}$ $n(E) = 1$

$P(E) = 1/3 \Rightarrow$ (c).

82. A class consists of 10 boys and 20 girls of which half the boys and half the girls have blue eyes. Find the probability that a student chosen random is a boy and has blue eyes.

(a) 1/6 (b) 3/5 (c) ½ (d) None of these

Sol.

B: 10, G: 20 = 30 Students

B (10) → Blue Eyes, Non Blue eyes
G (20) → Blue Eyes, Non-Blue Eyes

$5 + 5 + 10 + 10 = 30$

P(It is a Boy and has blue eyes) $= 5/30 = 1/6 \Rightarrow$ (a).

83. Mr. Roy is selected for three separate posts. For the first post, there are three candidates, for the second, there are five candidates and for the third, there are 10 candidates. What is the probability that Mr. Roy would be selected?

(a) $\frac{11}{25}$ (b) $\frac{13}{25}$ (c) $\frac{17}{25}$ (d) $\frac{19}{25}$

Sol.

84. Following are the wages of 8 workers in rupees: 50, 62, 40, 70, 45, 56, 32, 45

If one of the workers is selected at random, what is the probability that his wage would be lower than the average wage?

(a) 0.625 (b) 0.500 (c) 0.375 (d) 0.450

Sol.

Wages (x_i) $\Rightarrow$ 32, 40, 45, 45, 50, 56, 62, 70

$$\bar{x} = \frac{\sum x_i}{n} = \frac{32+40+45+45+50+56+62+70}{8}$$

$$\bar{x} = 50$$

$$P(\text{wages} < 50) = 4/8 = 0.5 \Rightarrow (b).$$

85. A committee of 7 members is to be formed from a group comprising of 8 gentlemen and 7 ladies. What is the probability that the committee would comprise of at least 2 ladies?

(a) $\frac{189}{429}$ (b) $\frac{392}{429}$ (c) $\frac{228}{429}$ (d) $\frac{95}{429}$

Sol.

86. There are 7 seats in a row. Three persons take seats at random. The Probability that the middle seat is always occupied and no two persons are consecutive is

(a) 9/70 (b) 9/35 (c) 4/35 (d) 1/5

87. The probability that A speaks truth is 4/5, while the probability for B is 3/4. The probability that they contradict each other when asked to speak on a fact is

(a) 3/20 (b) 1/5 (c) 7/20 (d) 4/5

Sol.

$P(A) = 4/5$ $P(A') = 1/5$

$P(B) = 3/4$ $P(B') = 1/4$

$P(\text{They Contradict each other}) = P(A \cap B')$ or $P(A' \cap B)$

$= P(A)\,P(B') + P(A')\,P(B)$

$= \frac{4}{5} \times \frac{1}{4} + \frac{1}{5} \times \frac{3}{4}$

$= \frac{4}{20} + \frac{3}{20}$

$= \frac{7}{20} \Rightarrow (c).$

88. A problem in probability was given to three CA students A, B and C whose chances of solving it are 1/3, 1/5 and 1/2 respectively. What is the probability that the problem would be solved?

(a) 4/15 (b) 7/8 (c) 8/15 (d) 11/15

Sol.

$P(A) = 1/3 \qquad P(A') = 2/3$

$P(B) = 1/5 \qquad P(B') = 4/5$

$P(C) = 1/2 \qquad P(C') = 1/2$

$P\left(\text{Problem is solved}\right) = 1 - P(\text{Problem is not solved})$

$= 1 - P(A' \cap B' \cap C')$

$= 1 - P(A')\,P(B')\,P(C')$

$= 1 - \frac{2}{3} \times \frac{4}{5} \times \frac{1}{2}$

$= 1 - \frac{4}{15}$

$= 11/15$ (d)

89. If the overall percentage of success in an exam is 60, what is the probability that out of a group of 4 students, at least one has passed?

(a) 0.6525 (b) 0.9744 (c) 0.8704 (d) 0.0256

Sol.

$P(\text{success}) = \frac{60}{100} = p$

$p = \frac{6}{10}, \quad q = \frac{4}{10} \quad n = 4$

x = atleast one

$P(\text{atleast one}) = P(x \geq 1)$

$= 1 - P(x < 1)$

$= 1 - P(x = 0)$

$= 1 - {}^4C_0 \left(\frac{6}{10}\right)^0 \left(\frac{4}{10}\right)^4$

$= 1 - (1)(1)\frac{256}{10000}$

$= 1 - 0.0256$

$= 0.9744$ (b)

90. If the probability of a horse A winning a race is 1/6 and the probability of a horse B winning the same race is 1/4, what is the probability that one of the horses will win

(a) 5/12 (b) 7/12 (c) 1/12 (d) None

Sol.

$P(A) = 1/6 \quad P(B) = 1/4$

$P(A') = 5/6 \quad P(B') = 3/4$

$P\left(\begin{array}{c}\text{one of Horses} \\ \text{win}\end{array}\right) = P(\text{only A wins}) \text{ or } P(\text{only B wins})$

$= P(A \cap B') + P(A' \cap B)$

$= P(A)\,P(B') + P(A')\,P(B)$

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

$= 3/24 + 5/24 = \frac{8}{24} = \frac{1}{3}$ (d)

91. An experiment succeeds twice as often as it fails. What is the probability that in next five trials there will be three success.

(a)192/243 (b) 19/243 (c) 80/243 (d) 50/243

Sol.

$p \Rightarrow$ Success $q \Rightarrow$ failure

$p = 2q$

$p = 2(1-p)$

$p = 2 - 2p$

$3p = 2$

$p = 2/3, \; q = 1/3 \quad n = 5, \; x = 3$

$P(X=3) = {}^5C_3 \left(2/3\right)^3 \left(1/3\right)^2$

$= \frac{5 \times 4 \times 3}{3 \times 2 \times 1} \times \frac{8}{27} \times \frac{1}{9}$

$= \frac{80}{243} \Rightarrow$ (c).

92. If on an average 9 ships out of 10 return safely to a port. The probabilities that a ship returns safely is

(a) 1/10 (b) 8/10 (c) 9/10 (d) None

Sol.

$P\left(\begin{array}{c}\text{Ships} \\ \text{returns} \\ \text{safely}\end{array}\right) = 9/10 \Rightarrow$ (c)

93. A man can kill a bird once in five shots. The probabilities that a bird is not killed is

(a) 4/5 (b) 1/5 (c) 3/5 (d) 2/5

Sol.

$P(\text{Killing a bird}) = 1/5$

$P(\text{not killing a bird}) = 4/5 \Rightarrow (a)$

94. Rupesh is known to hit a target in 5 out of 9 shots whereas David is known to hit the same target in 6 out of 11 shots. What is the probability that the target would be hit once they both try?

(a) $\frac{1}{3}$ (b) $\frac{79}{99}$ (c) $\frac{58}{99}$ (d) $\frac{28}{99}$

Sol.

$P(\text{Rupesh}) = 5/9 \Rightarrow P(A)$

$\therefore P(A') = 4/9$

$P(\text{David}) \Rightarrow 6/11 \Rightarrow P(B)$

$P(B') = 5/11$

$P(\text{Target is hit}) = 1 - P(\text{Target is not hit})$

$= 1 - P(A' \cap B')$

$= 1 - P(A')\,P(B')$ [$\because$ Independent Events]

$= 1 - \frac{4}{9} \times \frac{5}{11}$

$= 1 - \frac{20}{99}$

$= 79/99 \Rightarrow (b)$

95. There are three persons A, B and C having different ages. The probability that A survives for another 5 years is 0.80, B survives for another 5 years is 0.6C and C survives for another 5 years is 0.50. The probabilities that A and B survive for another 5 years is 0.46, B and C survive for another 5 years is 0.32, A and C survive for another 5 years is 0.48 and probability that all will survive is 0.26. Find the probability that at least one of them survives for another 5 years.

(a) 0.80 (b) 0.90 (c) 0.78 (d) 0.64

Sol.

