

ASSIGNMENT-1

Probability & Random Variables

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Question

A team of medical students doing their internship have to assist during surgeries at a city hospital. The probabilities of surgeries rated as very-complex, complex, routine, simple or very-simple are respectively, 0.15, 0.20, 0.31, 0.26, .08. Find the probabilities that a particular surgery will be rated

- 1) complex or very-complex
- 2) neither very-complex nor very simple
- 3) routine or complex
- 4) routine or simple

Solution

Let E_1, E_2, E_3, E_4, E_5 be the events that the surgeries are rated as very-complex, complex, routine, simple and very-simple respectively.

The given information is summarised in Table

Random Variables	Difficulty Levels	Probability
E_1	Very-Complex	$\Pr(E_1)=0.15$
E_2	Complex	$\Pr(E_2)=0.2$
E_3	Routine	$\Pr(E_3)=0.31$
E_4	Simple	$\Pr(E_4)=0.26$
E_5	Very-Simple	$\Pr(E_5)=0.08$

Here if you notice one thing, the events are **Disjoint** because we are talking about surgeries, it can be very-complex or complex but it cannot be very-complex and complex at the same time.

\Rightarrow These events are **Disjoint** to each other and intersection of these events is 0

We know that,

If A and B are two events then, One of the **Axioms** in Probability states that,
If (**Intersection**) $AB = 0$ then,

$$\implies \Pr(A + B) = \Pr(A) + \Pr(B)$$

- 1) To find the probabilities that a particular surgery will be rated complex or very-complex:

$$\begin{aligned}\Pr(E_1 + E_2) &= \Pr(E_1) + \Pr(E_2) && \because E_1 E_2 = 0 \\ &= 0.15 + 0.20 \\ &= 0.35\end{aligned}$$

$$\therefore \Pr(E_1 + E_2) = 0.35$$

- 2) To find the probabilities that a particular surgery will be rated neither very complex nor-very simple:

$$\begin{aligned}\Pr(E'_1 E'_5) &= \Pr((E_1 + E_5)') \\ &= 1 - \Pr(E_1 + E_5) \\ &= 1 - [\Pr(E_1) + \Pr(E_5)] && \because E_1 E_5 = 0 \\ &= 1 - [0.15 + 0.08] \\ &= 1 - 0.23 \\ &= 0.77\end{aligned}$$

$$\therefore \Pr(E'_1 E'_5) = 0.77$$

- 3) To find the probabilities that a particular surgery will be rated routine or complex:

$$\begin{aligned}\Pr(E_3 + E_2) &= \Pr(E_3) + \Pr(E_2) && \because E_3 E_2 = 0 \\ &= 0.31 + 0.20 \\ &= 0.51\end{aligned}$$

$$\therefore \Pr(E_3 + E_2) = 0.51$$

4) To find the probabilities that a particular surgery will be rated routine or simple:

$$\begin{aligned}\Pr(E_3 + E_4) &= \Pr(E_3) + \Pr(E_4) \quad \because E_3 E_4 = 0 \\ &= 0.31 + 0.26 \\ &= 0.57\end{aligned}$$

$$\therefore \Pr(E_3 + E_4) = 0.57$$