Excel Functions for Discrete Distributions

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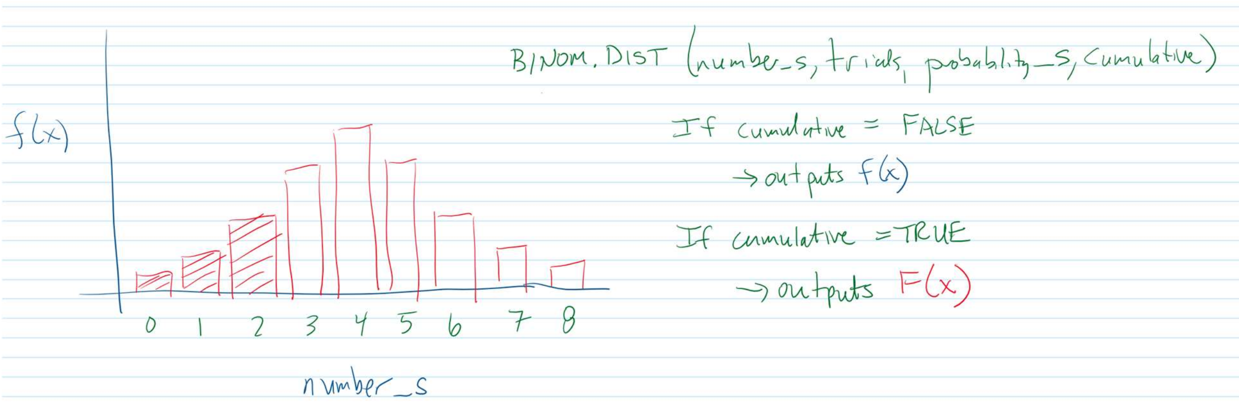
BINOMIAL DISTRIBUTION

BINOM.DIST(number_s,trials,probability_s,cumulative) – Provides the cumulative frequency (left-tailed) (if **cumulative** is **TRUE**) corresponding to the binomial distribution with **trials** number of trials and probability of success **probability_s** to the left of **number_s**. It is rare to use **FALSE** as the final argument unless you want to generate a plot of f(x) in Excel.



Example: The area of to the left of and including 2 below the binomial distribution with 8 trials and probability of success 0.5 is: **BINOM.DIST(2,8,0.5,TRUE)** = 0.144

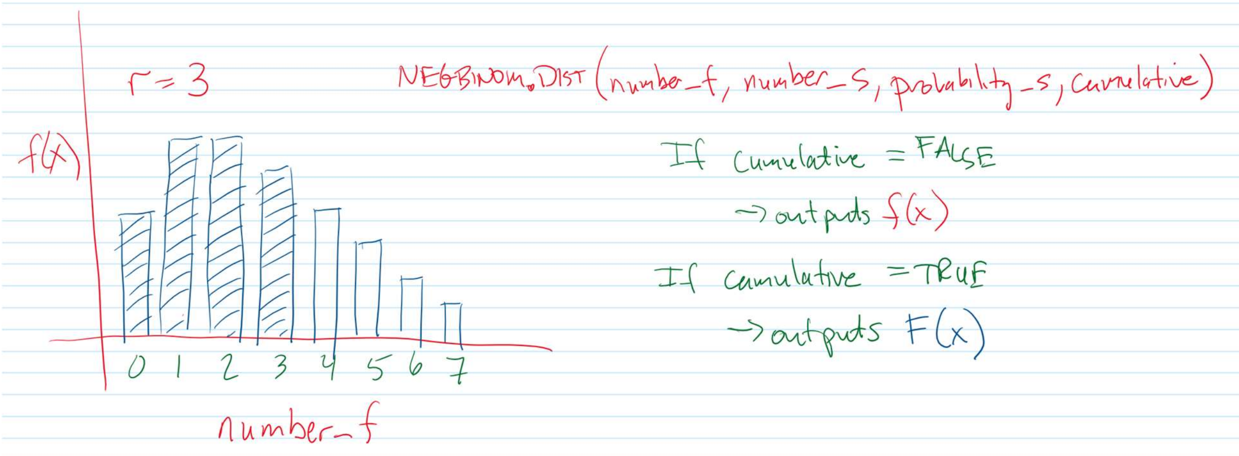
BINOM.INV(trials,probability_s,alpha) – Returns the smallest value for which the cumulative binomial distribution is greater than or equal to **alpha**. Outputs the x-value (number of successes) that has at least **alpha** proportion to the left of it based on the binomial distribution with **trials** number of trials and probability of success **probability_s**.

