

Assignment 1

AI1110: Probability and Random Variables

Indian Institute of Technology Hyderabad

CS22BTECH11046

P.Yasaswini

10.15.1.25: Question. Which of the following arguments are correct and which are not correct? Give reasons for your answer.

- 1) If two coins are tossed simultaneously, there are three possible outcomes - two heads, two tails, or one of each. Therefore, for each of these outcomes, the probability is $\frac{1}{3}$.
- 2) If a die is thrown, there are two possible outcomes - an odd number or an even number. Therefore, the probability of getting an odd number is $\frac{1}{2}$.

Solution:

- 1) X is a random variable which denotes the number of heads obtained when n coins are tossed simultaneously, $X = \{0, 1, 2, \dots, n\}$.
p = probability of getting head = $\frac{1}{2}$.

$\Pr(X = r)$ = The probability of obtaining r heads when n coins are tossed simultaneously.
then,

$$\Pr(X = r) = {}^nC_r \times \frac{1}{2^n} \quad (1)$$

Here n=2, So $X = \{0, 1, 2\}$
Therefore,

$$\Pr(X = 0) = {}^2C_0 \times \frac{1}{2^2} \quad (2)$$

$$\Pr(X = 1) = {}^2C_1 \times \frac{1}{2^2} \quad (3)$$

$$\Pr(X = 2) = {}^2C_2 \times \frac{1}{2^2} \quad (4)$$

Reason: For $X=1$, it contains two mutually exclusive events (H, T), (T, H). Therefore, the probability of getting one of each is $\frac{1}{2}$ and not $\frac{1}{3}$. So, the above statement is incorrect.

- 2) Here, let E be the event 'getting an odd number'.

$$\text{Sample space } \Omega = \{1, 2, 3, 4, 5, 6\} \quad (5)$$

$$E = \{1, 3, 5\} \quad (6)$$

$$\Pr(E) = \frac{3}{6} = \frac{1}{2} \quad (7)$$

Reason: Event of getting an odd number and Event of getting an even number are equally likely and they together forms an exhaustive event. Hence,

$$\Pr(E) = \frac{1}{2} \quad (8)$$

$$\Pr(E') = \frac{1}{2} \quad (9)$$

So the above statement is correct.