$P(A) = 0.80 \quad P(B) = 0.60 \quad P(C) = 0.50$

$P(A\cap B) = 0.46 \quad P(B\cap C) = 0.32 \quad P(A\cap C) = 0.48$

$P(A\cap B\cap C) = 0.26$

$P(\text{atleast one survives}) = P(A\cup B\cup C)$

$= P(A) + P(B) + P(C) - P(A\cap B) - P(B\cap C) - P(A\cap C) + P(A\cap B\cap C)$

$= 0.8 + 0.6 + 0.5 - 0.46 - 0.32 - 0.48 + 0.26$

$= 0.9 \quad (b)$

96. What is the probability that a leap year selected at random would contain 53 Saturdays?

(a) 1/7 (b) 2/7 (c) 1/12 (d) 1/4

Sol.

Total no. of days in a leap year = 366

Total no of days as per total weeks in a year = $52 \times 7 = 364$

$\therefore$ No of Extra days = 2

$S = \{SM, MT, TW, WTh, ThF, FS, SS\}$

$n(S) = 7$

$P(53 \text{ Saturdays}) = 2/7 \Rightarrow$ (b)

97. What is the probability that 4 children selected al random would have different birthdays?

(a) $\frac{364 \times 363 \times 362}{(365)^3}$ (b) $\frac{6 \times 5 \times 4}{7^3}$ (c) 1/365 (d) $(1/7)^3$

Sol.

$n(s) = \underset{\text{Child1}}{365} \; \underset{\text{Child2}}{365} \; \underset{\text{Child3}}{365} \; \underset{\text{Child4}}{365}$

$= (365)^4$

$n(A) = {}^{365}P_4$

$= (365 \times 364 \times 363 \times 362)$

$P(A) = \frac{n(A)}{n(S)} = \frac{\cancel{365} \times 364 \times 363 \times 362}{(365)^{\cancel{4}\,3}}$

$P(A) = \frac{(364 \times 363 \times 362)}{(365)^3} \Rightarrow$ (a).

98. There are 6 positive and 8 negative numbers. Four numbers are selected at random without replacement and multiplied. Find the probability that the product is positive:

(a) 420/1001 (b) 409/1001 (c) 70/1001 (d) 505/100

Sol.

+ −
6 8 = 14 Nos
Selection = 4 Nos

$n(s) = {}^{14}C_4 = 1001$

P(Product is positive) = P(2+ and 2+) or P(2+ or 2−) or P(4−)

$= \frac{{}^6C_4 + {}^6C_2\,{}^8C_2 + {}^8C_4}{1001}$

$= \frac{15 + 420 + 70}{1001}$

$= \frac{505}{1001} \Rightarrow$ (d)

99. $P(A_1) = 3/8$; $P(A_2) = 2/3$; $P(A_1 \cap A_2) = 1/4$ then A_1 and A_2 will be:

(a) Mutually exclusive & independent (b) Exclusive but not independent
(c) Independent but not exclusive (d) None of these

Sol.

$P(A_1) = 3/8$ $P(A_2) = 2/3$ $P(A_1 \cap A_2) = 1/4$

$P(A_1)\,P(A_2) = \frac{3}{8} \times \frac{2}{3} = \frac{1}{4} = P(A_1 \cap A_2)$

∴ A_1 & A_2 are Independent Event and not Mutually Exclusive Event

(c)

100. 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) $\frac{11}{12}$ (a) $\frac{7}{12}$ (c) $\frac{10}{12}$ (d) $\frac{1}{6}$

Sol.

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$= \frac{1}{2} + \frac{1}{3} - \frac{1}{4}$

$= \frac{6+4-3}{12} = \frac{7}{12} \Rightarrow$ (b)

101. Baye's Theorem is useful in

(a) Revising probability estimates (b)Computing conditional probabilities
(c) Computing sequential probabilities (d) None of these

Sol. (b) is correct

102. If the outcome is an odd number when a dice is rolled, then the probability that it is a prime number is

(a) 1/2 (b) 2/3 (c) 1/6 (d) 5/6

Sol.

$S = \{1, 3, 5\}$ $n(S) = 3$

E: Prime number

$E = \{3, 5\}$ $n(E) = 2$

$P(E) = 2/3 \Rightarrow$ (b).

103. A pair of dice is rolled. If the sum on the dice is 9, find the probability that one of dice showed 3.

(a) 1/9 (b) 1/4 (c) 1/2 (d) 1

Sol.

