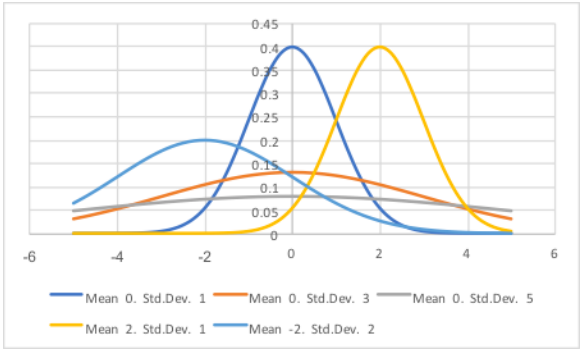
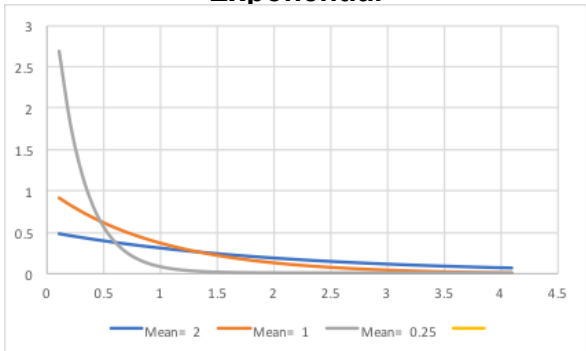
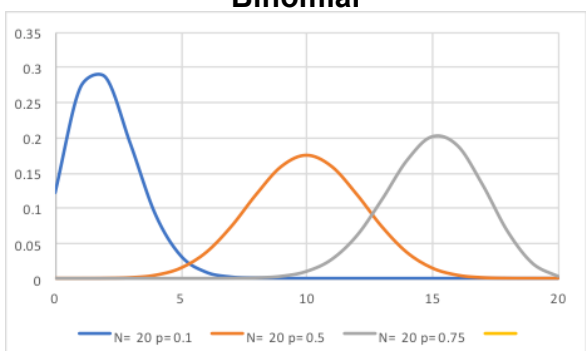
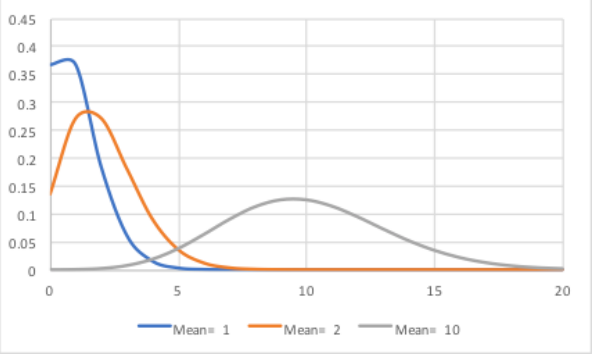


Tool: Theoretical Probability Distributions

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
<p>Normal</p> 	<p>Two parameter distribution, described by mean μ and standard deviation σ. Continuous, can take on any value from $-\infty$ to $+\infty$ but 99% of observations are within 3 standard deviations of the mean.</p>	<p>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.</p>	<p>In Excel, probability $P[n=x]$ is defined using <code>=NORMDIST(x, μ, σ, 0)</code> with cumulative probability ($P[n \leq x]$) defined with <code>=NORMDIST(x, μ, σ, 1)</code>.</p>

<p style="text-align: center;">Exponential</p>  <p>The graph shows three exponential distribution curves on a grid. The x-axis ranges from 0 to 4.5, and the y-axis ranges from 0 to 3. The curves are labeled: Mean = 2 (blue), Mean = 1 (orange), and Mean = 0.25 (grey). The Mean = 0.25 curve starts at y=3 and decays rapidly. The Mean = 1 curve starts at y=1 and decays more slowly. The Mean = 2 curve starts at y=0.5 and decays most slowly.</p>	<p>Single parameter distribution, described by the mean μ (since $\sigma = \mu$). Continuous values where $x \geq 0$.</p>	<p>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.</p>	<p>In Excel, probability $P[n=x]$ is defined using <code>=EXPONDIST (x, 1/μ, 0)</code> with cumulative probability ($P[n \leq x]$) defined with <code>=EXPONDIST (x, 1/μ, 1)</code>.</p>
<p style="text-align: center;">Binomial</p>  <p>The graph shows three binomial distribution curves on a grid. The x-axis ranges from 0 to 20, and the y-axis ranges from 0 to 0.35. The curves are labeled: N= 20 p=0.1 (blue), N= 20 p=0.5 (orange), and N= 20 p=0.75 (grey). The blue curve is skewed left with a peak at x=2. The orange curve is symmetric with a peak at x=10. The grey curve is skewed right with a peak at x=15.</p>	<p>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).</p>	<p>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 $N \cdot p$ and variance of $N \cdot p \cdot (1 - p)$. 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.</p>	<p>In Excel, probability $P[n=x]$ is defined using <code>=BINOMDIST (x, N, p, 0)</code> with cumulative probability ($P[n \leq x]$) defined with <code>=BINOMDIST (x, N, p, 1)</code>.</p>

<p style="text-align: center;">Poisson</p> 	<p>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).</p>	<p>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)</p>	<p>In Excel, probability $P[n=x]$ is defined using <code>=POISSON (x, μ, 0)</code> with cumulative probability ($P[n \leq x]$) defined with <code>=POISSON (x, μ, 1)</code>.</p>
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