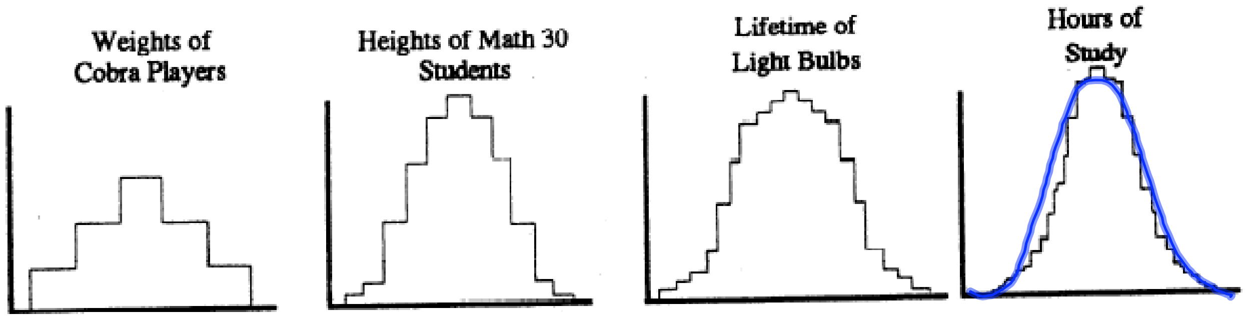
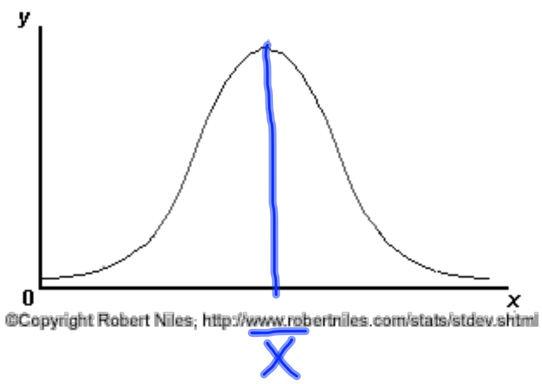
Day 2: Normal Distribution Curve

In this lesson (and the next one) we will introduce and apply what is considered to be one of the most important probability distributions - the normal distribution. It has been discovered that many data in physical measurements such as length, volume, mass, time, etc. all have common characteristics in how their data is distributed. This common characteristic is that they are "bell shaped" when plotted on a histogram taken from many random samples. Whenever this occurs we say the data is normally distributed. The mean, median, mode is the same value and is the middle of your data, and 50% of the values are above your mean and 50% are below your mean.