$S = \{(3,6), (4,5), (5,4), (6,3)\}$

$n(S) = 4$

E: One of dice showed 3

$E = \{(3,6), (6,3)\}$

$n(E) = 2$

$P(E) = \frac{2}{4} = \frac{1}{2}$ (c)

104. A pair of dice is thrown and sum of the numbers on the two dice comes to be 7. What is the probability that the number 3 has come on one of the dice?

(a) 1/9
(b) 1/3
(c) 1/4
(d) None of these.

Sol.

$S = \{(1,6), (2,5), (3,4), (4,3), (5,2), (6,1)\}$

$n(S) = 6$

$E = \{(3,4), (4,3)\}$

$n(E) = 2$

$P(E) = 2/6 = 1/3$ (b)

105. A pair of dice is thrown together and the sum of points of the two dice is noted to be 10. What is the probability that one of the two dice has shown the point 4

(a) $\frac{1}{3}$ (b) $\frac{2}{3}$ (c) $\frac{3}{4}$ (d) $\frac{1}{2}$

Sol.

$S = \{(4,6), (5,5), (6,4)\}$ $n(S) = 3$

$E = \{(4,6), (6,4)\}$ $n(E) = 2$

$P(E) = 2/3$ (c)

106. A family has 2 children. The probability that both of them are boys if it is known that one of them is a boy

(a) 1 (b) 1/2 (c) 2/3 (d) None

Sol.

$S = \{BB, BG, GB\}$ $n(S) = 3$

$E = \{BB\}$ $n(E) = 1$

$P(E) = 1/3$. (d)

107. The probability of the occurrence of a no. greater than 2 in a throw of a dice if its is known that only even nos. can occur is

(a) 1/3 (b) 1/2 (c) 2/3 (d) None

Sol.

$S = \{2, 4, 6\}$ $n(S) = 3$

$E = \{4, 6\}$ $n(E) = 2$

$P(E) = 2/3$ (c).

108. 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) 0.20 (b) 0.30 (c) 0.60 (d) 0.75

Sol.

M 20		F 15	
Non Service Holder 8	Service Holder 12	Service Holder 8	Non Service Holder 7

Required Probability $= \frac{12}{20} = 0.6$ (c)

109. A player has 7 cards in hand of which 5 are red and of these five, 2 are kings. A card is drawn at random. The probability that it is a king, it being known that it is red is

(a) 2/5 (b) 3/5 (c) 4/5 (d) None

Sol.

110. In a class 40% students read Maths, 25% Biology and 15% both Maths and Biology. One student is selected at random. The probability that he reads Maths if it is known that he read Biology is

(a) 2/5 (b) 3/5 (c) 4/5 (d) None

Sol.

111. 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) 1/9 (b) 8/9 (c) 7/9 (d) None of the above

Sol.

112. If (A U B) = 0.8 and P (A∩ B) = 0.3 then P P($\overline{A}$) (A) +(P($\overline{B}$)) is equal to:

(a) 0.3 (b) 0.5 (c) 0.9 (d) 0.7

Sol.

$P(A\cup B) = 0.8 \quad P(A\cap B) = 0.3$

$P(A\cup B) = P(A) + P(B) - P(A\cap B)$

$P(A) + P(B) = P(A\cup B) + P(A\cap B)$

$1 - P(A') + 1 - P(B') = P(A\cup B) + P(A\cap B)$

$P(A') + P(B') = 2 - P(A\cup B) - P(A\cap B)$

$= 2 - 0.8 - 0.3$

$= 0.9$ (c)

113. The probability that a leap year has 53 Wednesday is

(a) $\frac{2}{7}$ (b) $\frac{3}{5}$ (c) $\frac{1}{7}$ (d) $\frac{2}{3}$

Sol.

$S = \{MT, TW, WTh, ThF, FS, SS\}$

$n(S) = 7$

$E : \{TW, WTh\} \quad n(E) = 2$

$P(E) = 2/7$ (a)

114. 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) $\frac{1}{16}$

Sol.

