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M.Sc Math
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Q.6 $n(S) = 10+20 = 30$

A be event that monitor is girl

$n(A) = 10$

B be event that monitor is blue eyed so $n(B) = 5+10 = 15$

$n(A \cap B) = 5$

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

$= \frac{n(A)}{n(S)} + \frac{n(B)}{n(S)} - \frac{n(A \cap B)}{n(S)}$

$= \frac{10}{30} + \frac{15}{30} - \frac{5}{30} = \frac{20}{30}$

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

Exercise: 7.8

Q.1 $P(A) = 5/7$ where A is the event that person A lives 15 years.

$P(B) = 7/9$ where B is event that Person B lives 15 years.

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

$= \frac{5}{7} \cdot \frac{7}{9}$

$P(A \cap B) = 5/9$ Ans.

Q.2 $n(S) = 6^2 = 36$

$E_1 = \{(2,2),(2,4),(2,6),(4,2),(4,4),(4,6),(6,2),(6,4),(6,6)\}$

$n(E_1) = 9$

$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{9}{36} = 1/4$

$E_2 = \{(5,5),(5,6),(6,5),(6,6)\}$

$n(E_2) = 4$

$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{4}{36} = \frac{1}{9}$

$P(E_1) \cdot P(E_2) = \frac{1}{4} \cdot \frac{1}{9} = \frac{1}{36}$ —①

$E_1 \cap E_2 = \{(6,6)\}$

$n(E_1 \cap E_2) = 1$

$P(E_1 \cap E_2) = \frac{n(E_1 \cap E_2)}{n(S)} = \frac{1}{36}$

$P(E_1 \cap E_2) = \frac{1}{36}$ —②

From ① and ②

$P(E_1 \cap E_2) = P(E_1) \cdot P(E_2)$ (Proved)

Q.3 $S = \{(H,H),(H,T),(T,H),(T,T)\}$

$n(S) = 4$

A be event that both faces are head. $A = \{(H,H)\}$

$P(A) = \frac{n(A)}{n(S)} = \frac{1}{4}$ Ans.

Q.4 $S = \{(H,H),(H,T),(T,H),(T,T)\}$

$n(S) = 4$

let A be event that first is Head.

$A = \{(H,H)(H,T)\}$ $n(A) = 2$

$P(A) = \frac{n(A)}{n(S)} = \frac{2}{4} = \frac{1}{2}$

let B be the event that faces are same

$B = \{(H,H),(T,T)\}$ $P(B) = \frac{n(B)}{n(S)}$

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

Now $P(A \cap B) = P(A) \cdot P(B) = \frac{1}{2} \times \frac{1}{2}$

$P(A \cap B) = 1/4$ Ans.

Q.5 $n(S) = 52$

let A be event that cards are aces

$$P(A) = \frac{{}^4C_1}{{}^{52}C_1} \cdot \frac{{}^4C_1}{{}^{52}C_1}$$

$$= \frac{4}{52} \times \frac{4}{52} = \frac{1}{13} \times \frac{1}{13}$$

$$P(A) = \frac{1}{169} \quad \text{Ans.}$$

Q.7 $n(S) = 6^2 = 36$

let A be event that Sum is 7

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

$n(A) = 6$

$$P(A) = \frac{n(A)}{n(S)} = \frac{6}{36} = \frac{1}{6}$$

Let B be event that Sum is 11

$B = \{(5,6), (6,5)\} \Rightarrow n(B) = 2$

$$P(B) = \frac{n(B)}{n(S)} = \frac{2}{36} = \frac{1}{18}$$

Now

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

$$= \frac{1}{6} \times \frac{1}{18}$$

$$P(A \cap B) = \frac{1}{108} \quad \text{Ans.}$$

Q.8 $n(S) = 36 = 6^2$

Let A be event that Sum is 7

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

$n(A) = 6$

$$P(A) = \frac{n(A)}{n(S)} = \frac{6}{36} = \frac{1}{6}$$

Now $B = A$

So $n(B) = n(A) = 6$

$$P(B) = P(A) = 1/6$$

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

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

$$P(A \cap B) = \frac{1}{36} \quad \text{Ans.}$$

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Show that ${}^nC_r = {}^nC_{n-r}$.

$$RHS = {}^nC_{n-r}$$

$$= \frac{\lfloor n}{\lfloor n-n+r \rfloor \lfloor n-r}$$

$$= \frac{\lfloor n}{\lfloor r \rfloor n-r}$$

$$= {}^nC_r = LHS$$

$$\Rightarrow {}^nC_{n-r} = {}^nC_r \cdot \text{(Proved)}$$