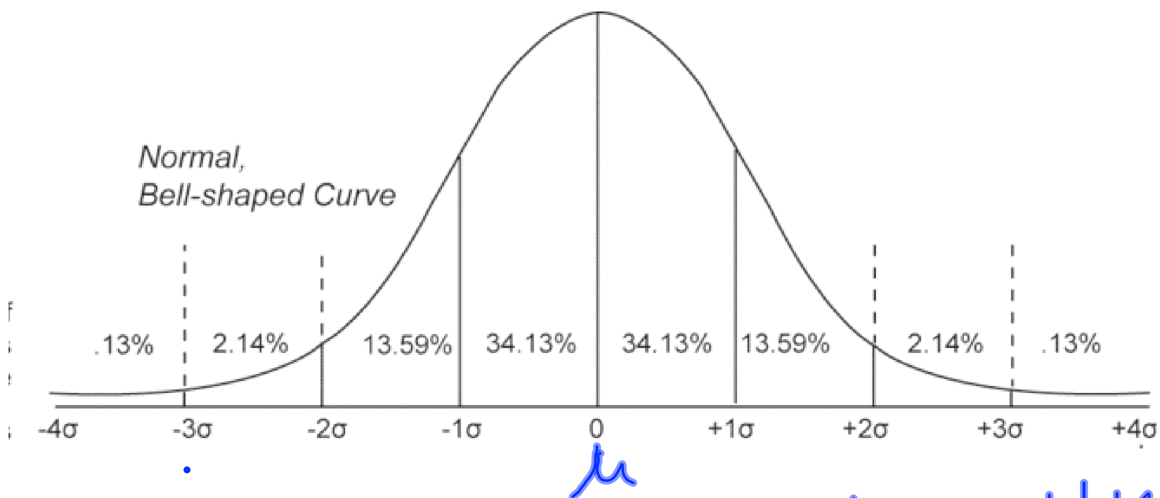


From left to right, the probability distributions involve more and more data. The more data used in the distribution, the more the histograms look like what is known commonly as a bell curve or a normal distribution.

Normal Distribution Curve



1. The total area under the curve is 1 unit (because all of the probabilities should add to 1).
2. The normal curve extends indefinitely in both directions (though very close to the x-axis).
3. The normal curve is symmetric.
4. All of the data is represented by the area under the curve.
5. The mean, median and mode lie in the centre of the data.
6. 50% of your data lies to the left of the mean and 50% of the data lies to the right of the mean.

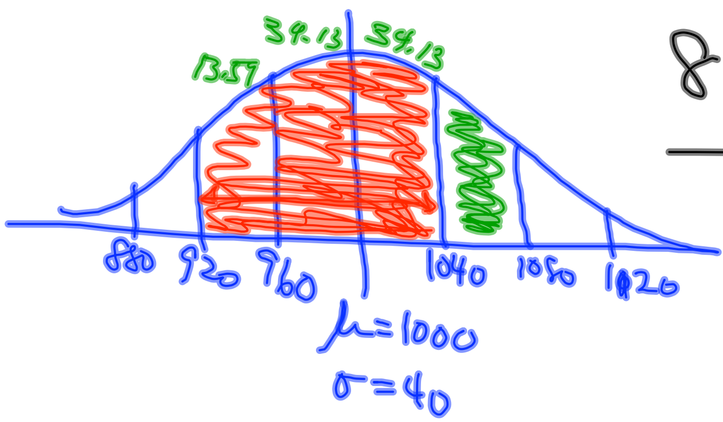


1 below & 1 above

1. 68.26 % of the data are within one standard deviation of the mean
2. 81.85 % of the data lie between μ - 1σ and μ + 2σ
3. 2.27 % of the data lies below μ - 2σ
4. 50 % of the data lies above μ
5. 13.59 % of the data lie between μ + 1σ and μ + 2σ
6. 84.13 % of the data lie below μ + 1σ

Eg 1) A light bulb manufacturer produced forty thousand 100W light bulbs for a retail store. From past data, he knows the life of the bulbs is normally distributed with a mean life of 1000 hours and a standard deviation of 40 hours.

a) What % of his light bulbs lasted between 920 and 1040 hours? How many bulbs will last that long?



81.85%

b) How many light bulbs last between 1040 and 1080 hours?

$0.1359 \times 40000 = 5436$

c) What % of light bulbs lasted less than 920 hours? How many bulbs will that be?

2.27%

0.0227×40000

908

Eg 2) A manufacturer of batteries advertises that the mean life of a nine volt battery is 20,000 hours with a standard deviation of 1500h. As a promotion, the manufacturer will offer a refund if the batteries do not last 17,000h. If 10,000 batteries are made, what percent will not last 17,000h? Approximately how many batteries will that be?

Assignment Handout

Assignment Answers:

1. a) 12.2 b) 1.3 c) A = 8.3, B = 9.6, C = 14.8, D = 16.1 d) 68.26%
2. a) 13.59% b) 2730
3. a) 456 b) 456
4. a) 81.25% b) 1637 c) 272 d) 91
5. 2006
6. 12.1%
7. a) 2.5% b) 0.15% d) 75 d) 97.5%