Example Problem: Break Even Analysis, Modeling Uncertainty

Oftentimes you will get a problem like the one below in a narrative format without any formatting (bolding, highlighting, color, and so on.)

The next page depicts the same problem; however, we added bolding and color, and we applied our knowledge by addressing the question:

Is the number a constant, a variable, or a random variable?

Example Problem in a Narrative Format

Marketing is uncertain what the selling price will be because it doesn't know what its competitors will do. The price could be as low as $200 or as high as $400; the values are equally likely. (When all outcomes are equally likely, we call this a uniform distribution.)

Production believes past labor costs will reflect future costs. It has extensive experience in building widgets. Based on its analysis of past data, it believes cost is a random variable that follows a lognormal distribution with a mean of $30 and a standard deviation of $15.

Purchasing feels there is a 50% chance the materials cost will be $14, a 30% chance they could increase to $20, and a 20% chance they could go as high as $27, depending on what OPEC does. We call this is a discrete distribution because each number is a whole number.

Quality Control (QC) has found its costs per widget follow a normal distribution with a mean of $2 per widget and a standard deviation of $0.70 per widget. In a normal distribution, the numbers follow a continuous distribution rather than a discrete distribution.

Research and Development (R&D) is sure its cost will not be below $60,000, and most likely it will be $80,000; however, there is a chance it could cost $120,000 but no higher. This could be modeled as a triangular distribution.

Facilities is certain the cost to build a production facility will be between $150,000 to $160,000 with all values equally likely in a uniform distribution.

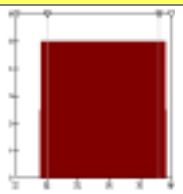
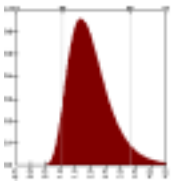
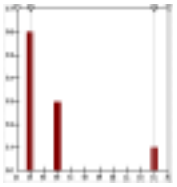
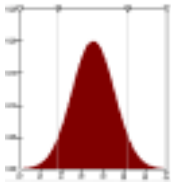
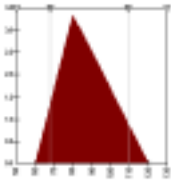
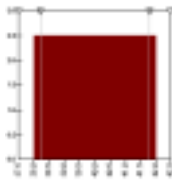
The company has negotiated an agreement to purchase equipment at a guaranteed price of $60,000.

Navigation Tip: Use the bookmark links on the left to navigate this PDF file. Use your browser's Back button to return to the main discussion.

Example Problem with Bolding and Color

Step I in the Five Step Process is expanded to address the following:

- Identify **quantitative information** (numbers) that will help solve the problem.
- Answer the question: Are numbers constants, variables, or random variables?
- Determine the distribution of each random variable.
- Identify **what your are trying to determine**.

Realistic Approach: Admitting Uncertainty	Constant, Variable, or Random Variable?	Distribution
Marketing is uncertain what the selling price will be because it doesn't know what its competitors will do. The price could be **as low as $200 or as high as $400; the values are equally likely**. (When all outcomes are equally likely, we call this a uniform distribution.)	Price is a random variable. It is more realistic to admit there is uncertainty in the price.	
Production believes past labor costs will reflect future costs. It has extensive experience in building widgets. Based on its analysis of past data, it believes cost is a random variable that follows a lognormal distribution with a **mean of $30 and a standard deviation of $15**.	Labor cost is a random variable. It is more realistic to admit there is uncertainty in the labor cost.	
Purchasing feels there is a **50% chance the materials cost will be $14, a 30% chance they could increase to $20, and a 20% chance they could go as high as $27**, depending on what OPEC does. We call this is a discrete distribution because each number is a whole number.	Materials cost is a random variable. It is more realistic to admit there is uncertainty in the materials cost.	
Quality Control (QC) has found its costs per widget follow a normal distribution with a **mean of $2 per widget and a standard deviation of $0.70** per widget. In a normal distribution, the numbers follow a continuous distribution rather than a discrete distribution.	QC cost is a random variable. It is more realistic to admit there is uncertainty in the QC cost.	
Research and Development (R&D) is sure its **cost will not be below $60,000, most likely it will be $80,000, and there is a chance it could cost $120,000 but no higher**. This could be modeled as a triangular distribution.	R&D cost is a random variable. It is more realistic to admit there is uncertainty in the R&D cost.	
Facilities is certain the cost to build a production facility will be **between $150,000 to $160,000 with all values equally likely** in a uniform distribution.	Facilities cost is a random variable. It is more realistic to admit there is uncertainty in the facilities cost.	
The company has negotiated an agreement to purchase equipment at a **guaranteed price of $60,000**.	Technically, Equipment cost is a constant. When the probability of something happening is one, it is a constant. We show Equipment as a random variable with a discrete distribution to include it in the @RISK analysis.