

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	description
X	0,1,2,3,4	no of heads
n	4	times event occurred
p	0.5	prob of getting head
q	0.5	prob of getting tail

TABLE 0: Random variable X declaration

$$P_X(k) = \begin{cases} 0 & k < 0 \\ \binom{n}{k} (p)^k (q)^{n-k} & 0 \leq k \leq n \end{cases} \quad (1)$$

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:

$$P_Y(y) = P_X(k) \quad (3)$$

$$P_Y(-6) = \binom{4}{0} \times \frac{1}{2}^0 \times \frac{1}{2}^4 \quad (4)$$

$$= \frac{1}{16} \quad (5)$$

$$P_Y(-3.5) = \binom{4}{1} \times \frac{1}{2}^1 \times \frac{1}{2}^3 \quad (6)$$

$$= \frac{1}{4} \quad (7)$$

$$P_Y(-1) = \binom{4}{2} \times \frac{1}{2}^2 \times \frac{1}{2}^2 \quad (8)$$

$$= \frac{3}{8} \quad (9)$$

$$P_Y(1.5) = \binom{4}{3} \times \frac{1}{2}^3 \times \frac{1}{2}^1 \quad (10)$$

$$= \frac{1}{4} \quad (11)$$

$$P_Y(4) = \binom{4}{4} \times \frac{1}{2}^4 \times \frac{1}{2}^0 \quad (12)$$

$$= \frac{1}{16} \quad (13)$$

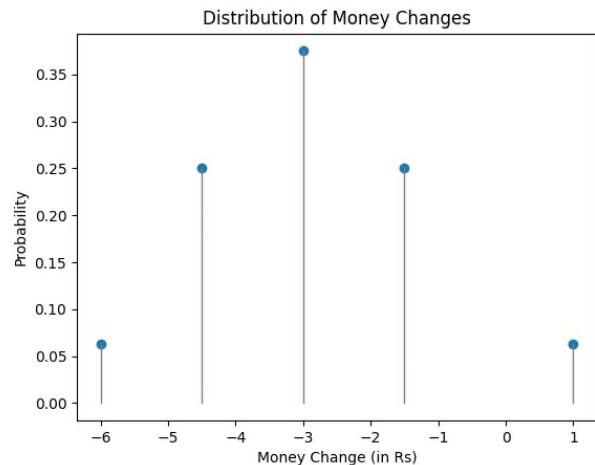


Fig. 0: distribution of Y