

Assignment 1

AI1110: Probability and Random Variables

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12.13.6.15 : Question. An electronic assembly consists of two subsystems, say A and B. From previous testing procedures, the following probabilities are assumed to be known:

$$\Pr(A \text{ fails}) = 0.20$$

$$\Pr(B \text{ alone fails}) = 0.15$$

$$\Pr(A \text{ and } B \text{ fails}) = 0.15$$

Evaluate the following probabilities

(i) $\Pr(A \text{ fails given } B \text{ has failed})$

(ii) $\Pr(A \text{ fails alone})$

ans:

$$\Pr(A \text{ fails given } B \text{ has failed}) = 0.50$$

$$\Pr(A \text{ fails alone}) = 0.05$$

Solution:

Given in question,

Probability that A fails $\Pr(A') = 0.20$

Probability that B fails alone $\Pr(AB') = 0.15$

Probability that both A and B fail $\Pr(A'B') = 0.15$

Now to find,

Probability that both A fails given B has failed

$\Pr(A'|B')$ and Probability that A fails alone $\Pr(BA')$

To obtain $\Pr(A'|B')$

we know that,

$$\Pr(A'|B') = \Pr(A'B') / \Pr(B') \quad (1)$$

to obtain $\Pr(B')$

let us use $\Pr(AB')$ and $\Pr(A'B')$

we know that,

$$\Pr(B') = \Pr(AB') + \Pr(A'B') \quad (2)$$

$$= 0.15 + 0.15 \quad (3)$$

$$\Pr(B') = 0.30 \quad (4)$$

now we have $\Pr(B')$ we can find $\Pr(A'|B')$

$$\Pr(A'|B') = 0.15/0.30 \quad (5)$$

$$\Pr(A'|B') = 0.50 \quad (6)$$

similarly,

To obtain $\Pr(BA')$ we have to use $\Pr(A'B')$ and

$\Pr(A')$

we know that,

$$\Pr(BA') = \Pr(A') - \Pr(A'B') \quad (7)$$

$$= 0.20 - 0.15 \quad (8)$$

$$\Pr(BA') = 0.05 \quad (9)$$