

10.3.3.3.1

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Question: Given $p(A) = \frac{3}{5}$ and $p(B) = \frac{1}{5}$. Find $p(A \text{ or } B)$, 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 $P(A + B)$, i.e., the probability of A or B occurring.

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

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 ,

$$\therefore A + A' = 1 \quad (0.1)$$

$$AB + A'B = B \quad (0.2)$$

$$\implies \Pr(AB) + \Pr(A'B) = \Pr(B) \quad (0.3)$$

$$\therefore B + B' = 1 \quad (0.4)$$

$$AB + AB' = A \quad (0.5)$$

$$\implies \Pr(AB) + \Pr(AB') = \Pr(A) \quad (0.6)$$

$$\text{adding (0.2) and (0.5)} \quad (0.7)$$

$$A + B = AB + AB + AB' + A'B \quad (0.8)$$

$$A + B = AB + AB' + A'B \quad (0.9)$$

$$\Pr(A + B) = \Pr(AB) + \Pr(AB') + \Pr(A'B) \quad (0.10)$$

$$\text{Adding (0.3), (0.6) and (0.10) and cancelling same terms} \quad (0.11)$$

$$\Pr(AB) = \Pr(A) + \Pr(B) - \Pr(A + B) \quad (0.12)$$

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:

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