ASSIGNEMNT-1 PROBABILITY

Katherapaka Nikhil EE22BTECH11028[*]

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:

$\Pr(E1) = p_1 \quad \Pr(E_2) = p_2$

1)

$$p_1 p_2 = \Pr(E_1)\Pr(E_2) \qquad (1)$$
$$= \Pr(E_1 E_2) \qquad (2)$$

So, E_1 and E_2 occur simultaneously.

2)

$$(1 - p_1)(p_2) = \Pr(E_1')\Pr(E_2) \qquad (3)$$
$$= \Pr(E_1' E_2) \qquad (4)$$

So E_1 does not occur but E_2 occurs.

3)

$$1 - (1 - p_1)(1 - p_2) = 1 - \Pr(E_1')\Pr(E_2') \qquad (5)$$
$$= 1 - \Pr(E_1' \ E_2') \qquad (6)$$
$$= \Pr(E_1 + E_2) \qquad (7)$$

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

4)

$$p_1 + p_2 - 2p_1 p_2 = \Pr(E_1) + \Pr(E_2) - 2\Pr(E_1)\Pr(E_2) \qquad (8)$$
$$= \Pr(E_1) - \Pr(E_1)\Pr(E_2) + \Pr(E_2) - \Pr(E_1)\Pr(E_2) \qquad (9)$$
$$= \Pr(E_1)(1 - \Pr(E_2)) + \Pr(E_2)(1 - \Pr(E_1)) \qquad (10)$$
$$= \Pr(E_1)\Pr(E_2') + \Pr(E_2)\Pr(E_1') \qquad (11)$$
$$= \Pr(E_1 E_2' + E_1' E_2) \qquad (12)$$

Since, $\Pr(E_1) + \Pr(E_1') = 1$

So, either E_1 or E_2 occurs but not both