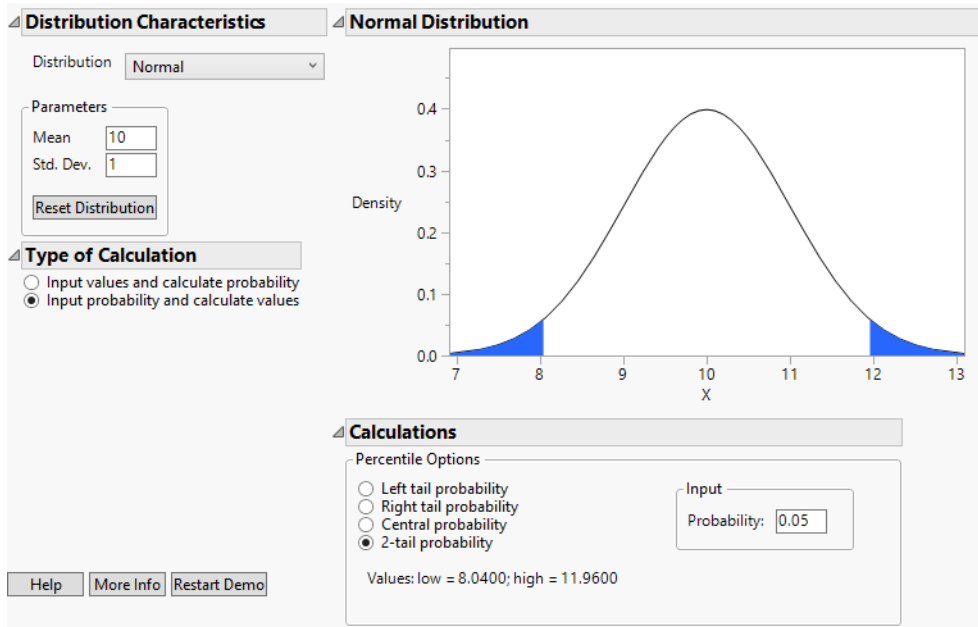# Distribution Calculator

Use the Distribution Calculator to show probabilities and percentiles of different distributions. You can specify the distribution that you want to see and its parameters.

Figure 2.1 Example of the Distribution Calculator

In the Distribution Calculator window, specify your distribution, its parameters, and calculations. The distribution graph appears at right.

Distribution Characteristics

Distribution   Choose the distribution that you want to use.

Parameters   Specify the parameters for the distribution. The parameters vary based on the distribution that you choose.

Reset Distribution   Returns all settings to the default.

Type of Calculation

Input values and calculate probability   Select a probability option and add value(s) for X.

Input probability and calculate values   Add a probability and select a percentile option.

Distribution Graph

Shows a graph of the selected distribution, with density or probability (as appropriate) on the Y axis.

Calculations

Based on the type of calculation that you selected, specify the input values and calculation options.

Examples of the Distribution Calculator

This section contains the following examples:

- "Build a Distribution Based on Your Values"
- "Find Probabilities from a Binomial Distribution"

Build a Distribution Based on Your Values

Suppose that you produce a widget with a mean diameter of 10 and a standard deviation of 1. The widget diameters follow a normal distribution reasonably well. The quality control department wants you to define specification limits for the product. They want to make sure that no more than 5% of the widget diameters are "out of specification" or wider than the specification limits. Find the values so that overall, only 5% of widget diameters fall beyond these limits.

1. Select **Applets** > **Distribution Calculator**.
2. Keep the distribution set to Normal.
3. Change the mean to 10. Keep the Std. Dev. set to 1.
4. Select **Input probability and calculate values**.
5. Select **2-tail probability**.
6. Change the Probability to 0.05.
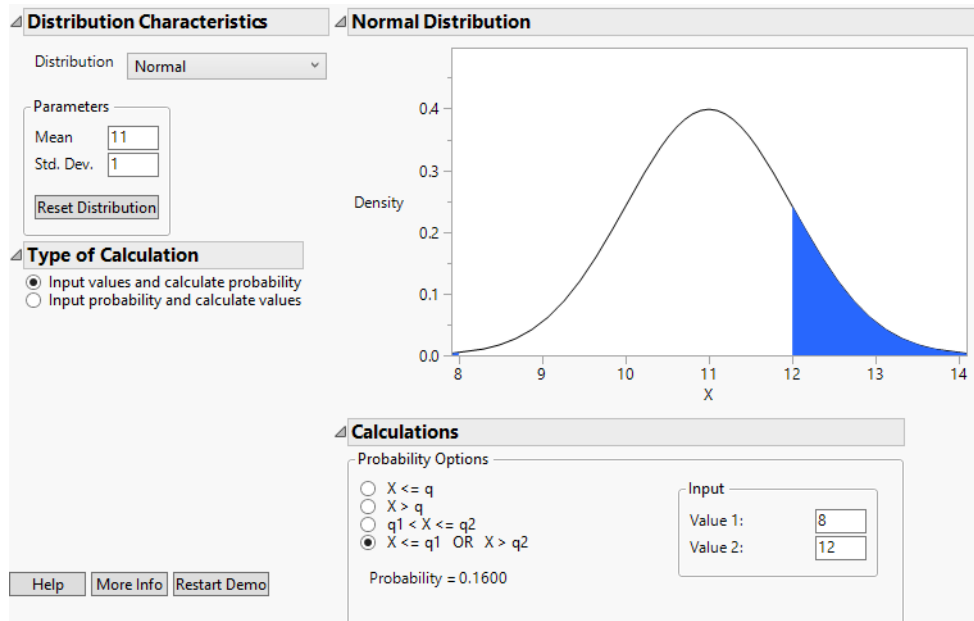
Figure 2.2 Normal Distribution
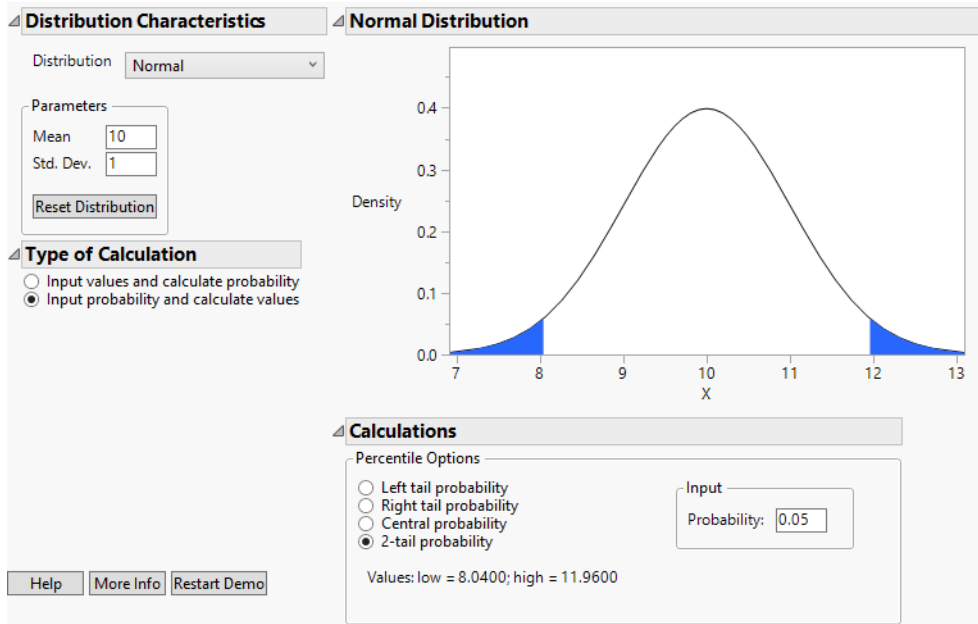
The values (under Calculations) are 8.04 and 11.96. This means you could set your specification limits at approximately 8 and 12.

