Problem

EE22BTECH11010 - Aryan Bubna

question: A fair coin is tossed four times and a person win Re 1 for each head and lose Re 1.5 for each tail that turns up.from the sample space calculate how many different amounts of money you can have after four tosses and the probability of having each of these amounts.
Solution: Let us define a random variable X, where getting heads is success.

parameters	values	descrption
X	0,1,2,3,4	no of heads
n	4	times event occured
p	0.5	prob of getting head
q	0.5	prob of getting tail

TABLE 0: Random variable X declaration

$$p_X(k) = \begin{cases} 0 & k < 0 \\ {}^nC_k \, (p)^k \, (q)^{n-k} & 0 \le k \le n \end{cases} \quad (1)$$

let Y be a random variable with "y" denoting amounts possible, whose value is given by:

$$y = k(1) + (4 - k)(-1.5) \quad (2)$$

k	y(profit in Rs)
0	-6
1	-3.5
2	-1
3	1.5
4	4

TABLE 0: amounts possible

now using PMF the probability of different amounts is:

$$p_Y(y) = \begin{cases} 0 & y < -6 \\ {}^nC_{\frac{y+6}{2.5}} \, (p)^{\frac{y+6}{2.5}} \, (q)^{n-\frac{y+6}{2.5}} & -6 \le y \le 4 \\ 0 & y > 4 \end{cases} \quad (3)$$

simulation steps:
1) define a function called binomial probability
2) set the parameters for the binomial distribution with n=4, $p = \frac{1}{2}, q = \frac{1}{2}$
3) define a list called money changes and this list contains all possible amounts ranging from -6 to 4.
4) create a empty list called probabilities to store probabilities of each amount.
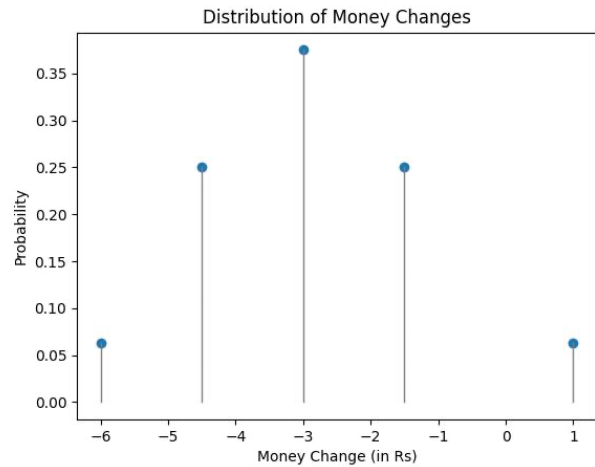5) calculated the probabilities using loops and stored them in the above list.
6) create a plot

Fig. 6: distribution of Y