

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 4.

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	$\Pr(E_5)=0.08$

TABLE 4

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,

$$\Rightarrow \Pr(A + B) = \Pr(A) + \Pr(B) \quad (1)$$

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

$$\Pr(E_1 + E_2) = \Pr(E_1) + \Pr(E_2) \quad \because E_1 E_2 = 0 \quad (2)$$

$$= 0.15 + 0.20 \quad (3)$$

$$= 0.35 \quad (4)$$

$$\therefore \Pr(E_1 + E_2) = 0.35 \quad (5)$$

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

$$\Pr(E'_1 E'_5) = \Pr((E_1 + E_5)') \quad (6)$$

$$= 1 - \Pr(E_1 + E_5) \quad (7)$$

$$= 1 - [\Pr(E_1) + \Pr(E_5)] \quad \because E_1 E_5 = 0 \quad (8)$$

$$= 1 - [0.15 + 0.08] \quad (9)$$

$$= 1 - 23 \quad (10)$$

$$= 0.77 \quad (11)$$

$$\therefore \Pr(E'_1 E'_5) = 0.77 \quad (12)$$

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

$$\Pr(E_3 + E_2) = \Pr(E_3) + \Pr(E_2) \quad \because E_3 E_2 = 0 \quad (13)$$

$$= 0.31 + 0.20 \quad (14)$$

$$= 0.51 \quad (15)$$

$$\therefore \Pr(E_3 + E_2) = 0.51 \quad (16)$$

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

$$\Pr(E_3 + E_4) = \Pr(E_3) + \Pr(E_4) \quad \because E_3 E_4 = 0 \quad (17)$$

$$= 0.31 + 0.26 \quad (18)$$

$$= 0.57 \quad (19)$$

$$\therefore \Pr(E_3 + E_4) = 0.57 \quad (20)$$

$$(21)$$