

Building spreadsheet-based simulation models

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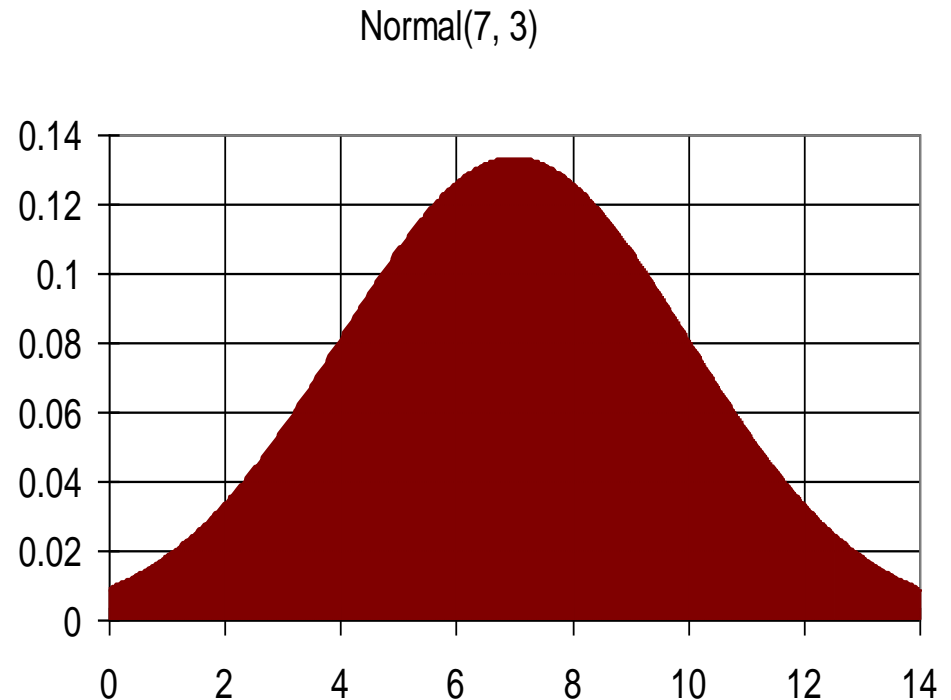
PopTools demonstrations:

- I. Sampling from a Normal distribution
- II. Rolling two dice



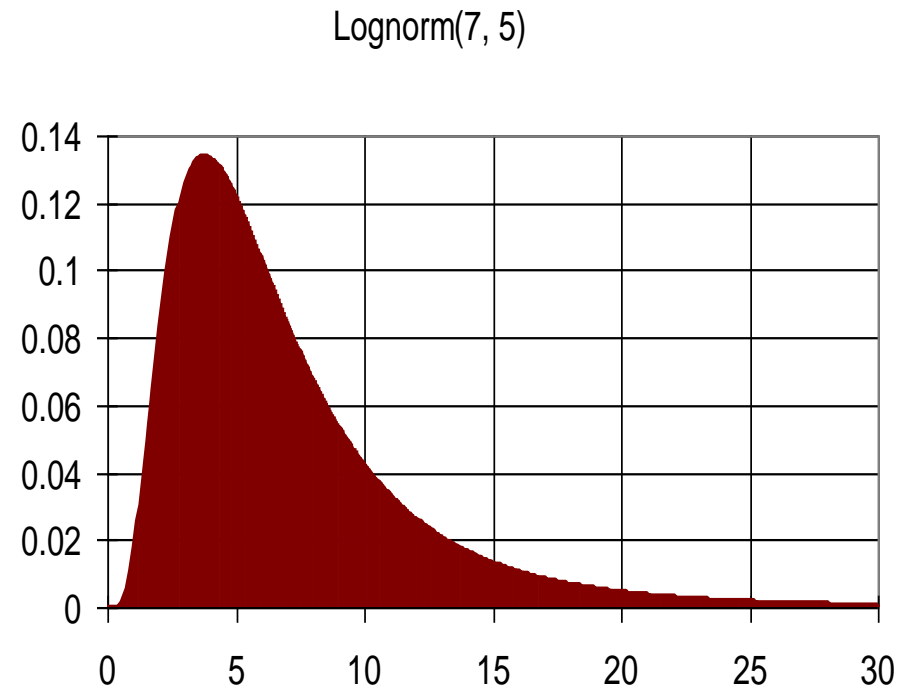
Sample theoretical distributions: Gaussian (normal) distributions

- Normal distributions are defined by a mean and standard deviation
- These distributions are theoretically infinite in extent
- A normal distribution is symmetrical about its mean



