CA Foundation Notes

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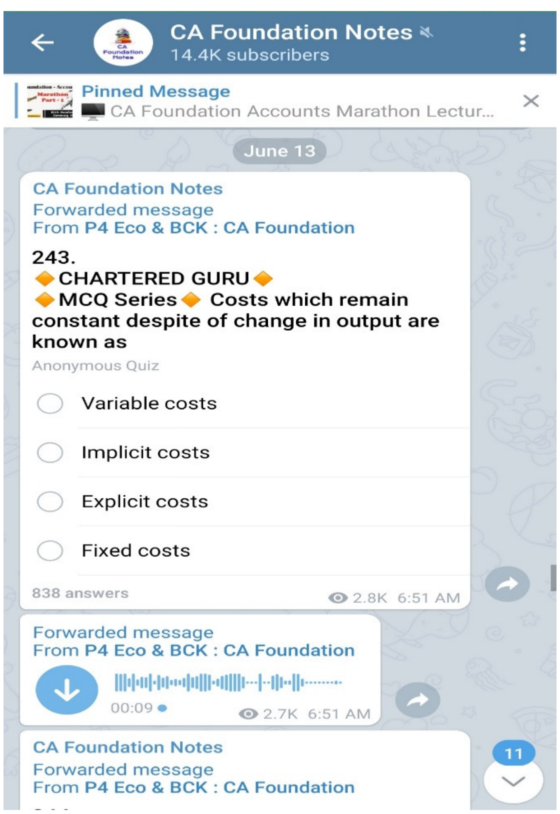

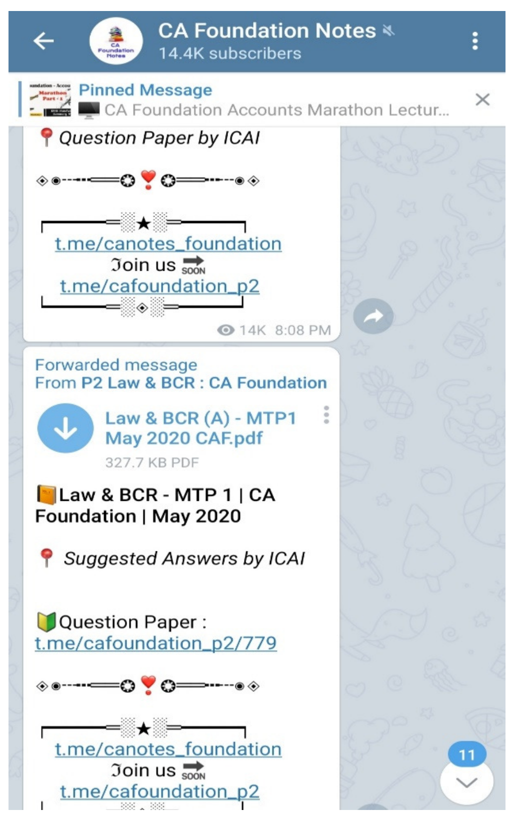

PROBABILITY

[16] Probablity =

- Also known as;
  Possibility, chances, likely hood, odds in favour, odds against.
- Origin of probablity from mathematics.
- Use - testing hypothesis and estimation.

Subjective	objective
- experience	- depend upon experiment (performance).
- knowledge	- Not different from person to person.
- Differs from person to person	
- use management	

* Experiment :

- An experiment may be described as a performance that produces certain results.

- Experiment → Random experiment

Experiment
↓
Any performance
↓
Results
↓
outcome

Random experiment
↓
Performance
↓
Random result
⇓
Event

Event → Simple/Elementary ; Composite/compound

Simple/Elementary
↓
The Event can't be divided into further events
↓
e.g. 1/ Pass, Fail

Composite/compound
↓
The event which can be divided into further events.
↓
e.g. 2 coins are tossed
→ (TT, HH, TH, HT)

✱ Event :

- The reasults of outcomes of a random experiment (performance) are known as events.

Mutually Exclusive/ Incompatible Event	Exhaustive Events/ Sample Space	Equaly likely Events/ Mutually symmetric/Equi-probable
- only 1 at a time (either, or)	- set of all possible events	- Equal chances & probablity
- **Example**:	- **Example**:	- **Example**:
1) X is minor or X is having voting rights.	1) Coin is tossed → H,T	1) Pass & Fail chances equal. $P(A) = P(B) = \frac{1}{2}$
2) Pass / fail	2) Exam → Pass, fail	2) Head & Tail chances equal. $P(A) = P(B) = \frac{1}{2}$.
3) Study in class / watching movie in PVR.	3) Dice is thrown → 1, 2, 3, 4, 5, 6.	• A & B may be diff^n events
- **Condition**: $P(A \cap B) = 0$	- **Condition**: $P(A \cup B) = 1$	- **Condition**: $P(A) = P(B)$

If Exhaustive + Equallikely then $P(A) = P(B) = 0.5$

- In case of : coins → 2^n
  dice → 6^n

Type - 1 : Classical / Prior defination

- Defination of classical is given by Bournoulli & Laplace.

- Conditions:
  1) Events must be finite
  2) Events must be equally likely.
  3) Use - limited field.
     - e.g. coins, cards, diece.

- Formula:

$$P(A) = \frac{n(A)}{n} = \frac{\text{No. of favourable Events}}{\text{Total no. of events.}}$$

Notes: 1) Probablity of impossible event is 0, i.e. $P(A)=0$.

2) Probablity of sure event is 1, ie. $P(A)=1$.

3) Occurence is denoted by 'A'.
Non-occurance is denoted by A', A^c, $\bar{A}$.

