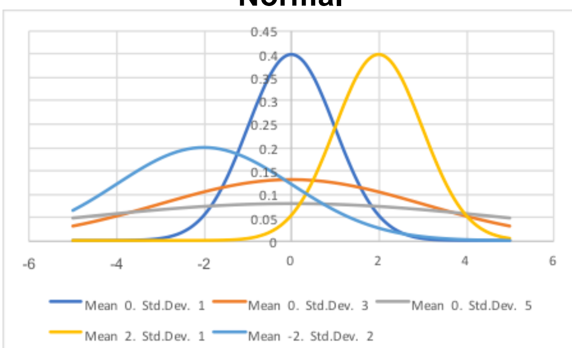
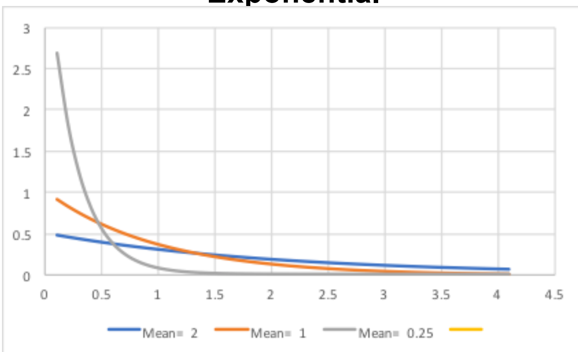
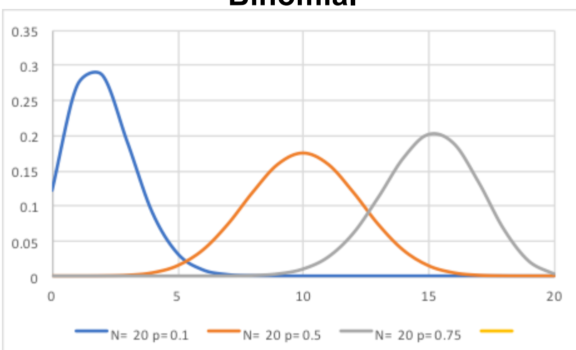
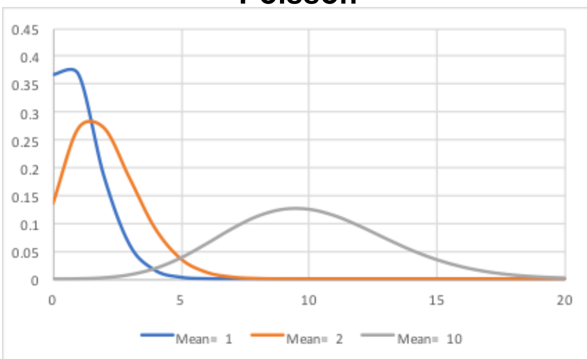
Tool: Theoretical Probability Distributions

Instructions: Use the table below to help choose the most appropriate distribution for your decision-making situation.

Theoretical Probability Distributions

Distribution Type	Data Type/Range	Usage	Excel
Normal 	Two parameter distribution, described by mean μ and standard deviation σ. Continuous, can take on any value from –∞ to +∞ but 99% of observations are within 3 standard deviations of the mean.	A very commonly used continuous probability distribution, it is sometimes informally referred to as the bell curve distribution. Commonly used as an approximation, even for scenarios with discrete data.	In Excel, probability P[n=x] is defined using =NORMDIST(x, μ, σ, 0) with cumulative probability (P[n ≤ x]) defined with =NORMDIST(x, μ, σ, 1).

Exponential 	Single parameter distribution, described by the mean μ (since σ = μ). Continuous values where x ≥ 0.	Commonly used to model service times or other situations where most observations take on values less than the mean but there exist some observations where it takes a very long time.	In Excel, probability P[n=x] is defined using =EXPONDIST (x, 1/μ, 0) with cumulative probability (P[n ≤ x]) defined with =EXPONDIST (x, 1/μ, 1).
Binomial 	Two parameter distribution described by number of trials N and probability p, Takes on discrete, non-negative values (i.e. integers 0, 1, 2, ..., N).	Used to model the number of successes, each with probability p out of N trials or attempts. The binomial distribution has parameters N and p producing a mean of N • p and variance of N • p • (1 – p). Each of the trials must be independent of each other—each asking a yes–no question, and each with its own outcome of 1 or 0.	In Excel, probability P[n=x] is defined using =BINOMDIST (x, N, p, 0) with cumulative probability (P[n ≤ x]) defined with =BINOMDIST (x, N, p, 1).

Poisson 	A single parameter distribution with $\mu = \sigma^2$ (where σ^2 is the variance) that takes on discrete, non-negative values (i.e. integers 0, 1, 2, ..., N).	Used to model the number of events occurring in a fixed interval of time where μ is the average number of events occurring in the interval (e.g. the number of people arriving at a restaurant per hour or customer demand for a flight or movie)	In Excel, probability P[n=x] is defined using =POISSON (x, μ, 0) with cumulative probability (P[n ≤ x]) defined with =POISSON (x, μ, 1).