

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:

$$\begin{aligned}\Pr(A \text{ fails}) &= 0.20 \\ \Pr(B \text{ alone fails}) &= 0.15 \\ \Pr(A \text{ and } B \text{ fails}) &= 0.15\end{aligned}$$

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:

let:

A represent when subsystem A works

Similary **B** represent when subsystem B works

Given in question,

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

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

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

Now to find,

Probability that both **A** fails given **B** has failed

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

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

we know that,

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

to obtain $\Pr(B')$

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

we know that,

$$\begin{aligned}\Pr(B') &= \Pr(AB') + \Pr(A'B') \\ &= 0.15 + 0.15 \\ \Pr(B') &= 0.30\end{aligned}$$

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

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

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

similarly,

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

we know that,

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

$$= 0.20 - 0.15$$

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