10.3.3.3.1

EE24BTECH11009 - Mokshith kumar

Question: Given $p\left(a\right) = \frac{3}{5}$ and $p\left(b\right) = \frac{1}{5}$. Find $p\left(\left(\right)aorb\right)$, if a and b are mutually exclusive events.

solution: Given the events A and B, where $P(A) = \frac{3}{5}$ and $P(B) = \frac{1}{5}$, and it is stated that A and B are mutually exclusive events, we are asked to find $P(A \cup B)$, i.e., the probability of A or B occurring.

$p\left(A\right)$	$\frac{3}{5}$
$p\left(B\right)$	$\frac{1}{5}$

Since A and B are mutually exclusive, it means that the events cannot occur simultaneously.

$$P(AB) = 0$$

For any two boolean variables A and B,

$$\because A + A' = 1 \tag{0.1}$$

$$AB + A'B = B \tag{0.2}$$

$$\implies \Pr\left(AB\right) + \Pr\left(A'B\right) = \Pr\left(B\right) \tag{0.3}$$

$$\because B + B' = 1 \tag{0.4}$$

$$AB + AB' = A \tag{0.5}$$

$$\implies \Pr\left(AB\right) + \Pr\left(AB'\right) = \Pr\left(A\right) \tag{0.6}$$

adding (0.2) and (0.5) (0.7)

$$A + B = AB + AB + AB' + A'B \tag{0.8}$$

$$A + B = AB + AB' + A'B \tag{0.9}$$

$$\Pr\left(A + B\right) = \Pr\left(AB\right) + \Pr\left(AB'\right) + \Pr\left(A'B\right) \tag{0.10}$$

Adding (0.3),(0.6) and (0.10) and cancelling same terms (0.11)

$$\Pr\left(AB\right) = \Pr\left(A\right) + \Pr\left(B\right) - \Pr\left(A + B\right) \tag{0.12}$$

From above Boolean Logic, the probability of $A + B$ is given by the formula:

$$P(A + B) = P(A) + P(B) - P(AB)$$

Substitute the given values of $P(A)$ and $P(B)$:

$$P(A + B) = \frac{3}{5} + \frac{1}{5}$$

Simplifying the sum:

$$P(A + B) = \frac{3 + 1}{5} = \frac{4}{5}$$

Thus, the probability of $A + B$ is:

$$P(A \cup B) = \frac{4}{5}$$