For example, **BINOM.INV(8,0.5,0.05)** = 2. I'll attempt to explain this a little bit here. The cumulative binomial distribution up to 1 success (out of 8) is equal to: **BINOM.DIST(1,8,0.5,TRUE)** = 0.035. The cumulative binomial distribution up to 2 successes (out of 8) is equal to (see above): **BINOM.DIST(2,8,0.5,TRUE)** = 0.144. The **BINOM.INV** function outputs the minimum number of trials whose cumulative distribution is at least **alpha**. Since alpha = 0.05 lies between the cumulative probabilities for 1 and 2 successes, we must round up to 2, which is the output of the function.

NEGATIVE BINOMIAL DISTRIBUTION

NEGBINOM.DIST(number_f,number_s,probability_s,cumulative) – Outputs the left-tailed, cumulative probability [F(x)] of the negative binomial distribution up to **number_s** (if **cumulative** = **TRUE**) based on

number_f failures, **number_s** successes, with probability of success **probability_s**. If **cumulative** = **FALSE**, it outputs f(x), the probability density function.



Example: If we need 3 successes (r = 3), the area up to and including x = 6 (3^{rd} success in at most 6 total trials) of the negative binomial distribution with probability of success = 0.5 is:

NEGBINOM.DIST(3,3,0.5,TRUE) = 0.656

Note that $x \geq r$. For example, we cannot have 3 successes in 2 trials.

There is no **.INV** version of the negative binomial function in Excel (i.e., there is no **NEGBINOM.INV** function).

GEOMETRIC DISTRIBUTION

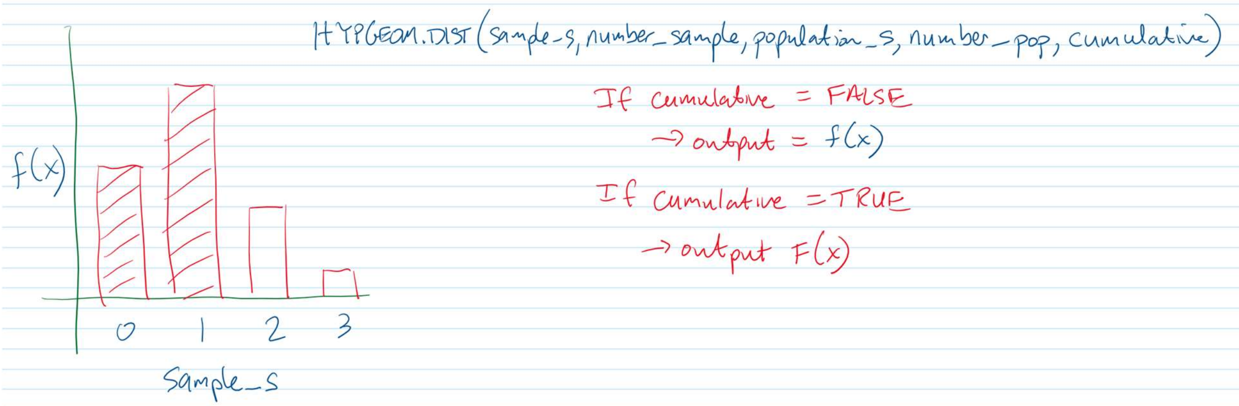
There is no "**GEOM.DIST**" function in Excel. However, since the geometric distribution is a special case of the negative binomial distribution with only 1 success in x number of trials, we can use the **NEGBINOM.DIST** function with the number of successes equal to 1:
NEGBINOM.DIST(number_f,1,probability_s,cumulative)

