

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 $P(A) = 0.3$, $P(B) = 0.6$. Find

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

2 SOLUTION

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

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

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

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

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

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

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

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

And we know that,

$$P(B') = 1 - P(B) \quad (2.0.6)$$

Using (2.0.6) in (2.0.5) we will get,

$$P(A \text{ and not } B) = P(AB') \quad (2.0.7)$$

$$= P(A).P(B') \quad (2.0.8)$$

$$P(A \text{ and not } B) = p(A).(1 - P(B)) \quad (2.0.9)$$

On substituting the values of $P(A)$, $P(B)$ in (2.0.9), we get

$$P(A \text{ and not } B) = (0.3).(1 - 0.6) \quad (2.0.10)$$

$$= (0.3).(0.4) \quad (2.0.11)$$

$$\Rightarrow P(A \text{ and not } B) = 0.12 \quad (2.0.12)$$

iii)

$$P(A \text{ or } B) = P(A + B) \quad (2.0.13)$$

We know that,

$$P(A + B) = P(A) + P(B) - P(AB) \quad (2.0.14)$$

As events A and B are independent events,

$$P(AB) = P(A).P(B) \quad (2.0.15)$$

Using (2.0.15) and (2.0.14) in (2.0.13), We get

$$P(A \text{ or } B) = P(A) + P(B) - P(A).P(B) \quad (2.0.16)$$

On substituting the values of $P(A)$, $P(B)$ in (2.0.16), we get

$$P(A \text{ or } B) = 0.3 + 0.6 - ((0.3).(0.6)) \quad (2.0.17)$$

$$= 0.9 - 0.18 \quad (2.0.18)$$

$$\Rightarrow P(A \text{ or } B) = 0.72 \quad (2.0.19)$$

iv)

$$P(\text{neither } A \text{ nor } B) = P(A'B') \quad (2.0.20)$$

$$= P((A + B)') = 1 - P(A + B) \quad (2.0.21)$$

From (2.0.19),

$$P(A \text{ or } B) = P(A + B) = 0.72 \quad (2.0.22)$$

Using (2.0.22) in (2.0.21), We get

$$P(\textit{neither } A \textit{ nor } B) = 1 - 0.72 \quad (2.0.23)$$

$$\implies P(\textit{neither } A \textit{ nor } B) = 0.28 \quad (2.0.24)$$