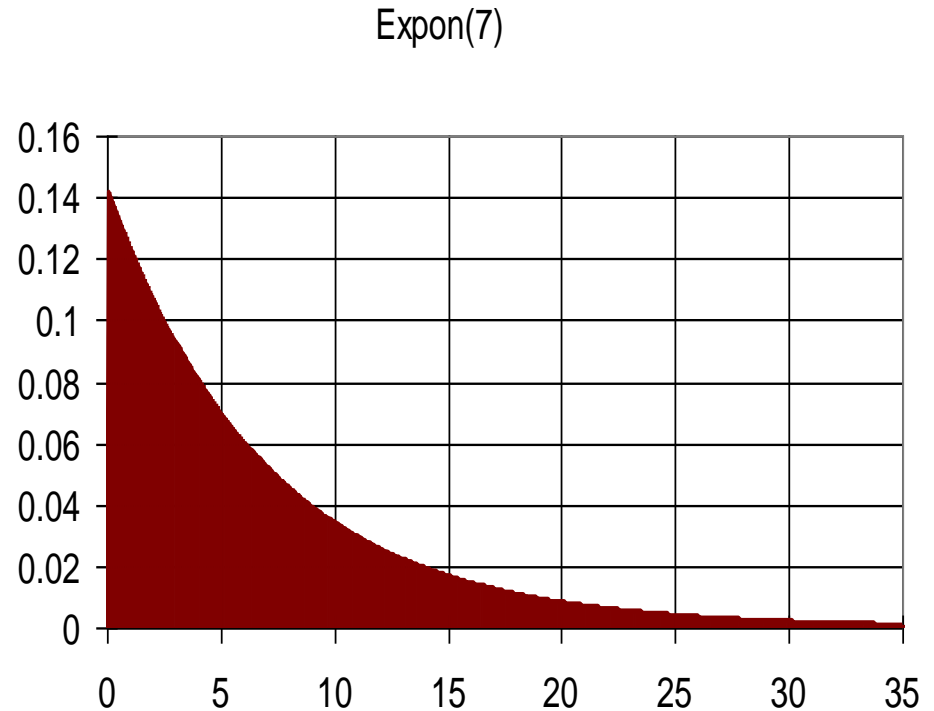
Sample theoretical distributions: Lognormal distributions

- Lognormal distributions are defined by a mean and a standard deviation
- These distributions have a minimum of 0, but are theoretically infinite at the upper limit
- Lognormal distributions are asymmetrical



Sample theoretical distributions: Exponential distributions

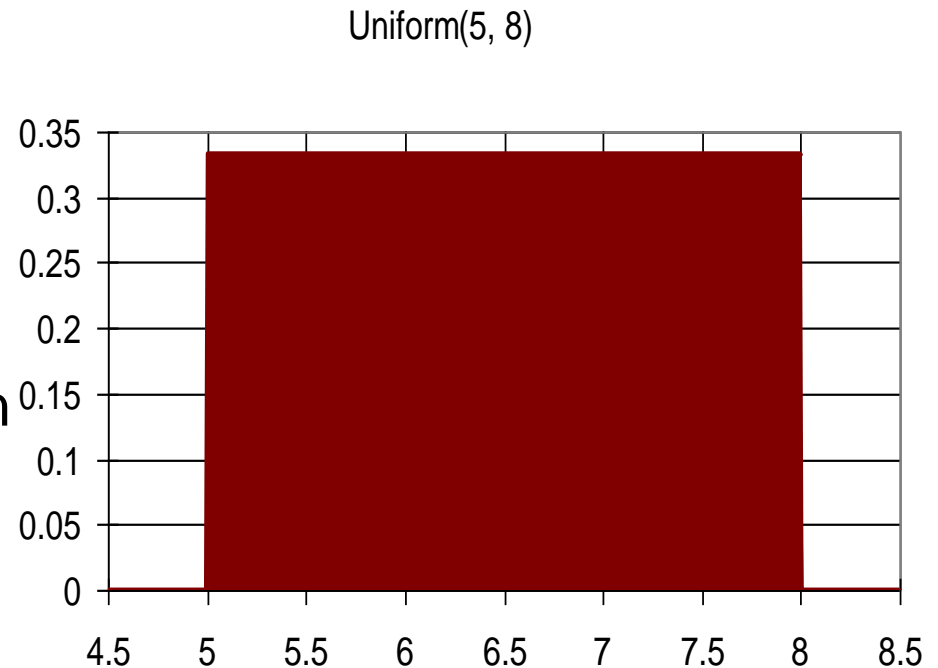
- Exponential distributions are defined by a mean
- These distributions have a minimum of 0, but are theoretically infinite at the upper limit