Suppose that the process shifted and the widgets were bigger, with a mean of 11 and the same standard deviation of 1. What is the probability that a widget is now outside of your specification limits?

7. Change the Mean to 11.

8. Select **Input values and calculate probability**.

9. Select **X <= q1 or X > q2**.

10. Set Value 2 to 12 and Value 1 to 8 (you get an error message if you try to set Value 1 first and it is larger than the Value 2).

Figure 2.3 Updated Normal Distribution

The probability (under Calculations) is 0.16 that a value from a Normal distribution with a mean of 11 and a standard deviation of 1 is greater than 12 or less than 8. If the mean shifts from 10 to 11, then the probability of a widget having a measurement above 12 or below 8 shifts from 0.025 (half of the 5% that you used to set up the two sided limits) to 0.16.

Find Probabilities from a Binomial Distribution

Consider 20 flips of a fair coin. What is the probability of observing 6 or fewer heads?

1. Select **Applets** > **Distribution Calculator**.
2. Set the distribution to **Binomial**.
3. Keep the P(Success) set to 0.5.
4. Change N to 20.
5. Select **Input values and calculate probability**.
6. Keep the probability option set to X <= q.
7. Set the Value to 6 and press Enter.

Figure 2.4 Binomial Distribution
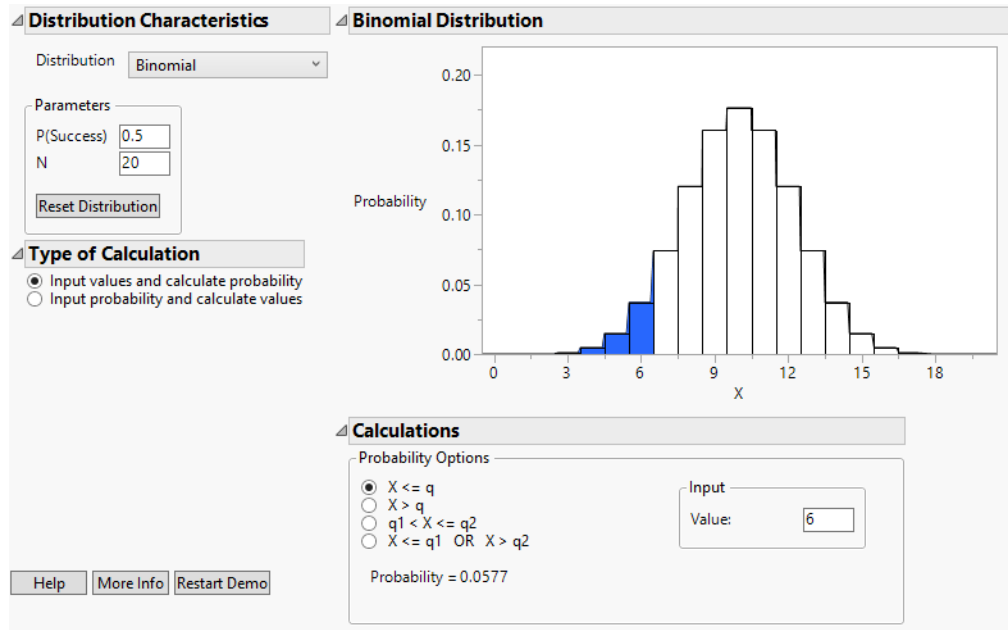
The probability of observing 6 or fewer heads in 20 flips of a fair coin is equal to 0.0577, or 5.7%.