Assignment 3

AI1110: Probability and Random Variables
Indian Institute of Technology Hyderabad

Ashwin Agrawal
CS22BTECH11009

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: Let us define the random variables X and Y:

Parameter	Value	Description
X	{0,1,2}	Number of Heads in two coin tosses
Y	{1,2,3,4,5,6}	Number appering on a Die throw
n	2	Number of coin tossed
p	$\frac{1}{2}$	Probability of getting heads on a coin

PMF of X:

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

$$\Pr(X = i) = \binom{n}{i} \times p^i \times (1-p)^{n-i} = \binom{2}{i} \times \frac{1}{2^2} \tag{2}$$

PMF OF Y:

$$\Pr(X = i) = \frac{1}{6}, i = 1, 2, 3, 4, 5, 6 \tag{3}$$

1) There are 3 possible outcomes i.e $X = 0, 1, 2$
For 1st outcome (Two Heads) X=2,

$$\Pr(X = 2) = \binom{2}{2} \times \frac{1}{2^2} = \frac{1}{4} \tag{4}$$

For 2nd outcome(Two Tails) X=0,

$$\Pr(X = 2) = \binom{2}{0} \times \frac{1}{2^2} = \frac{1}{4} \tag{5}$$

For 3rd outcome (One Head and One Tail) X=1,

$$\Pr(X = 1) = \binom{2}{1} \times \frac{1}{2^2} = 2 \times \frac{1}{4} = \frac{1}{2} \tag{6}$$

From (4) , (5) and (6) , the probabilities are not equal to $\frac{1}{3}$. Hence, the statement is false.

2) There are 2 possible outcomes i.e Y=Odd,Even

$$\Pr(Y = Odd) = \Pr(Y = 1) + \Pr(Y = 3) + \Pr(Y = 5) = \frac{1}{2} \tag{7}$$

Hence, the statement is true.