

Probability Problems involving Coin Toss

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YouTube Video Link to this Post is [Here](#)

Following is covered in the video

- ✂ **What is Probability of an Event ?**
- ✂ **Probability: Tossing 1 Fair Coin**
- ✂ **Probability: Tossing 2 Fair Coins**
- ✂ **Probability: Tossing 3 Fair Coins**

Theory

What is Probability of an Event?

- Probability of an Event is the Likelihood of occurrence of that event.
- Probability that an Event, E, will occur is denoted by P(E)

$P(E) = \frac{\text{"No. of successful Outcomes"}}{\text{"Total number of Outcomes"}}$

Probability: Tossing 1 Fair Coin

Fair coin is a coin which has equal probability of getting a Head or a Tail.

When we toss one coin or when we toss a coin one time then

- Total Number of Outcomes = 2 (We can get a Head(H) or a Tail(T))
- Outcomes are { H , T }
- Probability of Getting a Head, $P(H) = \frac{1}{2}$ (As there are two outcomes and only one out of those results in a head)
- Probability of Getting a Tail, $P(T) = \frac{1}{2}$ (As there are two outcomes and only one out of those results in a Tail)

Probability: Tossing 2 Fair Coins

When we toss two coins or when we toss a coin two times then

- Total Number of Outcomes = $2^2 = 4$ (In each of the toss we can get a Head(H) or a Tail(T) $\Rightarrow 2*2 = 4$)
- Outcomes are { HH, HT, TH, TT }
- Probability of Getting 0 Head, $P(0H) = \frac{1}{4}$ (As there is ONLY one outcome out of 4 where we get 0 Head or 2 Tails)
- Probability of Getting 1 Head, $P(1H) = \frac{2}{4} = \frac{1}{2}$ (As there are two outcomes out of 4 where we get 1 Head i.e. HT, TH)
- Probability of Getting 2 Head, $P(2H) = \frac{1}{4}$ (As there is ONLY one outcome out of 4 where we get 2 Head i.e. HH)
- Probability of Getting 0 Tail, $P(0T) = \frac{1}{4}$ (As there is ONLY one outcome out of 4 where we get 0 Tail or 2 Heads)
- Probability of Getting 1 Tail, $P(1T) = \frac{2}{4} = \frac{1}{2}$ (As there are two outcomes out of 4 where we get 1 Tail i.e. HT, TH)
- Probability of Getting 2 Tail, $P(2T) = \frac{1}{4}$ (As there is ONLY one outcome out of 4 where we get 2 Tails i.e. TT)
- $P(0H) + P(1H) + P(2H) = \frac{1}{4} + \frac{2}{4} + \frac{1}{4} = 1$
- Probability of at least 1 Head = $P(1H) + P(2H) = \frac{2}{4} + \frac{1}{4} = \frac{3}{4}$
- Probability of at least 1 Head = $1 - P(0H) = 1 - \frac{1}{4} = \frac{3}{4}$
- Probability of at least 1 Tail = $1 - P(0T) = 1 - \frac{1}{4} = \frac{3}{4}$

Probability: Tossing 3 Fair Coins

When we toss three coins or when we toss a coin three times then

- Total Number of Outcomes = $2^3 = 8$ (In each of the toss we can get a Head(H) or a Tail(T) $\Rightarrow 2*2*2 = 8$)
- Outcomes are { HHH, HHT, HTH, HTT, THH, THT, TTH, TTT }
- Probability of Getting 0 Head, $P(0H) = \frac{1}{8}$ (As there is ONLY one outcome out of 8 where we get 0 Head or 3 Tails)

- Probability of Getting 1 Head, $P(1H) = \frac{3}{8}$ (As there are three outcomes out of 8 where we get 1 Head i.e. HTT, THT, TTH)

We can also find this by finding the position of that one Head out of three slots in ${}^3C_1 = \frac{3!}{(1! \cdot 2!)} = 3$ ways and divide it by the total number of outcomes which is 8

- Probability of Getting 2 Head, $P(2H) = \frac{3}{8}$ (As there are three outcomes out of 8 where we get 2 Heads i.e. HHT, THH, HTH)

We can also find this by finding the position of those 2 Heads or 1 Tail out of three slots in ${}^3C_2 = \frac{3!}{(2! \cdot 1!)} = 3$ ways and divide it by the total number of outcomes which is 8

- Probability of Getting 3 Head, $P(3H) = \frac{1}{8}$ (As there is ONLY one outcome out of 8 where we get 3 Head i.e. HHH)

- Probability of Getting 0 Tail, $P(0T) = \frac{1}{8}$ (As there is ONLY one outcome out of 8 where we get 0 Tail or 3 Heads)

- Probability of Getting 1 Tail, $P(1T) = \frac{3}{8}$ (As there are three outcomes out of 8 where we get 1 Tail i.e. THH, HTH, HHT)

We can also find this by finding the position of that one Tail out of three slots in ${}^3C_1 = \frac{3!}{(1! \cdot 2!)} = 3$ ways and divide it by the total number of outcomes which is 8

- Probability of Getting 2 Tail, $P(2T) = \frac{3}{8}$ (As there are three outcomes out of 8 where we get 2 Tails i.e. TTH, THT, HTT)

We can also find this by finding the position of those 2 Tails or 1 Head out of three slots in ${}^3C_2 = \frac{3!}{(2! \cdot 1!)} = 3$ ways and divide it by the total number of outcomes which is 8

- Probability of Getting 3 Tail, $P(3T) = \frac{1}{8}$ (As there is ONLY one outcome out of 8 where we get 3 Tail i.e. TTT)

- $P(0H) + P(1H) + P(2H) + P(3H) = \frac{1}{8} + \frac{3}{8} + \frac{3}{8} + \frac{1}{8} = 1$

- Probability of at least 1 Head = $1 - \frac{1}{8} = \frac{7}{8}$

- Probability of at least 2 Head = $P(2H) + P(3H) = \frac{3}{8} + \frac{1}{8} = \frac{4}{8} = \frac{1}{2}$

- Probability of at least 1 Tail = $1 - P(0T) = 1 - \frac{1}{8} = \frac{7}{8}$

- Probability of at least 2 Tail = $P(2T) + P(3T) = \frac{3}{8} + \frac{1}{8} = \frac{4}{8} = \frac{1}{2}$

Hope it helps!
Good Luck!