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/32af3c126c29083264f47a33631b9e1223a91957/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/94b3ebfff312e0992f21ef9f0be3e3c45d2fcb20/ASSIGNMENT%201/assign1.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.

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

And we know that,

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

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

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

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

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

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 are independent,

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

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

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

iv)

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

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

$$P(neither\, A\, nor\, B) = 1 - 0.72 \quad (2.0.23)$$
$$\implies P(neither\, A\, nor\, B) = 0.28 \quad (2.0.24)$$