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.

$\Longrightarrow$ 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:

$$\begin{aligned}\Pr(E_1 + E_2) &= \Pr(E_1) + \Pr(E_2) \qquad \because E_1E_2 = 0\\ &= 0.15 + 0.20\\ &= 0.35\end{aligned}$$

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

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

$$\begin{aligned}\Pr\left(E_1'E_5'\right) &= \Pr\left((E_1 + E_5)'\right)\\ &= 1 - \Pr(E_1 + E_5)\\ &= 1 - [\Pr(E_1) + \Pr(E_5)] \quad \because E_1E_5 = 0\\ &= 1 - [0.15 + 0.08]\\ &= 1 - 23\\ &= 0.77\end{aligned}$$

$\therefore \Pr\left(E_1'E_5'\right)$=0.77

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

$$\begin{aligned}\Pr(E_3 + E_2) &= \Pr(E_3) + \Pr(E_2) \quad \because E_3E_2 = 0\\ &= 0.31 + 0.20\\ &= 0.51\end{aligned}$$

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

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

$$\begin{aligned} \Pr(E_3 + E_4) &= \Pr(E_3) + \Pr(E_4) \quad \because E_3E_4 = 0 \\ &= 0.31 + 0.26 \\ &= 0.57 \end{aligned}$$

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