

Assignment 2 in L^AT_EX

AI1110: Probability and Random Variables

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12.13.6.10 Question: How many times must a man toss a fair coin so that the probability of having at least one head is more than 90%?

Solution:

Let us say the man has tossed the fair coin 'n' times. The event of having no heads is same as the event of having tails in all tosses.

$$\therefore \Pr(\text{no heads}) = \Pr(\text{all tails}) = \frac{1}{2^n}. \quad (1)$$

$$\therefore \Pr(\text{atleast one head}) = 1 - \Pr(\text{no heads}). \quad (2)$$

$$\Pr(\text{atleast one head}) = 1 - \frac{1}{2^n} \quad (3)$$

$$1 - \frac{1}{2^n} > \frac{90}{100} \quad (4)$$

$$\frac{1}{2^n} < \frac{10}{100} \quad (5)$$

$$\frac{1}{2^n} < \frac{1}{10} \quad (6)$$

$$2^n > 10 \quad (7)$$

$$n > \log_2 10 \quad (8)$$

$$n > 3.3219 \quad (9)$$

$$\therefore n \geq 4 \quad (10)$$

\therefore the man should toss the fair coin atleast 4 times so that probability of having at least one head is more than 90%.