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,p = probability of getting head .

$$X \sim \text{Bin(n,p)} \tag{1}$$

then,

$$\Pr(X = r) = {}^{n}C_r \times (p^r) \times ((1-p)^{n-r} \tag{2}$$

Here n=2 and p=$\frac{1}{2}$,
Therefore,

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

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'.

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

$$\text{E } = \{1,3,5\} \tag{5}$$

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

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,

$$\Pr(E) = \frac{1}{2} \tag{7}$$

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

So the above statement is correct.