$P(\text{Heads and Tails alternatively}) = \left(\frac{1}{2}\right)^3 \left(\frac{1}{2}\right)^3 = \frac{1}{8} \times \frac{1}{8}$

$= \frac{1}{64}$ (c)

115.The term “chance” and probability are synonyms:

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

Sol.(a) is correct

116. The theorem of compound probability states that for any two events A an 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) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

Sol. (a) is correct

117. Variance of a 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)

Sol. (d) is correct

118.If two random variables x and y are related by y=2-3x, then the SD of y is given by

(a) - 3 x SD of x (b) 3 x SD of x (c) 9 x SD of x (d) 2 x SD of x

Sol.

$y = 2 - 3x$ $S.D(y) = ?$

Comparing with $y = a + bx$

$b = -3$ $|b| = 3$

$S.D(y) = |b|\ S.D(x)$

$= 3\ S.D(x)$ (b)

119.What is the probability of having at least one ‘six’ in 3 throws of a project die?

(a) 5/6 (b) $(5/6)^3$ (c) $1-(1/6)^3$ (d) 1-(5/6)

Sol.

$P(\text{atleast one six}) = 1 - P(\text{no six})$

$= 1 - \frac{5}{6} \times \frac{5}{6} \times \frac{5}{6}$

$= 1 - (5/6)^3$ (d)

120. Sum of all probabilities mutually exclusive and exhaustive events is equal to

(a) 0 (b) 1/2 (c) 1/4 (d) 1

Sol. (d) is correct

121. 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) $\frac{3}{11}$ (c) $\frac{10}{33}$ (d) $\frac{6}{11}$

Sol.

$P(R) = \frac{2}{3}$ $P(R') = \frac{1}{3}$

$P(S) = \frac{5}{11}$ $P(S') = \frac{6}{11}$

$P(\text{Target would be hit}) = 1 - P(\text{Target is not hit})$

$= 1 - P(A' \cap S')$

$= 1 - P(A')\,P(S')$

$= 1 - \frac{1}{3} \times \frac{6}{11}$ [∵ Independent Events]

$= 1 - \frac{2}{11}$

$= \frac{9}{11} \rightarrow$ (a)

122. 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

Sol. (b) is correct

123.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

Sol. (b) is correct

124.According to baye's theorem, $P(E_K / A) = \dfrac{P(E_K)P(A/E_K)}{\sum_1^n P(E_1)P(A/E_1)}$

(a) E_1, E_2 ….. are mutually exclusive

(b) $P(E/A), P(E/A_2)$ …… 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

Sol. (b) is correct

125. 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) $\frac{1}{64}$

Sol.

Starts with Head

$P\left(\text{Heads and Tail alternatively}\right) = \left(\frac{1}{2}\right)^3\left(\frac{1}{2}\right)^2$

$= \frac{1}{8} \times \frac{1}{4}$

$= \frac{1}{32}$

Starts with Tail

$P\left(\text{Heads and Tails alternatively}\right) = \left(\frac{1}{2}\right)^3\left(\frac{1}{2}\right)^2$

$= \frac{1}{8} \times \frac{1}{4} = \frac{1}{32}$

Required Probability $= \frac{1}{32} + \frac{1}{32}$

$= 2/32$

$= \frac{1}{16}$ → (b)

126. 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) $\frac{1}{7}$

Sol.

$n(S) = 36$

E : atleast one 5

$E = \{(1,5)\ (2,5)\ (3,5)\ (4,5)\ (5,1)\ (5,2)\ (5,3)\ (5,4)\ (5,5)\ (5,6)\ (6,5)\}$

$n(E) = 11$

$P(E) = 11/36$ (a)

127. Two letters are chosen from the word HOME. What is the probability that none of the letters would be vowels.

(a) 1/2 (b) 1/6 (c) 2/3 (d) 0

Sol.

HOME = 4 letters

selection = 2 letters

$n(S) = {}^4C_2 = \frac{4 \times 3}{2 \times 1} = 6$

V C

2 2 = 4 letters

E: No vowels

$n(E) = {}^2C_2 = 1$

$P(E) = 1/6$ (b)

128. The chance of getting 7 or 11 when two dices are thrown is ?

(a) 2/9 (b) 6/36 (c) 10/36 (d) 2/36

Sol.

