

Assignment 1

AI1110: Probability and Random Variables

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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 many different amounts of money you can have after four tosses and the probability of having each of these amounts.

Solution.

The Sample space of for tosses is $S = \{ \text{HHHH, HHHT, HHTH, HTHH, THHH, HHTT, HTTH, TTHH, HTHT, THTH, THHT, HTTT, THTT, TTHT, TTTH, TTTT} \}$ After 4 tosses he can have 5 different amounts

- (i) 4 heads & 0 tails - Rs 4
- (ii) 3 heads & 1 tails - Rs 1.5
- (iii) 2 heads & 2 tails - Rs -1
- (iv) 1 head & 3 tails - Rs -3.5
- (v) 0 heads & 4 tails - Rs -6

Their Probabilities are

- (i) Probability of having Rs 4 is

$$\Pr(4) = \frac{{}^4C_4}{2^4} \quad (1)$$

$$= \frac{1}{16} \quad (2)$$

- (ii) Probability of having Rs 1.5 is

$$\Pr(1.5) = \frac{{}^4C_3}{2^4} \quad (3)$$

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

- (iii) Probability of having Rs -1 is

$$\Pr(-1) = \frac{{}^4C_2}{2^4} \quad (5)$$

$$= \frac{3}{8} \quad (6)$$

- (iv) Probability of having Rs -3.5 is

$$\Pr(-3.5) = \frac{{}^4C_1}{2^4} \quad (7)$$

$$= \frac{1}{4} \quad (8)$$

- (v) Probability of having Rs -6 is

$$\Pr(-6) = \frac{{}^4C_0}{2^4} \quad (9)$$

$$= \frac{1}{16} \quad (10)$$