ASSIGNMENT-1
Probability & Random Variables

Merugu Balavardhan
BT22BTECH11010

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.

Then according to the given information.

$$\Pr(E_1) = 0.15 \qquad \Pr(E_2) = 0.20$$

$$\Pr(E_3) = 0.31 \qquad \Pr(E_4) = 0.26$$

$$\Pr(E_5) = 0.08$$

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

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

We have this **Axiom** in Probability that
Lets say A and B are two events and if (**Intersection**)$AB = 0$

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

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

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

$\therefore P(E_1 \cup E_2)=0.35$

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

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

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

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

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

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

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

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

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