$n(S) = 36$

E: 7 or 11

E = { (1,6) (2,5) (3,4) (4,3) (5,2) (5,6) (6,1) (6,5) }

$n(E) = 8$

$P(E) = 8/36 = 2/9$ (a)

129. 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.

(a) 12/216 (b) 36/216 (c) 48/216 (d) 60/216

Sol.

130. 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) $\frac{1}{24}$

Sol.

$n(S) = 216$

$E = \{(1,1,1)\ (2,2,2)\ (3,3,3)\ (4,4,4)\ (5,5,5)\ (6,6,6)\}$

$n(E) = 6$

$P(E) = 6/216 = 1/36 \Rightarrow c$

131.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

Sol.

W R B
15 25 10 = 50 Balls

P(not a White ball) $= 35/50 = 7/10 = 0.7$ (d)

132. If there are 48 marbles market with numbers 1 to 48, then the probability of selecting a marble having the number divisible by 4 is:

(a) ½ (b) 2/3 (c) 1/3 (d) 1/4

Sol.

$n(S) = 48$

E: Divisible by 4

$E = \{4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44,$

$n(E) = 12$

$P(E) = 12/48 = 1/4$ (d)

133. 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

Sol.

B G
7 5 = 12 Balls

P(Blue Ball) $= 7/12$ (c)

134. 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

Sol.

$P(M \cap S) = \frac{60}{100}$ $P(S) = \frac{90}{100}$

$P(M/S) = \frac{P(M \cap S)}{P(S)} = \frac{60/100}{90/100} = \frac{60}{90}$

$= \frac{2}{3}$ (b)

135. 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

Sol.

Android 10 Apple 6 = 16

Selection = 4

$n(S) = {}^{16}C_4 = \frac{16 \times 15 \times 14 \times 13}{4 \times 3 \times 2 \times 1} = 1820$

Android 2 Apple 2 = 4 Selection

$n(E) = {}^{10}C_2 \, {}^{6}C_2 = \frac{10 \times 9}{2 \times 1} \times \frac{6 \times 5}{2 \times 1} = 675$

$P(E) = \frac{675}{1820} = 0.37$ (c)

136. The value of K for the probability density function of a variate X is equal to:

)							k

(a) 39 (b) $\frac{1}{40}$ (c) $\frac{1}{49}$ (d) $\frac{1}{45}$

Sol.

$\Sigma[P(x)] = 1$

$5k+3k+4k+6k+7k+9k+11k = 1$

$45k = 1$

$k = 1/45$. (d)

137. Two dice are thrown simultaneously. The probability of a total score of 5 from the out comes of dice is.

(a) $\frac{1}{18}$ (b) $\frac{1}{12}$ (c) $\frac{1}{9}$ (d) $\frac{2}{5}$

Sol.

$n(S) = 36$

$E = \{(1,4)\ (2,3)\ (3,2)\ (4,1)\}$

$n(E) = 4$

$P(E) = \frac{4}{36} = \frac{1}{9}$ (c)

138. For any two dependent events A and B, P(A) = 5/9 and P(B) = 6/11 and $P(A \cap B) = 10/33$. 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

Sol.

$P(A/B) = \frac{P(A\cap B)}{P(B)} = \frac{10/33}{6/11} = \frac{10}{33} \times \frac{11}{6} = \frac{5}{9}$

$P(B/A) = \frac{P(A\cap B)}{P(A)} = \frac{10/33}{5/9} = \frac{10}{33} \times \frac{9}{5} = \frac{6}{11}$

(a)

139. 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}

Sol. (a) is correct

140. Four unbiased coins are tossed simultaneously. The expected number of heads is:

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

Sol.

x_i	p_i	$p_i x_i$
0	1/16	0
1	4/16	4/16
2	6/16	12/16
3	4/16	12/16
4	1/16	4/16
		32/16

141. 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

Sol.

x_i	p_i	$p_i x_i$
400	0.4	160
(-100)	0.6	-60
		100

$E(x) = \Sigma(x_i p_i) = 100$ (c)

142. 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

Sol.

x_i	p_i	$p_i x_i$	$p_i x_i^2$
1	0.15	0.15	0.15
2	0.25	0.50	1.00
4	0.2	0.80	3.20
5	0.3	1.50	7.50
6	0.1	0.60	3.60
		3.55	15.45

$$\text{Variance} = \Sigma(x_i^2 p_i) - (\Sigma x_i p_i)^2$$
$$= 15.45 - (3.55)^2$$
$$= 2.8475$$
$$S.D = \sqrt{2.8475} = 1.687 \approx 1.69$$

143. 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

Sol. Same as Q.108

144. 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) ½

Sol.

