

Binomial Distribution 38

Tree diagrams are useful for solving many problems which involve only two outcomes such as winning or losing a game or flipping a coin.

Tree diagrams become difficult to use when there are many repeated trials.

In this case we can use the binomial formula. If p is the probability of success and $q = (1 - p)$ is the probability of failure, then the probability of X successes in N trials is given by:

$$P(\mathbf{x \text{ successes}}) = {}_N C_X \cdot p^X \cdot q^{(N-X)}$$

Example: Find the probability of tossing six heads if a coin is tossed 15 times. In this problem, $p = 0.5$, $q = 0.5$, $X = 6$, and $N = 15$. Substituting these numbers into the above formula gives $P = 0.15$.

1) Find the probabilities for a coin which is tossed three times. Use the above formula. You can also use a tree diagram.

a) $P(3 \text{ heads})$

b) $P(2 \text{ heads})$

2) Ten coins are tossed. Find the probabilities.

a) $P(7 \text{ heads})$

b) $P(4 \text{ heads})$

3) In a certain game, a good player wins 85% of the time. Use the formula to find the probability that the player will win:

a) six games in a row

b) four out of six games

4) A die is rolled four times. Find the probability of getting:

a) one 5

b) three 5's

Answers: 1)a) $1/8$, b) $3/8$, 2)a) $15/128$, b) $105/512$, 3)a) 0.38 , b) 0.18 , 4)a) $125/324$, b) $5/324$.