“sigma notation” simply indicates we’ll be adding together a bunch of these guys

$$(x + y)^n = \sum_{k=0}^{n} \binom{n}{k} x^{n-k} y^k$$

“n choose k” combinations formula we learned about earlier

With x = Probability of flipping a coin and getting a Head,

and y = Probability of flipping a coin and getting a Tail,

Use the binomial theorem https://medium.com/i-math/the-binomial-theorem-explaine

to calculate the probability of flipping a coin 4 times and getting 1 tail and 3 heads.

$$\binom{n}{k} x^{n-k} \quad y^k$$

x = Probability of flipping a coin and getting Heads

y = Probability of flipping a coin and getting Tails

n = number of trials

k = Number of times for a specific outcome within n trails

x = 50% or 0.50

y = 50% or 0.50

n = 4 coin flips
k = 1 getting 1 tail

$$\frac{n!}{k!(n-k)!} \qquad \binom{4}{1} \quad 0.50^{\cancel{4-1}\;3} \quad 0.50^{\cancel{1}}$$

$$\frac{4!}{1!\,(4-1)!} = 4\,(0.125 \times 0.50)$$

$$\downarrow$$

$$4\,(0.0625)$$

$$\downarrow$$

$$0.25$$

or

25%

c) What if you had a biased coin that would come up heads 60% of the time.

1) Calculate the probability using the binomial theorem.

2) Simulate the results like in b)

x = 60% or 0.60
y = 40% or 0.40
n = 4 coin flips
k = 1 getting 1 tail

$$\frac{n!}{k!(n-k)!} \qquad \binom{4}{1} \quad \underset{x}{0.60}^{\cancel{4-1}\;3} \quad \underset{y}{0.40}^{\cancel{1}}$$

$$\frac{4!}{1!\,(4-1)!} = 4\,(0.216 \times 0.40)$$

$$\downarrow$$

$$4\,(0.0864)$$

$$\downarrow$$

$$0.3456$$

or

$$34.56\%$$