Assignment 1
AI1110: Probability and Random Variables
Indian Institute of Technology Hyderabad

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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,

$$p_X(r) = {}^nC_r p^r (1-p)^{n-r} \tag{2}$$

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

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

Therefore,

0:	Getting two tails	$p_X(0)$=0.25
1:	Getting one of each	$p_X(1)$=0.50
2:	Getting two heads	$p_X(2)$=0.25

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, X is a random variable which denotes the number of success in getting odd number. Sample space $\Omega = \{1, 2, 3, 4, 5, 6\}$,Probability of getting each number=$\frac{1}{6}$

$$X = \begin{cases} 0 & \text{if no success,} \\ 1 & \text{if success.} \end{cases}$$

$p_X(1) = \Pr(1) + \Pr(3) + \Pr(5)$
$= \frac{1}{6} + \frac{1}{6} + \frac{1}{6}$
$= \frac{3}{6}$
$= 0.5$

0:	Getting even number	$p_X(0)$=0.50
1:	Getting odd number	$p_X(1)$=0.50

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,

$$p_X(0) = \frac{1}{2} \tag{4}$$

$$p_X(1) = \frac{1}{2} \tag{5}$$

So the above statement is correct.