Probability density functions for modeling limited information or expert opinion

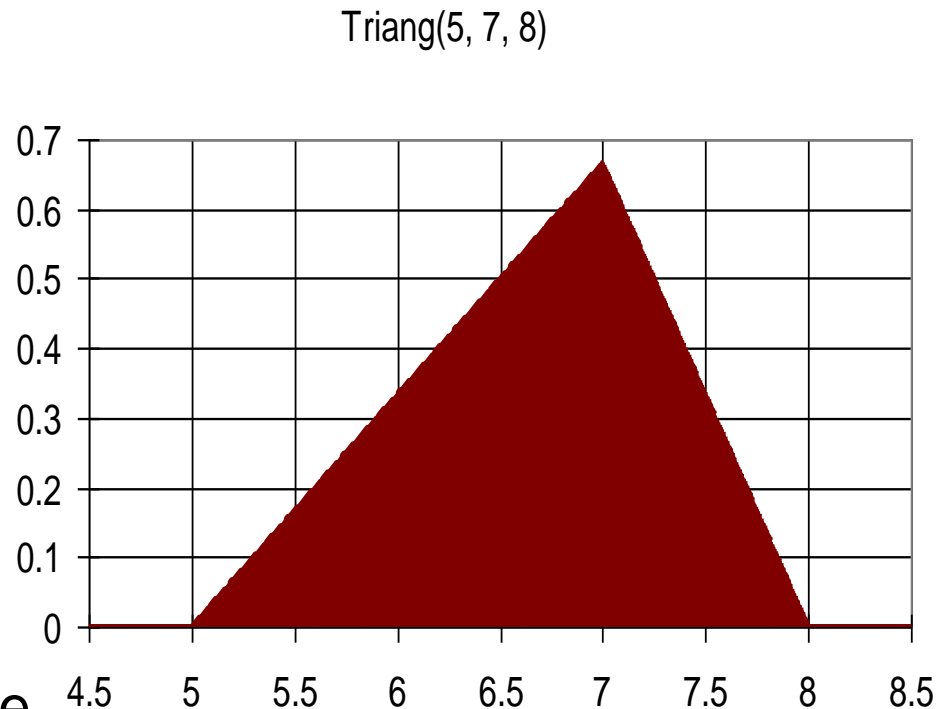
Uniform distributions

- If only a minimum and maximum possible value for a model parameter are known, a uniform distribution can be used.
- During sampling, all values between this minimum and maximum (inclusive) have an equal probability of being selected
- The probability of selecting a value less than the minimum or greater than the maximum is 0



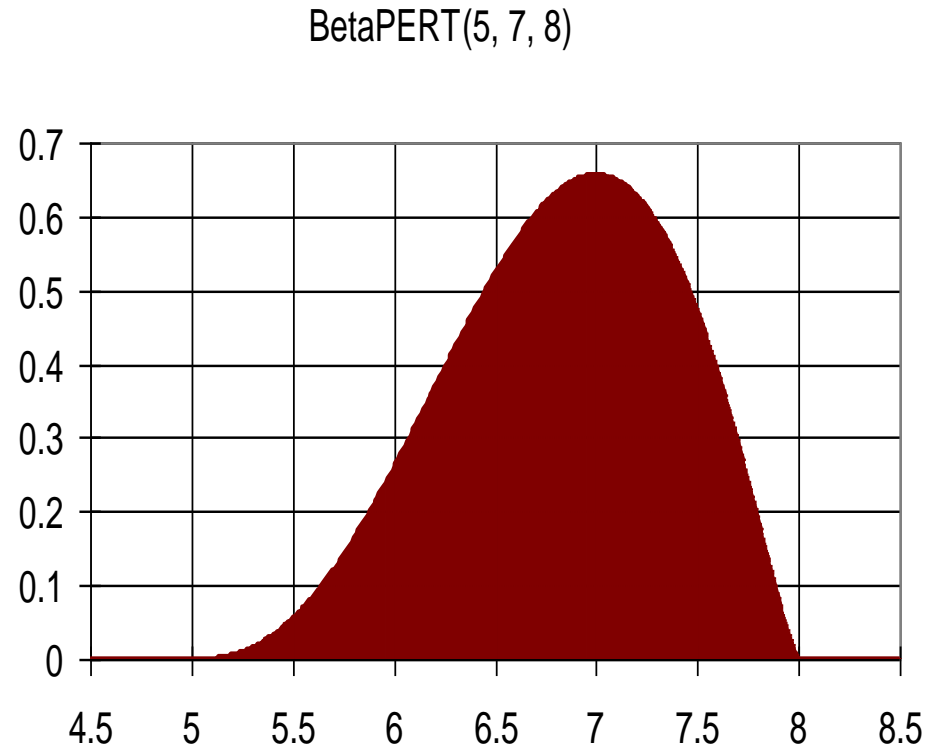
Triangular distributions

- These distributions are defined by a minimum, most likely, and maximum value
- The distribution may be symmetrical or skewed to either the right or left
- During sampling, the most likely value has the highest probability of being selected
- Triangular distributions are used for rough modeling, where limited data is available, or where expert opinion is used to define distributions



