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Probability → Study of uncertainity.

→ Random Experiment (RE): It is a process for which outcome can't be predicted with certainity
Ex: tossing a coin, rolling a dice, picking a object

→ Sample Space (SS): Set of all possible outcome
Ex: RE → tossing a coin
SS → {Head, Tail}

RE: Rolling a dice
SS: {1, 2, 3, 4, 5, 6}

→ Event (E): Any subset of Sample space
Ex: RE → tossing of two coins
SS → {HH, TT, TH, HT}
E_1 → Getting two heads {H, H}
E_2 → Getting atleast one head {HH, TH, HT}

RE → rolling a dice SS → {1, 2, 3, 4, 5, 6}
E_1 → getting odd no → {1, 3, 5}
get probability of the above event

$$\text{Probability of Event} = \frac{\text{no. favourable outcome (Event)}}{\text{Total no of Possible outcome (Sample Space)}}$$

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

* Axioms of Probability

→ $0 \leq P(E_1) \leq 1$

→ $P(SS) = P(S) = 1$

→ for any sequence of event that are mutually exclusive

$$P(E_1 \cup E_2 \cup \cdots E_n) = P(E_1) + P(E_2) \cdots + P(E_n) = P\left(\bigcup_{i=1}^{n} E_i\right) = \sum_{i=1}^{n} P(E_i)$$

→ Mutually Exclusive Event : events intersection is null.

RE → flipping 2 coins ∴ SS = {HH, HT, TH, TT}

E_1 → getting 2 head ⇒ {HH}

E_2 → getting 2 tails ⇒ {TT}

E_3 → getting both head or tail ⇒ {HH, TT}

So if $E_1 \cap E_2 = \phi$ then E_1 & E_2 are mutually exclusive events

$$P(E_3) = \frac{2}{4} = \frac{1}{2}$$

∴ $E_3 \Rightarrow E_1 \cup E_2$

$$P(E_3) = P(E_1 \cup E_2) = \frac{1}{4} + \frac{1}{4} = \frac{2}{4} = \frac{1}{2}$$

Qu) What if events aren't mutually exclusive find $P(E_1 \cup E_2)$

Soln) Given E_1 & E_2 are not mutually exclusive

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

Q) RE → Rolling a dice

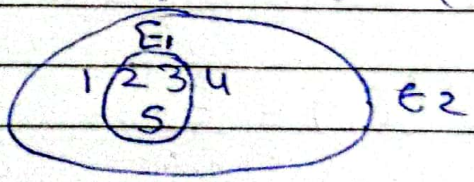
SS → {1, 2, 3, 4, 5, 6}

E_1 → getting a prime no {2, 3, 5}

E_2 → getting no. less than 6 {1, 2, 3, 4, 5}

Is $E_1 \subseteq E_2$

~~So, $E_1 \subseteq E_2$~~



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

$P(E_2) = \frac{5}{6}$ so, $\frac{3}{6} \leq \frac{5}{6}$

$$P(E_1) \leq P(E_2)$$

$$\Rightarrow E_1 \subseteq E_2$$