Box 1
R W B
7 5 4 = 16 Balls

Box 2
R W B
5 6 3 = 14 Balls

Box 3
R W B
4 3 2 = 9

$$P\left(\begin{array}{c}\text{Box is selected}\\ \text{and Red}\\ \text{Ball is drawn}\end{array}\right) = \frac{1}{3}\times\frac{7}{16} + \frac{1}{3}\times\frac{5}{14} + \frac{1}{3}\times\frac{4}{9}$$

$$= \frac{7}{48} + \frac{5}{42} + \frac{4}{27}$$

$$= \frac{7938+6480+8064}{54432}$$

$$= \frac{22482}{54432}$$

$$= \frac{11241}{27216} = \frac{3747}{9072} = \frac{1249}{3024}$$

(a)

145. For a probability distribution, probability is given by, $P(X) = \frac{X_i}{k}$; X_i=1,2,………… 9. The value of k is:

(a) 55 (b) 9 (c) 45 (d) 81

Sol.

$$P(x) = \frac{x_i}{K}, \quad x_i = 1, 2, \ldots, 9$$

$$\Sigma(P(x_i)) = 1$$

$$\frac{1}{K} + \frac{2}{K} + \cdots + \frac{9}{K} = 1$$

$$(1+2+3+4+5+6+7+8+9) = K.$$

$$45 = K \quad (c)$$

146. 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

Sol.

$P(B/A) = \frac{P(A \cap B)}{P(A)}$

$\therefore 0.5 = \frac{P(A \cap B)}{0.3}$

$\therefore P(A \cap B) = (0.5)(0.3) = 0.15$

$\therefore P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$= 0.3 + 0.8 - 0.15$

$= 0.95$ (b)

147. 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

Sol.

S = {MT, TW, WTh, ThF, FS, SS}

n(S) = 7

E: Fridays

E = {FS, ThF}

n(E) = 2

P(E) = 2/7 (c)

148. Two balanced dice are rolled. The probability of getting 1 in at least one dice is x/36 where x is

(a) 12 (b) 1 (c) 11 (d) 2

Sol.

n(S) = 30

E = Multiple of 3 or 5

E = {3, 5, 6, 9, 10, 12, 15, 18, 20, 21, 24, 25, 27, 30}

n(E) = 14

P(E) = 14/30 = 7/15 (d)

149. 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

Sol.

$n(S) = 30$

E = Multiple of 3 or 5

$E = \{3, 5, 6, 9, 10, 12, 15, 18, 20, 21, 24, 25, 27, 30\}$

$n(E) = 14$

$P(E) = 14/30 = 7/15$ (d)

150. 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

Sol.

$P(A) = 2/5 \quad P(A') = 3/5$

$P(B') = 6/10 \quad P(B) = 4/10$

P(one one of A and B occurs) = p(only A) or p(only B)

$\frac{y}{25} = P(A \cap B') + P(A' \cap B)$

$\frac{y}{25} = P(A)\,P(B') + P(A')\,P(B)$

$\frac{y}{25} = \frac{2}{5} \times \frac{6}{10} + \frac{3}{5} \times \frac{4}{10}$

$\frac{y}{25} = \frac{12}{50} + \frac{12}{50}$

$y = \frac{24}{50} \times 25$

$y = 12$

(a)

151. 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

Sol.

$P(A) = 0.08 \quad P(A') = 0.92$

$P(B) = 0.05 \quad P(B') = 0.95$

$P(\text{no defect}) = P(A' \cap B') = P(A')\,P(B')$

$= (0.92)(0.95)$

$= 0.874$ (d)

152. 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 defect?

