Assignment 1

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Download all python codes from

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https://github.com/adhvik24/AI1103−PROBABILITY−AND−RANDOM−VARIABLES/blob/main/ASSIGNMENT%201/codes/assign1.py
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and latex-tikz codes from

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

$$P(A\,and\,B) = P(A)P(B) \tag{2.0.2}$$
$$= (0.3)(0.6) \tag{2.0.3}$$
$$\implies P(A\,and\,B) = 0.18 \tag{2.0.4}$$

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

$$\implies P(A\,and\,not\,B) = P(AB') \tag{2.0.5}$$
$$= P(A)P(B') \tag{2.0.6}$$
$$\therefore P(A\,and\,not\,B) = P(A)P(B') \tag{2.0.7}$$

And we know that,

$$P(B') = 1 - P(B) \tag{2.0.8}$$

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

$$P(A\,and\,not\,B) = P(AB') \tag{2.0.9}$$
$$= P(A)P(B') \tag{2.0.10}$$
$$P(A\,and\,not\,B) = P(A)(1 - P(B)) \tag{2.0.11}$$

On substituting the values of P(A), P(B) in (2.0.11), we get

$$P(A\,and\,not\,B) = (0.3)(1 - 0.6) \tag{2.0.12}$$
$$= (0.3)(0.4) \tag{2.0.13}$$
$$\implies P(A\,and\,not\,B) = 0.12 \tag{2.0.14}$$

iii)

$$P(A\,or\,B) = P(A + B) \tag{2.0.15}$$

We know that,

$$P(A + B) = P(A) + P(B) - P(AB) \tag{2.0.16}$$

As events A and B are independent events,

$$P(AB) = P(A)P(B) \tag{2.0.17}$$

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

$$P(A\,or\,B) = P(A) + P(B) - P(A)P(B) \tag{2.0.18}$$

On substituting the values of P(A), P(B) in (2.0.18), we get

$$P(A\,or\,B) = 0.3 + 0.6 - (0.3)(0.6) \tag{2.0.19}$$
$$= 0.9 - 0.18 \tag{2.0.20}$$
$$\implies P(A\,or\,B) = 0.72 \tag{2.0.21}$$

iv)

$$P(neither\,A\,nor\,B) = P(A'B') \tag{2.0.22}$$
$$= P((A + B)') \tag{2.0.23}$$
$$P(neither\,A\,nor\,B) = 1 - P(A + B) \tag{2.0.24}$$

From (2.0.21),

$$P(A\,or\,B) = P(A + B) = 0.72 \tag{2.0.25}$$

Using (2.0.25) in (2.0.24), We get

$$P(neither\, A\, nor\, B) = 1 - 0.72 \tag{2.0.26}$$

$$\implies P(neither\, A\, nor\, B) = 0.28 \tag{2.0.27}$$