# 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 and B)
ii) P(A and not B)
iii) P(A or B)
iv) P(neither A nor B)

## 2 Solution

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

$$P(A\,and\,B) = P(AB) = P(A).P(B) \tag{2.0.1}$$

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

$$\begin{aligned} P(A\,and\,B) &= P(A).P(B) && (2.0.2)\\ &= (0.3).(0.6) && (2.0.3)\\ \implies P(A\,and\,B) &= 0.18 && (2.0.4)\end{aligned}$$

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

$$\implies P(A\,and\,not\,B) = P(AB') = P(A).P(B') \tag{2.0.5}$$

And we know that,

$$P(B') = 1 - P(B) \tag{2.0.6}$$

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

$$\begin{aligned} P(A\,and\,not\,B) &= P(AB') && (2.0.7)\\ &= P(A).P(B') && (2.0.8)\\ P(A\,and\,not\,B) &= p(A).(1 - P(B)) && (2.0.9)\end{aligned}$$

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

$$\begin{aligned} P(A\,and\,not\,B) &= (0.3).(1 - 0.6) && (2.0.10)\\ &= (0.3).(0.4) && (2.0.11)\\ \implies P(A\,and\,not\,B) &= 0.12 && (2.0.12)\end{aligned}$$

iii)

$$P(A\,or\,B) = P(A\,+\,B) \tag{2.0.13}$$

We know that,

$$P(A\,+\,B) = P(A) + P(B) - P(AB) \tag{2.0.14}$$

As events A and B are independent events,

$$P(AB) = P(A).P(B) \tag{2.0.15}$$

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

$$P(A\,or\,B) = P(A) + P(B) - P(A).P(B) \tag{2.0.16}$$

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

$$\begin{aligned} P(A\,or\,B) &= 0.3 + 0.6 - ((0.3).(0.6)) && (2.0.17)\\ &= 0.9 - 0.18 && (2.0.18)\\ \implies P(A\,or\,B) &= 0.72 && (2.0.19)\end{aligned}$$

iv)

$$\begin{aligned} P(neither\,A\,nor\,B) &= P(A'B') && (2.0.20)\\ &= P((A + B)') \quad = 1 - P(A + B) && (2.0.21)\end{aligned}$$

From (2.0.19),

$$P(A\,or\,B) = P(A\,+\,B) = 0.72 \tag{2.0.22}$$

Using (2.0.22) in (2.0.21), We get

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

$$\implies P(neither\, A\, nor\, B) = 0.28 \tag{2.0.24}$$