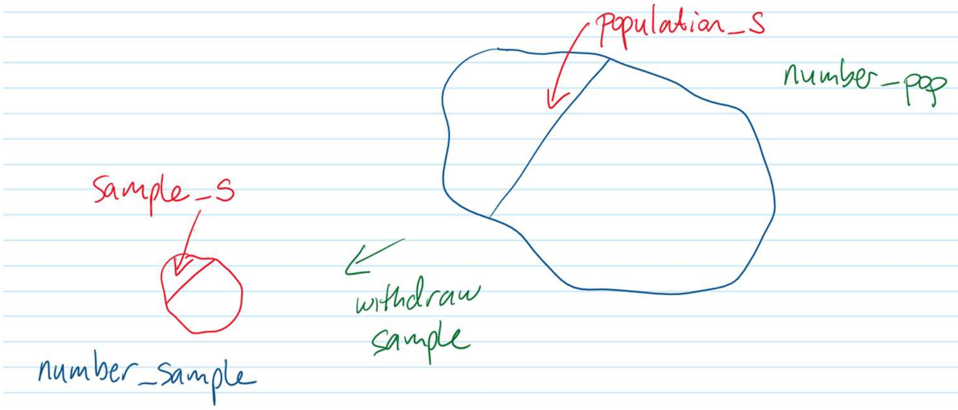
Example: The probability of obtaining the first success in at most 5 trials (area up to and including x = 8 in the negative binomial distribution with r = 1) with probability of success 0.3 is given by:

NEGBINOM.DIST(4,1,0.3,TRUE) = 0.832

HYPERGEOMETRIC DISTRIBUTION

HYPGEOM.DIST(sample_s,number_sample,population_s,number_pop,cumulative) – Outputs the left-tailed, cumulative probability [F(x)] of the hypergeometric distribution up to number of successes in the sample **sample_s** (if **cumulative** = **TRUE**) based on sample size **number_sample**, **population_s** successes in the population, and population size **number_pop**. If **cumulative** = **FALSE**, it outputs f(x), the probability density function.





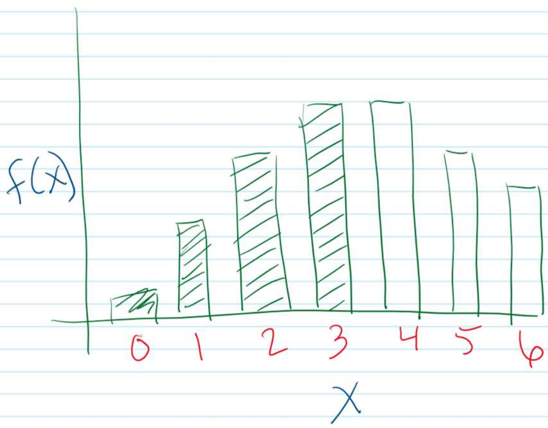
Example: The probability of obtaining 0 or 1 successes in a sample of size 4 drawn from a population of size 20 that contains 5 successes is:

HYPGEOM.DIST(1,4,5,20,TRUE) = 0.751

Note that it wouldn't make sense for **sample_s** to be greater than **population_s**.

<u>POISSON DISTRIBUTION</u>

POISSON.DIST(x,mean,cumulative) – Outputs the left-tailed, cumulative probability [F(x)] of the Poisson distribution up to **x** (if **cumulative** = **TRUE**) based on **mean** of the Poisson distribution. The parameter **mean** is equal to the product of λ and interval T: **mean** = λT. If **cumulative** = **FALSE**, it outputs f(x), the probability density function.



POISSON.DIST(x, mean, cumulative)

If cumulative = FALSE

→ output = f(x)

If cumulative = TRUE

→ output = F(x)

Example: The probability that x will be less than or equal to 3 given a mean of 4 is:

POISSON.DIST(3,4,TRUE) = 0.433