

11.16.3.9: Probability of Complementary Events

EE24BTECH11007 - Arnav Makarand Yadnopavit

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Question

If $\frac{1}{12}$ is the probability of an event, what is the probability of the event 'not A'?

Bernoulli Random Variable

Let us solve the problem using a Bernoulli random variable.
The Bernoulli R.V is defined as:

$$X_i = \begin{cases} 0 & \text{not A} \\ 1 & \text{A} \end{cases} \quad (3.1)$$

The PMF of Bernoulli R.V is given by:

$$p_X(x) = \begin{cases} 1 - p & x = 0 \\ p & x = 1 \end{cases} \quad (3.2)$$

Probability Calculation

- The probability of A occurring is given as $P(A) = \frac{1}{12}$. Therefore,
$$p_X(1) = P(A) = \frac{1}{12}.$$
- The probability of the complement of A (denoted as "not A ") is $P(A') = p_X(0)$. Using the rule of complementary probabilities:

$$P(A') = 1 - P(A).$$

- Substitute $P(A) = \frac{1}{12}$ into the equation:

$$P(A') = 1 - \frac{1}{12} = \frac{11}{12}.$$

PMF of Bernoulli R.V

Thus, the probabilities for the Bernoulli random variable X are:

$$p_X(x) = \begin{cases} \frac{11}{12} & x = 0 \\ \frac{1}{12} & x = 1 \end{cases} \quad (3.3)$$

Hence, the probability of the event 'not A' is $\frac{11}{12}$.

Code for finding probability using computational methods can be found at below link

<https://github.com/ArnavYadnopavit/EE1003/tree/main/ncert/11.16.3.9/codes>

Stem Plot of the PMF

Below is the stem plot for the PMF of the Bernoulli random variable:

