Assignment 1

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1 PROBLEM

Given that the events A and B are such that $P(A) = \frac{1}{2}$, $P(A \cup B) = \frac{3}{5}$ and $P(B) = p$. Find p if they are

  i) mutually exclusive
  ii) independent

2 SOLUTION

i)
Since the events are mutually exclusive, by definition

$$P(A \cap B) = 0 \tag{2.0.1}$$
$$\implies P(A \cup B) = P(A) + P(B) \tag{2.0.2}$$

On substituting the values of P(A), P(B) and P(A∪B) in (2.0.2), we get

$$\frac{3}{5} = \frac{1}{2} + p \tag{2.0.3}$$

$$\implies p = \frac{1}{10} \tag{2.0.4}$$

ii)
Since the events are independent

$$P(A \cap B) = P(A)P(B) \tag{2.0.5}$$

We know

$$P(A \cup B) = P(A) + P(B) - P(A \cap B) \tag{2.0.6}$$
$$\implies P(A \cup B) = P(A) + P(B) - P(A)P(B) \tag{2.0.7}$$

On substituting the values of P(A), P(B) and P(A∪B) in (2.0.7), we get

$$\frac{3}{5} = \frac{1}{2} + p - \frac{1}{2}p \tag{2.0.8}$$

$$\implies p = \frac{1}{5} \tag{2.0.9}$$