# AI1103-Assignment 1

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Download all python codes from

https://github.com/ayushjha2612/AI11003/tree/main
/Assignment1/Codes

and latex-tikz codes from

https://github.com/ayushjha2612/AI11003/tree/main
/Assignment1

### QUESTION 1.11

In a meeting, 70% of the members favour and 30% oppose a certain proposal. A member is selected at random and we take X = 0 if he opposed, and X = 1 if he is in favour. Find E(X) and Var (X).

### SOLUTION

$E(X)$ is the expectation value (or mean) of random variable X .

Let probability that a randomly selected person is in favour be $\Pr(X = 1)$ and if he is in oppose is $\Pr(X = 0)$.

So we have that, 70% of people are in favour thus, $\Pr(X = 1) = 70/100$ and 30% are in oppose so $\Pr(X = 0) = 30/100$.

X=0 if he opposed the proposal, and X=1 if he is in favour.

Therefore, we have

$$E(X) = \sum_{i=0}^{1} \Pr(X = i) X_i$$
$$= 0 \times \Pr(X = 0) + 1 \times \Pr(X = 1)$$
$$= 0 \times 30/100 + 1 \times 70/100$$
$$= 70/100$$
$$= 0.7$$

For calculating variance i.e. Var(X)

$$Var(X) = E(X^2) - E(X)^2$$

$X^2 = 0 \times 0 = 0$ if the person is in oppose and $X^2 = 1 \times 1 = 1$ if the person is in favour. So similarly we have,

$$E(X^2) = \sum_{i=0}^{1} \Pr\left(X^2 = i^2\right) X_i^2$$
$$= 0^2 \times \Pr\left(X^2 = 0\right) + 1^2 \times \Pr\left(X^2 = 1\right)$$
$$= 70/100$$
$$= 0.7$$

So we have finally,

$$Var(X) = E(X^2) - E(X)^2$$
$$= 0.7 - 0.7^2$$
$$= 0.7 - 0.49$$
$$= 0.21$$

Therefore we have, $E(X) = 0.7$ and $Var(X) = 0.21$.

**Note :** The E(X) and Var (X) can also be calculated using the formulas $E(X) = n \times p$ and $Var(X) = n \times p \times (1 - p)$ where n = 1 as only one person is selected and p is the probability when the random variable X will be 1 which corresponds to the case of favour.