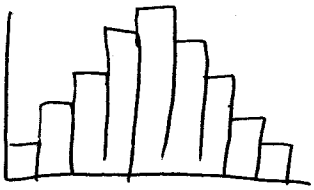
Lesson Notes 7-4 **Normal Distributions**

The study of continuous data requires some different methods. When we looked at the heights of trees, the data was continuous but we assumed them to be discrete by rounding them off to the nearest 1 cm. Truly continuous data though includes the possibility of a tree of height 31.75 cm or 23.8231 cm. (Rather accurate tree height!)

Because exact measurements are truly impossible (we could always go to more decimal places) we identify data within a range. For example, rather than asking for the number of trees that are 31 cm tall, we must ask what number of trees fall within the range [30.5, 31.5) "greater than or equal to 30.5 and less than 31.5."

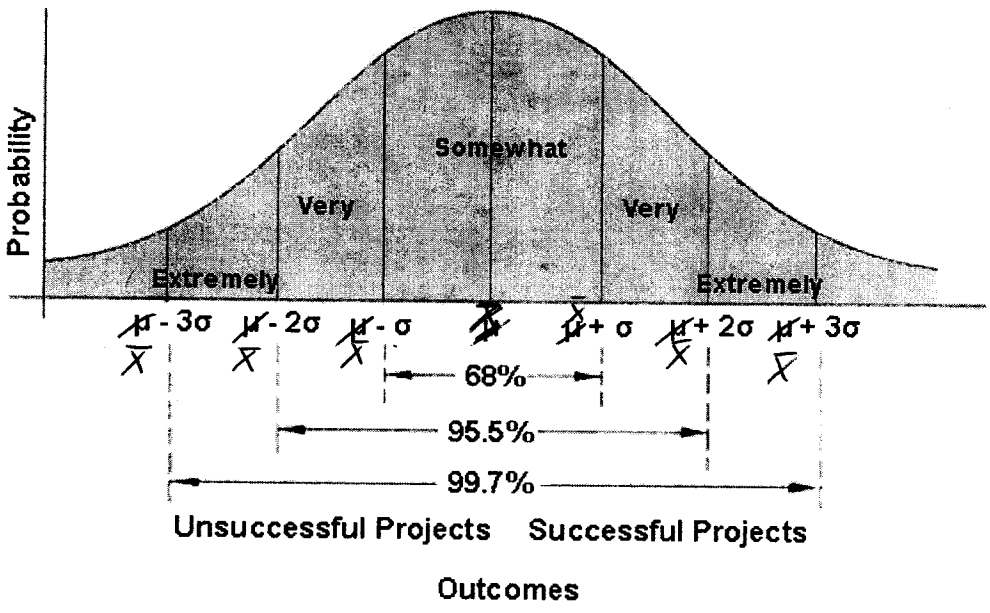
Completing histograms of sample sizes 20 or 30 may result in examples such as:

If larger sample sizes are taken the histogram will always tend to look more like this:



This **normal distribution** is best used for data that clusters about a particular mean and varies as a result of random factors. For example tree heights will vary depending on growing conditions, such as sunlight exposure, soil quality, water exposure…

Producing a histogram of infinite sample size and very small ranges will produce **the standard normal curve**.



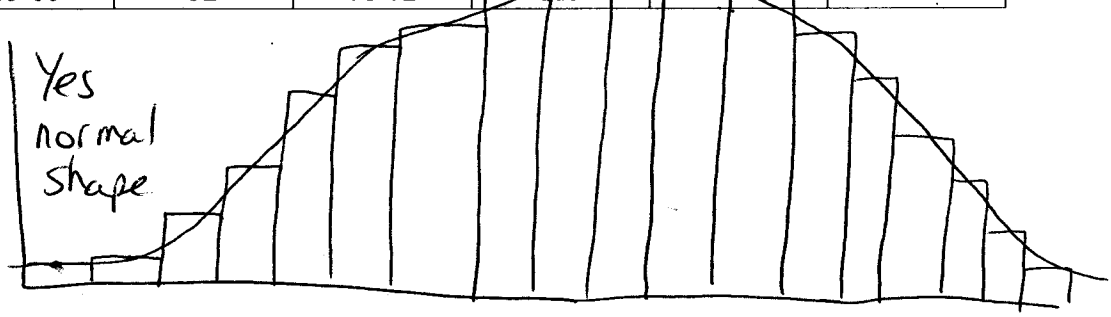
Notice that the distribution is:

- Symmetrical
- Bell shaped – with fewer observations as you move away from the central value.
- The curve extends to both $\pm\infty$ along the x-axis without ever reaching the x-axis.
- The total area under the curve is equal to 1.

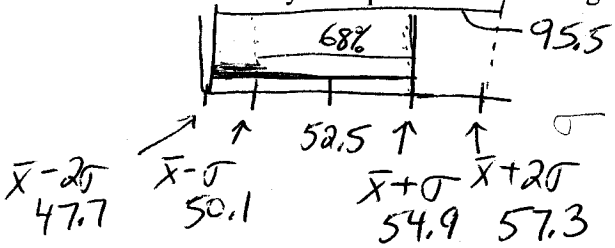
Because the distribution is symmetrical the mean, median and mode are all equal.

Example 1: To help with determining the most popular snowboard lengths, a company collected height data for 1000 people. Does the data follow a normal distribution?

Height	Frequency	Height	Frequency	Height	Frequency
< 61	3	66-67	64	72-73	63
61-62	4	67-68	116	73-74	53
62-63	10	68-69	128	74-75	29
63-64	18	69-70	147	75-76	20
64-65	30	70-71	129	76-77	12
65-66	52	71-72	115	77-78	5



Example 2: The weights of adult male dogs are normally distributed, with a mean of 52.5 lb and a standard deviation of 2.4 lb. What percent of adult male dogs would you expect to have a weight between 47.7 lb and 54.9 lb?



$95.5-68=\frac{27.5}{2}=13.75$

$13.75+68=81.75$

Example 3: The members of two teams had carry-on luggage for their sports equipment. The masses of the carry-on luggage were normally distributed, with the characteristics shown below. Sketch a graph to show the distribution of the masses of the luggage for each team.

Team	$\mu(\bar{x})$	σ
One	6.35	1.04
Two	6.35	0.59