

Assignment 5

CBSE Class 11 Probability

Ex 16.3 Q7

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L^AT_EX

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Question

A fair coin is tossed four times, and a person wins ₹1 for each head and loses ₹1.50 for each tails 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 the amounts.

Theory

Let the binomial random variable $X \in \{0, 1, 2, 3, 4\}$ denote the number of heads, and let Y denote the net gain in rupees.

Calculations

Since rolling heads gives ₹1, and tails gives ₹−1.5, we have that

$$Y = (1)(X) + (-1.5)(4 - X) = 2.5X - 6 \quad (1)$$

Since X is a binomial variable, we know that,

$$\Pr(X = i) = \binom{4}{i} p^i (1 - p)^{4-i} \quad (2)$$

where p is the probability of getting heads. Since the coin is fair, we have $p = \frac{1}{2}$, and so,

$$\Pr(X = i) = \binom{4}{i} \left(\frac{1}{2}\right)^4 \quad (3)$$

Values

Substituting the values for X , we get the following probabilities.

X	$Y = 2.5X - 6$	$\Pr(X = i)$
0	-6	0.0625
1	-3.5	0.25
2	-1	0.375
3	1.5	0.25
4	4	0.0625

Table: Probabilities of different gains

Graph

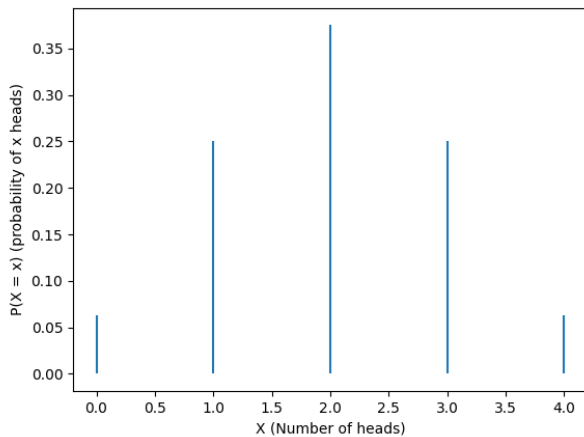


Figure: Probability Mass Function