Probability

10 July 2020 03:53 PM

Starting @ 4:05 PM

→ Probability

{ Probability → Study of uncertainity }
↳ Study of uncertain event

- Random Experiment → It is a process for which outcome cannot be predicted with certainity.
  For eg: Tossing a coin, Rolling a dice

- Sample Space → Set of all the possible outcomes of a Random Experiment.

$$S_1 = \{H, T\}$$

$$S_2 = \{1, 2, 3, 4, 5, 6\}$$

→ R.E → Weather ?

→ S.S → { Sunny, Rainy, Cloudy, windy, Hot, cold }

→ R.E → Any process for which outcome cannot be predicted with certainty.

S.S → Set of all possible outcome's of any uncertain process (R.E)

→ Event → Any subset of Sample Space.

R.E → Toss two coins

→ S.S → { HH, HT, TH, TT }

R.E → Toss two coins

→ S.S → { HH, HT, TH, TT }

Events → E_1 = Getting 2 Heads = { HH }

Prob → Study of uncertain events

E_2 = $\boxed{\text{Getting atleast 1 Head}}$ = { HH, HT, TH }

$$P(E_2) = \frac{3}{4}$$

$$P(\text{Event}) = \frac{\text{Favourable no. of outcomes}}{\text{Total no. of possible outcome}}$$

$$= \left\{ \frac{\text{size of Event}}{\text{size of S.S}} \right\} = \left\{ \frac{|\text{Event}|}{|S.S|} \right\}$$

→ R.E → Rolling a dice

→ S.S → { 1, 2, 3, 4, 5, 6 }

→ Events → $\boxed{E_1}$ = Getting a prime no.

{ $\boxed{2, 3, 5}$ }

$$P(E_1) = \frac{3}{6} = \frac{1}{2} = 0.5$$

Axioms of Probability

→ 1. $0 \le P(\text{Event}) \le 1$

Always probability will be a number b/w 0 & 1.

2. $P(S.S) = 1$

R.E → Tossing two coins

S.S → { HH, HT, TH, TT }

= $1 + 1 + 1 + 1$

S.S → {HH, HT, TH, TT}

$\frac{1}{4} \quad \frac{1}{4} \quad \frac{1}{4} \quad \frac{1}{4}$

$= \frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}$

$= 1$

3. For any sequence of events that are mutually exclusive :

$$* \quad P\left(\bigcup_{n=1}^{\infty} E_n\right) = \sum_{n=1}^{\infty} P(E_n)$$

$\boxed{E_1 \cap E_2 = \phi}$

R.E → Tossing two coins

S.S → {HH, HT, TH, TT}

E_1 = Getting 2 Heads = $\boxed{\{HH\}}$ ⇒ $P(E_1) = \frac{1}{4}$

E_2 = Getting 2 tails = $\boxed{\{TT\}}$ ⇒ $P(E_2) = \frac{1}{4}$

E_3 = Getting Either 2 Heads or 2 tails = {HH, TT}

$P(E_3) = P(E_1) + P(E_2)$ {E_1 & E_2 are mutually exclusive}

$P(E_1 \cup E_2) = \underbrace{P(E_1) + P(E_2)}$

$P(E_3) = \boxed{P(E_1) + P(E_2)}$

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

$E_1 \cap E_2 \neq \phi$

$P(E_1 \cup E_2) = P(E_1) + P(E_2) - P(E_1 \cap E_2)$

3. If Events are mutually Exclusive ?

$E_1 \cap E_2 = \phi$

$P(E_1 \cup E_2) = P(E_1) + P(E_2)$

else if Events are not mutually Exclu?

else if Events are not mutually Exclu]

$E_1 \cap E_2 \neq \phi$

$P(E_1 \cup E_2) = P(E_1) + P(E_2) - P(E_1 \cap E_2)$

4:58 to 5:05 $\boxed{\text{BREAK}}$

1. Conditional Probability]

R.E → Rolling a dice ←

S.S → {1, 2, 3, 4, 5, 6}

E_1 → $\boxed{\text{Getting a number less than 2}}$

{ 1 }

$P(E_1) = \frac{1}{6}$

→ dice → throw → Even no. { E_2 → getting a no. greater than 4 }

→ {dice} → throw → even ... { a no. greater than 4 }

$P(E_2) = ?$ $\frac{1}{3}$

$E_2 = \{5, 6\}$

R.E → Throwing dice

S.S → $\{1, 2, 3, 4, 5, 6\}$

E_1 → Getting a no. greater 4.

$= \{5, 6\}$

$P(E_1) = \frac{2}{6} = \frac{1}{3}$

Condition → Even no. on the dice

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

1/6 1/6 1/6 1/6 1/6 1/6

E_1 = Getting a no. greater than $4 = \{5, 6\}$

New: $S.S = \{2, 4, 6\}$

1/3 1/3 1/3

$\frac{1}{3}$

Conditional Prob

$P(E_1 / E_2)$ → E_2 has already occured $= \frac{P(E_1 \cap E_2)}{P(E_2)}$

/ → given that

... Even no. will appear on the dice)

P(Getting a no. greater than 4 | Even no. will appear on the dice)

=

R.E → Dice

SS → {1, 2, 3, 4, 5, 6}

E_1 → Getting a 6

$E_1 = \{6\} = \frac{1}{6}$

E_2 → Condition → Getting an odd no.

$E_2 = \{1, 3, 5\} \Rightarrow P(E_2) = \frac{3}{6} = \frac{1}{2}$

$\boxed{E_1 \cap E_2 = \phi} = P(E_1 \cap E_2) = 0$

Condition → Get odd no. on the dice

$$P(E_1 \mid E_2) = \frac{P(E_1 \cap E_2)}{P(E_2)}$$

$$= \frac{0}{1/2} = 0$$

→ Random Variables

Statistics → In hand

H	W	A	Nationality	Gender

Probability

P(Event)

P(R.V) → Distribution

P(R.V ∈ Male) 0.8

P(R.V ∈ Female) 0.2

Male