4) $P(A) + P(A') = 1$.

5) Odds in favour and odds against:
- e.g. 1) If $P(A) = \frac{3}{10}$ (odds in favour)
  → odds in favour = 3 : 7
  odds against = 7 : 3
  i.e. $P(A') = \frac{7}{10}$

2) If odds in favour = 9 : 7
  → $P(A) = \frac{9}{16}$
  $P(A') = \frac{7}{16}$

3) odds against $= 6:7$, $P(A) = ?$

$\rightarrow$ $P(A) = \frac{7}{13}$

$P(A') = \frac{6}{13}$

- 6) If events are mutually exclusive, events are independent.

7) If A&B are independent events, A&B' are independent.

$$\left.\begin{array}{l} A \,\&\, B' \\ B \,\&\, A' \\ A' \,\&\, B' \end{array}\right\} \text{Independent.}$$

Type 2: Stastical Defination of Probablity :-

- When frequency is given, this defination will be used.

Ex. 16.7

Q.

Wages in (₹)	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100	100 - 110
No. of workers.	15	23	36	42	17	12

a) $P(A) = \frac{0}{150} = 0$

b) $P(B) = \frac{75}{150} = 0.4933$

c) $P(C) = \frac{17}{150} =$

d) $P(D) = \frac{95}{150} = \frac{19}{30}$

classmate
Date
Page

Type 3 : Addition Theorem / Theorem on Total P.

- Cal^n of one event or theorem on total probablity, if another event is given.

General Event	Mutually Exclusive	Independent Event.
- If P(A∪B) or P(A∩B) is given then events are General.	- If p(A∪B) or P(A∩B) is not given then events are either mutually exclusive or independent	- Not depended on each other.

- In mutually exclusive both can't possible at a time.
- In independent events 2 events does not depend on each other.
- Mutually exclusive need not be independent.
- Independent need not be mutually exclusive.

A) General Event :

1) Either or/ at least one ⟶ $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

2) Only A occurs ⟶ $P(A \cap B') = P(A) - P(A \cap B)$

3) Only B occurs ⟶ $P(A' \cap B) = P(B) - P(A \cap B)$

4) Neither A nor B ⟶ $P(A' \cap B') = 1 - P(A \cup B) = P(A \cup B)'$

5) Only one occur. ⟶ $P(A \cap B') + P(A' \cap B)$

6) In case of 3 events ⟶
$$P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(A \cap C) + P(A \cap B \cap C)$$

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Date
Page

Example:

1) Probablity of 'x' to complete B.com is 0.85, he complete CA is 0.3, he complete both is 0.25.

→ $P(A) = 0.85$, $P(B) = 0.3$, $P(A \cap B) = 0.25$

a) Either Bcom or CA:

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

$= 0.85 + 0.3 - 0.25$

$= 0.9$

b) Only Bcom:

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

$= 0.85 - 0.25$

$= 0.6$

c) Only CA:

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

$= 0.3 - 0.25$

$= 0.05$

d) Nither BCom nor CA:

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

$= 1 - 0.9$

$= 0.1$

e) Only one occur:

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

$= 0.6 + 0.05$

$= 0.65$

classmate
Date
Page

B] Mutually Exclusive Events : (Either or)

1] $P(A \cap B) = 0$

2] $P(A \cup B) = P(A) + P(B)$

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

4] $P(A \cup B \cup C) = P(A) + P(B) + P(C)$.

Q. A travel by plane with 40% and travel by train with 20%. What is the probablity of travelling either plane or train.

→ $P(A) = 40\% = 0.4$
$P(B) = 20\% = 0.2$

1] $P(A \cup B) = P(A) + P(B)$
$= 0.4 + 0.2$
$= 0.6$

2] $P(A' \cap B') = 1 - P(A \cup B)$
$= 1 - 0.6$
$= 0.4$

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Conditional Probablity:

- Also known as:-
  Compound Probablity / Joint Probablity / Dependent Events.
- Probablity of one event is not depend upon another event then this is known as unconditional / Marginal Prob.
- If occurance of event A is influenced by occurance of another event B then A & B are dependent events.

1) $P\left(\frac{A}{B}\right) = \frac{P(A \cap B)}{P(B)}$; $P(B) \neq 0$ i.e. B is not impossible event.

2) $P\left(\frac{B}{A}\right) = \frac{P(A \cap B)}{P(A)}$; $P(A) \neq 0$

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

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

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

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

7) $P\left(\frac{A'}{B'}\right) = \frac{P(A' \cap B')}{P(B')} = \frac{1 - P(A \cup B)}{1 - P(B)}$

- Sum of Probablity always 1.
- Values of x are +ve/-ve/0.

Expected Value/Mean/μ:

Random Variable:

- Also known as stochastic variable.
- The value which changes known as variable.
- Presentation of Random Variable i.e. 'x' along with respective probablity is known as probablity distribution.

- Random Variable may be discrete or continous.

a) if x is discrete, it is known as prob. Mass Function.
(finite value)

b) if x is continous, it is known as Prob. Density Function.
(non-finite value)

* Formula:

1) Mean $= \mu = E(x) = \Sigma P \times x$

2) Variance $= \sigma^2 = E(x^2) - \mu^2$

$= E(x - \mu^2)$

- Example:

1)

x	4	6	8
$P(x)$	0.2	0.4	0.4
$x \cdot P(x)$	0.8	2.4	3.2

$E(x) = \mu = 0.8 + 2.4 + 3.2 = 6.4$

$E(x^2) = 3.2 + 14.4 + 25.6 = 43.2$

Variance $= 43.2 - 40.96 = 2.24$

$\sigma = 1.5$