(a) 0.934 (b) 0.864 (c) 0.85 (d) 0.874

Sol.

$P(A) = 0.08 \quad P(A') = 0.92$

$P(B) = 0.05 \quad P(B') = 0.95$

$P(\text{no defect}) = P(A' \cap B') = P(A')\,P(B')$

$= (0.92)(0.95)$

$= 0.874$ (d)

153. 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) $\frac{1}{8}$

Sol.

$P(A \cap B) = P(A) + P(B) - P(A \cup B)$

$= \frac{1}{3} + \frac{3}{4} - \frac{11}{12}$

$= \frac{4+9-11}{12}$

$= 2/12 = 1/6$

$P(B/A) = \frac{P(A \cap B)}{P(A)} = \frac{1/6}{1/3} = 3/6 = 1/2$ (c)

154. The probability that a leap year has 53 Monday is:

(a) $\frac{1}{7}$ (b) $\frac{2}{3}$ (c) $\frac{2}{7}$ (d) $\frac{3}{5}$

Sol.

$S = \{SM, MT, TW, WTh, ThF, FS, SS\}$

$n(S) = 7$

$P(53 \text{ mondays}) = 2/7$. (c)

155. 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) $P(A' \cap B') = P(A')P(B')$

Sol. (c) is correct

156. 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) $P(A \cap B) = P(A)+P(B)-P(A \cap B)$

Sol. (a) is correct

157. 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) 1/4 (b) 2/25 (c) 3/50 (d) 4/25

Sol.

$S = \{1, 2, 3, \ldots\ldots, 50\}$ $n(S) = 50$

E: Multiple of 3 and 4 [ie 12]

$E = \{12, 24, 36, 48\}$ $n(E) = 4$

$P(E) = 4/50 = 2/25$ (b)

158. 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

Sol.

$n(S) = 8$

E: Two Heads

$E = \{HHT, HTH, THH\}$

$n(E) = 3$

$P(E) = 3/8$ (d)

159. 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

Sol.

$P(A) = \frac{10}{100}$ $\quad P(A') = \frac{90}{100}$

$P(B) = \frac{20}{100}$ $\quad P(B') = \frac{80}{100}$

$P(C) = \frac{5}{100}$ $\quad P(C') = 95/100$

$P(\text{no defect}) = P(A' \cap B' \cap C')$

$= P(A')\,P(B')\,P(C')$ [∵ Independent Event]

$= \frac{90}{100} \times \frac{80}{100} \times \frac{95}{100} = 0.684$ (a)

160. 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

Sol.

x_i	p_i	$(p_i x_i)$
1	p	p
0	$(1-p)$	0
		p

$E(x) = \Sigma(p_i x_i) = p \Rightarrow$ (a).

161. For any two events 'A' and 'B' it is known that P(A)=2/3, P(B)=3/8 and P(A∩ B) = 1/4, then the events A and B are:

(a) Mutually exclusive and Independent
(b) Mutually Independent not exclusive and
(c) Mutually exclusive but not independent
(d) Neither independent nor mutually exclusive

Sol.

$P(A) = 2/3$ $\quad P(B) = 3/8$ $\quad P(A \cap B) = 1/4$.

$P(A)\,P(B) = \frac{2}{3} \times \frac{3}{8} = \frac{1}{4} = P(A \cap B)$

∴ A and B are ~~Mutually Exclusive~~ Independent Events

$P(A \cap B) \neq 0$

∴ A and B are not Mutually Exclusive Events.

(b)

162. 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) $\frac{1}{3}$

Sol.

x_i	p_i	$p_i x_i$
-1	$1/3$	$-1/3$
-2	$1/6$	$-2/6$
0	0	0
1	$1/6$	$1/6$
2	$1/3$	$2/3$
	1	$1/6$

$E(x) = \Sigma(p_i x_i) = 1/6$

(c)

163. 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

Sol. Same as Q.22.

164. 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

Sol.

x_i	p_i	$p_i x_i$
50000	0.75	37500
(-20000)	0.25	5000

$E(x) = \Sigma(p_i x_i) = 32500$ (a)