**Binomial Probabilities**

A Binomial Probability is a type of discrete probability with only two outcomes (male or female, win or lose, have disease or don’t have disease)

Success Category (have disease)

Failure Category (don’t have disease)

For a binomial probability, individual observations should be independent of each other with a consistent probability of success. (For example, winning at cards often fails this assumption because the number of cards and the probabilities are always changing.)

**Calculate Binomial Probabilities with StatCrunch**

Stat Menu => Calculator => Binomial => Standard or Between

What you need?

X = # of successes and what you are finding the probability of

p = the probability of success in 1 observation

n = total number of observations

Note about inequality symbols.

Normal Probabilities: When dealing with continuous quantitative data with decimals, we had infinite totals so the probability of less than 3 kilograms is 2.999999999... or below. Hence for normal probabilities the probability of less than 3 is about the same as less than or equal to.
Binomial Probabilities: This is not the case for binomial probabilities. Winning a game less than 3 times means winning less than or equal to 2 times. So be careful about the wording with inequalities. For Binomial, StatCrunch gives the options of =, <, >, ≤, ≥ Remember greater than points right and less than points left.

Wording examples

= “probability that exactly 5 people have the disease”

> “ probability that she wins more than 4 times “

≥ “ probability that she wins 4 or more times “ or “ at least 4 times”

< “ probability that he wins less than 6 times “

≤ “ probability that he wins 6 times or less “ or “ at most 6 times”

Let’s look at an example.

Sarah likes to play slot machines in a Casino in Las Vegas. The particular slot machine she is playing has a 7% chance of winning. Suppose Sarah plays the game 35 total times.

1. What is the probability that Sarah wins more than 3 times?

\[ P(x > 3) = ??? \]

We will need to go to StatCrunch and click the stat menu, then calculator, then binomial. Since this is not a “between” problem, click on the standard button. Notice n = 35, and p = 0.07 and x =3. Click the greater than but not the greater than or equal to.
2. What is the probability that Sarah wins at most 2 times?

We will need to go to StatCrunch and click the stat menu, then calculator, then binomial. Since this is not a “between” problem, click on the standard button. Notice $n = 35$, and $p = 0.07$ and $x = 2$. Click the less than or equal to sign.
3. Find the probability that Sarah wins 5, 6 or 7 times (between 5 and 7 inclusively)?

We will need to go to StatCrunch and click the stat menu, then calculator, then binomial. Since this is a “between” problem, click on the between button. Notice $n = 35$, and $p = 0.07$ and $x = 5$ and $x = 7$. 

$P(X \leq 2) = 0.55249848$
Binomial Distribution

n: 35  p: 0.07

P(5 \leq X \leq 7) = 0.09239171