

ASSIGNMENT-1 PROBABILITY

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Question 12.13.3.9

Let E_1 and E_2 be two independent events such that $\Pr(E_1) = p_1$ and $\Pr(E_2) = p_2$. Describe in words the events whose probabilities are:

- 1) $p_1 p_2$
- 2) $(1 - p_1) p_2$
- 3) $1 - (1 - p_1)(1 - p_2)$
- 4) $p_1 + p_2 - 2p_1 p_2$

Solution:

$$\Pr(E_1) = p_1 \quad \Pr(E_2) = p_2$$

1)

$$p_1 p_2 = \Pr(E_1) \Pr(E_2) \quad (1)$$

$$= \Pr(E_1 E_2) \quad (2)$$

So, E_1 and E_2 occur simultaneously.

2)

$$(1 - p_1)(p_2) = \Pr(E'_1) \Pr(E_2) \quad (3)$$

$$= \Pr(E'_1 E_2) \quad (4)$$

So E_1 does not occur but E_2 occurs.

3)

$$1 - (1 - p_1)(1 - p_2) = 1 - \Pr(E'_1) \Pr(E'_2) \quad (5)$$

$$= 1 - \Pr(E'_1 E'_2) \quad (6)$$

$$= \Pr(E_1 + E_2) \quad (7)$$

So, either E_1 or E_2 or both E_1 and E_2 occurs.

4)

$$p_1 + p_2 - 2p_1 p_2 = \Pr(E_1) + \Pr(E_2) - 2\Pr(E_1) \Pr(E_2) \quad (8)$$

$$= \Pr(E_1) + \Pr(E_2) - 2\Pr(E_1 E_2) \quad (9)$$

$$= \Pr(E_1 + E_2) - \Pr(E_1 E_2) \quad (10)$$

Since, $\Pr(E_1 + E_2) = \Pr(E_1) + \Pr(E_2) - \Pr(E_1 E_2)$

So, either E_1 or E_2 occurs but not both