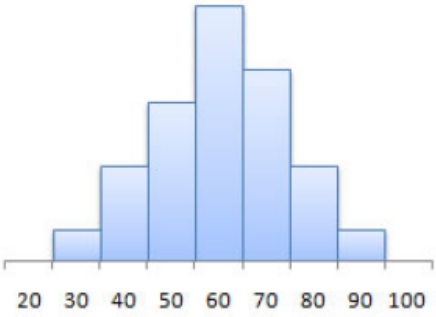
Section 7.3: Assessing Normality

Objectives

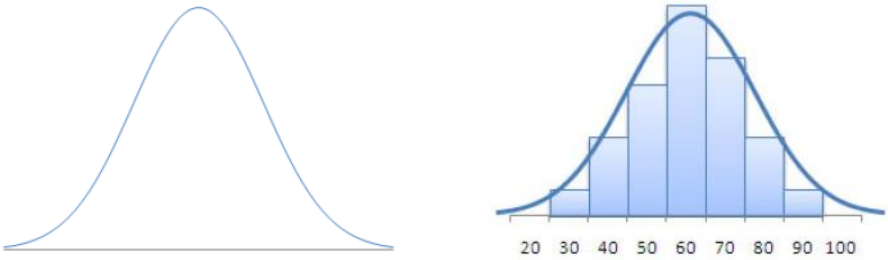
By the end of this lesson, you will be able to...

1. use normal probability plots to assess normality.

Earlier in the course, in Section 2.2, we learned that we can characterize the distribution shape of a random variable using a histogram. One of those distribution shapes was **bell-shaped (symmetric)**.



Normally distributed random variable which is Normal or Bell-shaped curve



What happens, though, when the sample size is so small that we can't really see the distribution shape in the histogram? We need another method, which brings us to the topic for this section.

The Normal Probability Plot

A normal probability plot is a graph that plots the observed data versus the *normal score*, which is what we would expect if the data actually followed the standard normal distribution.

In other words, if we have 15 observations, the 10th normal score would be the *expected 10th value if the data followed the standard normal distribution*.

$$Z = \frac{x - \mu}{\sigma}$$

If we solve this equation for X, we get $X = \mu + \sigma Z$, which is the equation for a line. This gets us to the key result:

> If sample data are taken from a population that is normally distributed, a normal probability plot **should be approximately linear**.

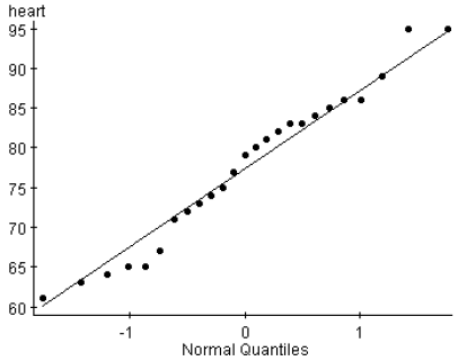
Q-Q Plots in StatCrunch

1. Import the data. To copy-paste,
   a. Copy the data from the data file.
   b. In StatCrunch, select **Data** > **Load Data** > from **paste**.
   c. Select **paste data from clipboard** and click **OK**.
2. Select **Graphics** > **QQ Plot**.
3. Select the column you want to plot, and click **Create Graph!**

Example 1

Suppose we wish to know whether the resting heart rates of a sample of Mth120 students are normally distributed.

heart rate				
61	63	64	65	65
67	71	72	73	74
75	77	79	80	81
82	83	83	84	85
86	86	89	95	95

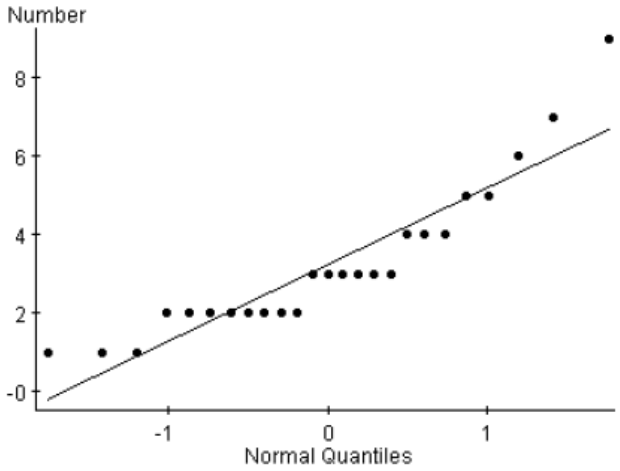


Based on this plot, it does appear as though the resting heart rates are approximately normally distributed. The plot is fairly linear, with just a couple points straying from the line.

Example 2

Suppose we wish to know whether the number of children that students in a particular Mth120 class have in their family is normally distributed.

number of children				
3	4	3	1	5
3	2	4	2	5
9	2	3	2	7
3	1	2	6	2
4	3	1	2	2



This plot is clearly *not* linear, so the data do not come from a normally distributed population.