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

Kedareswar Kondakavuri
CS22BTECH11033

29 April 2023

CBSE Grade 11

Question : A fair coin is tossed four times, and a person win Rs 1 for each head and lose Rs 1.5 for each tail that turns up. From the sample space calculate how miany different amounts of money you can have after four tosses and the probability of having each of these amounts.

Solution.

Let X be the random variable that represents the amount of money won or lost after four coin tosses we can define X as:

X = 1*(number of heads) - 1.5*(number of tails)

(i) X = 1*(4) - 1.5*(0) = 4 when 4 heads appear
(ii) X = 1*(3) - 1.5*(1) = 2.5 when 3 H and 1 T appear
(iii) X = 1*(2) - 1.5*(2) = -0.5 when 2 H and 2 T appear
(iv) X = 1*(1) - 1.5*(3) = -3.5 when 1 H and 3 T appear
(v) X = 1*(0) - 1.5*(4) = -6 when 4 T appear

Now, let's calculate the probability of each value of X using the pmf.

(i) Probability of having Rs 4 is

$$\Pr(X = 4) = {}^4C_4 \times \left(\frac{1}{2}\right)^4 \quad = \frac{1}{16} \quad (1)$$

(ii) Probability of having Rs 1.5 is

$$\Pr(X = 1.5) = {}^4C_3 \times \left(\frac{1}{2}\right)^4 \quad = \frac{1}{4} \quad (2)$$

(iii) Probablity of having Rs -1 is

$$\Pr(X = -1) = {}^4C_2 \times \left(\frac{1}{2}\right)^4 \quad = \frac{3}{8} \quad (3)$$

(iv) Probability of having Rs -3.5 is

$$\Pr(X = -3.5) = {}^4C_1 \times \left(\frac{1}{2}\right)^4 \quad = \frac{1}{4} \quad (4)$$

(v) Probability of having Rs -6 is

$$\Pr(X = -6) = {}^4C_0 \times \left(\frac{1}{2}\right)^4 \quad = \frac{1}{16} \quad (5)$$

Therefore ,the possible amounts of money are 4, 2.5, -0.5, -3.5, and -6, and the probability are 1/16, 1/4, 3/8, 1/4, and 1/16, respectively.