

Assignment 1

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Download all python codes from

<https://github.com/adhvik24/AI1103-PROBABILITY-AND-RANDOM-VARIABLES/blob/main/ASSIGNMENT%201/codes/assign1.py>

and latex-tikz codes from

https://github.com/adhvik24/AI1103-PROBABILITY-AND-RANDOM-VARIABLES/blob/main/ASSIGNMENT%201/AI1103_Assignment1.tex

1 PROBLEM 6.15

Given two independent events A and B such that $\Pr(A) = 0.3$, $\Pr(B) = 0.6$. Find

- i) $\Pr(A \text{ and } B)$
- ii) $\Pr(A \text{ and not } B)$
- iii) $\Pr(A \text{ or } B)$
- iv) $\Pr(\text{neither } A \text{ nor } B)$

2 SOLUTION

- i) Since the events A and B are independent events, by definition

$$\Pr(A \text{ and } B) = \Pr(AB) = \Pr(A) \Pr(B) \quad (2.0.1)$$

On substituting the values of $\Pr(A), \Pr(B)$ in (2.0.1), we get

$$\Pr(A \text{ and } B) = \Pr(A) \Pr(B) \quad (2.0.2)$$

$$= (0.3)(0.6) \quad (2.0.3)$$

$$\Rightarrow \Pr(A \text{ and } B) = 0.18 \quad (2.0.4)$$

- ii) As the events A and B are independent, then A and B' are also independent.

$$\Rightarrow \Pr(A \text{ and not } B) = \Pr(AB') \quad (2.0.5)$$

$$= \Pr(A) \Pr(B') \quad (2.0.6)$$

$$\therefore \Pr(A \text{ and not } B) = \Pr(A) \Pr(B') \quad (2.0.7)$$

And we know that,

$$\Pr(B') = 1 - \Pr(B) \quad (2.0.8)$$

Using (2.0.8) in (2.0.7) we will get,

$$\Pr(A \text{ and not } B) = \Pr(AB') \quad (2.0.9)$$

$$= \Pr(A) \Pr(B') \quad (2.0.10)$$

$$\Pr(A \text{ and not } B) = \Pr(A)(1 - \Pr(B)) \quad (2.0.11)$$

On substituting the values of $\Pr(A), \Pr(B)$ in (2.0.11), we get

$$\Pr(A \text{ and not } B) = 0.3(1 - 0.6) \quad (2.0.12)$$

$$= (0.3)(0.4) \quad (2.0.13)$$

$$\Rightarrow \Pr(A \text{ and not } B) = 0.12 \quad (2.0.14)$$

iii)

$$\Pr(A \text{ or } B) = \Pr(A + B) \quad (2.0.15)$$

We know that,

$$\Pr(A + B) = \Pr(A) + \Pr(B) - \Pr(AB) \quad (2.0.16)$$

As events A and B are independent events,

$$\Pr(AB) = \Pr(A) \Pr(B) \quad (2.0.17)$$

Using (2.0.17) and (2.0.16) in (2.0.15), We get

$$\Pr(A + B) = \Pr(A) + \Pr(B) - \Pr(A) \Pr(B) \quad (2.0.18)$$

On substituting the values of $\Pr(A), \Pr(B)$ in (2.0.18), we get

$$\Pr(A \text{ or } B) = 0.3 + 0.6 - (0.3)(0.6) \quad (2.0.19)$$

$$= 0.9 - 0.18 \quad (2.0.20)$$

$$\Rightarrow \Pr(A \text{ or } B) = 0.72 \quad (2.0.21)$$

iv)

$$\Pr(\text{neither } A \text{ nor } B) = \Pr(A'B') \quad (2.0.22)$$

$$= \Pr((A + B)') \quad (2.0.23)$$

$$\Pr(\text{neither } A \text{ nor } B) = 1 - \Pr(A + B) \quad (2.0.24)$$

From (2.0.21),

$$\Pr(A \text{ or } B) = \Pr(A + B) = 0.72 \quad (2.0.25)$$

Using (2.0.25) in (2.0.24), We get

$$\Pr(\text{neither } A \text{ nor } B) = 1 - 0.72 \quad (2.0.26)$$

$$\implies \Pr(\text{neither } A \text{ nor } B) = 0.28 \quad (2.0.27)$$