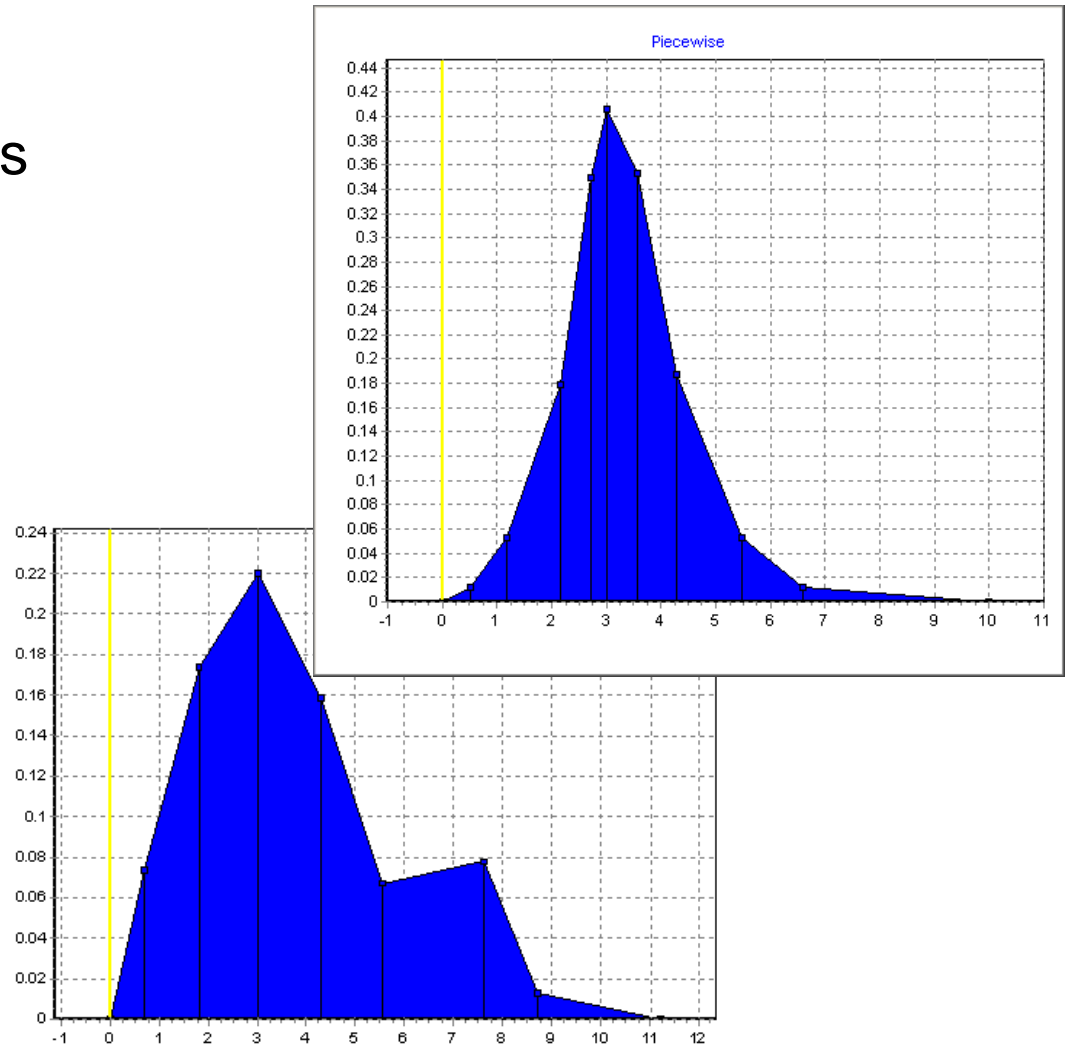
BetaPERT distributions

- BetaPERT distributions are very similar to triangular distributions, but values near the tails are less likely to be selected



Piecewise (general) distributions

- Piecewise distributions are empirical distributions
 - They can be derived from data, or from expert opinion
- Piecewise distributions are drawn from a specified series of x and y values
- These distributions can be manipulated to take on a wide variety of shapes



Questions?

Recommended reading & useful resources

- PopTools: <http://www.cse.csiro.au/poptools/> (*A simple and free add-in for Microsoft Excel that facilitates analysis of matrix population models and simulation of stochastic processes. Note that the number of supported probability density functions is small, and that some of these functions are specified in a non-standard way.*)
- Vose, D. 2000. Risk Analysis: A Quantitative Guide, 2nd ed. New York: John Wiley & Sons. (*Includes very useful chapters on probability density functions and their applications, and on distribution fitting.*)
- @Risk: <http://www.palisade.com/risk/> (*A sophisticated – and definitely NOT free – software package for Monte Carlo simulation modeling and risk analysis. @Risk includes BestFit, a specialized package for distribution fitting.*)