Math-3A
Lesson 11-2

Statistics:
Measures of “Spread”

Measure of spread

Range: the difference between the greatest and least data point.

$Range = (105 - 35) = 70$

105
100
100
100
95
90
85
80
80
75
75
75
75
75
70
65
55
50
50
50
45
35

$Range = (91 - 45) = 46$

91
86
86
86
82
82
82
77
77
73
68
68
64
64
50
45

$Range = 77$

88
79
68
60
55
48
44
33
33
25
25
25
21
13
13
13
13
11

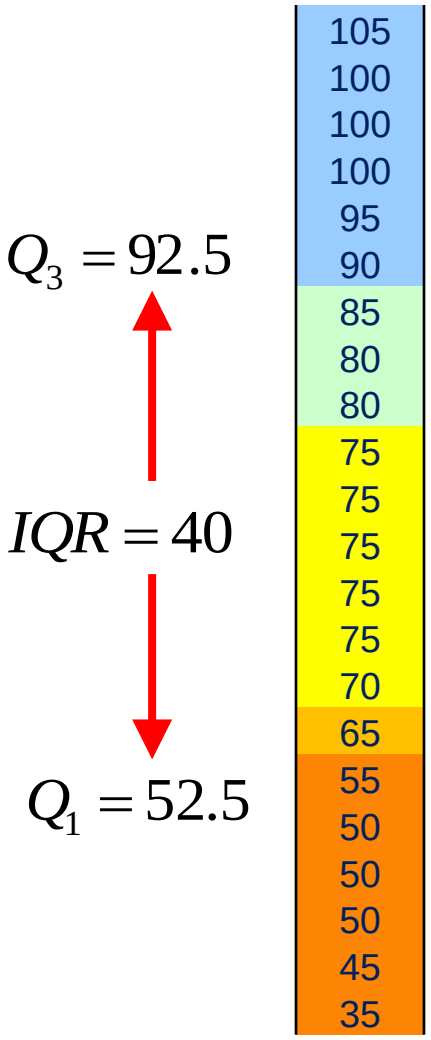
$Range = 93$

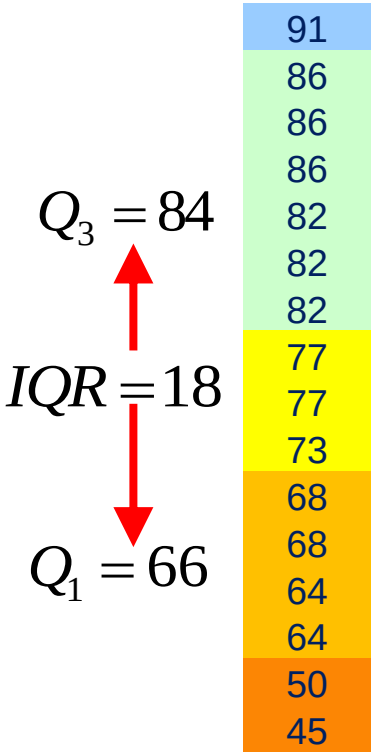
107
107
107
107
93
93
93
93
93
93
93
93
86
86
79
64
57
57
43
36
14

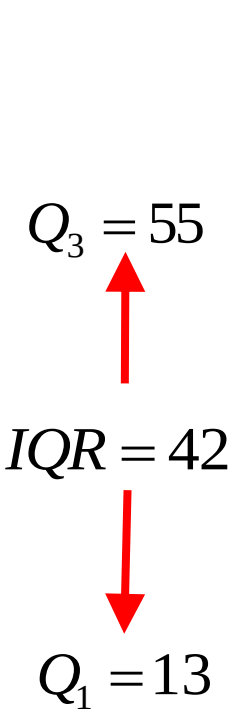
Q1: The median of the bottom ½ of the data

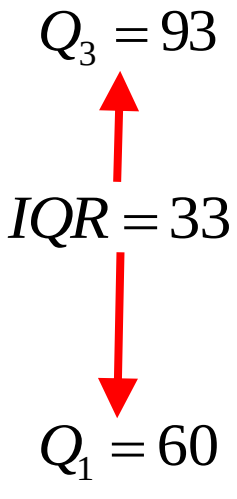
Q3: The median of the top ½ of the data

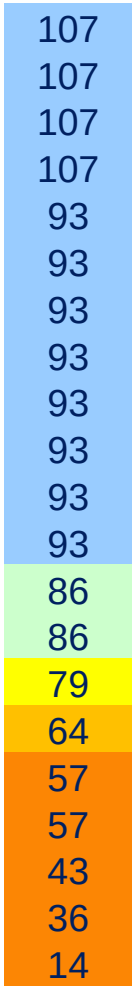
Inter-quartile Range: Q3 – Q1



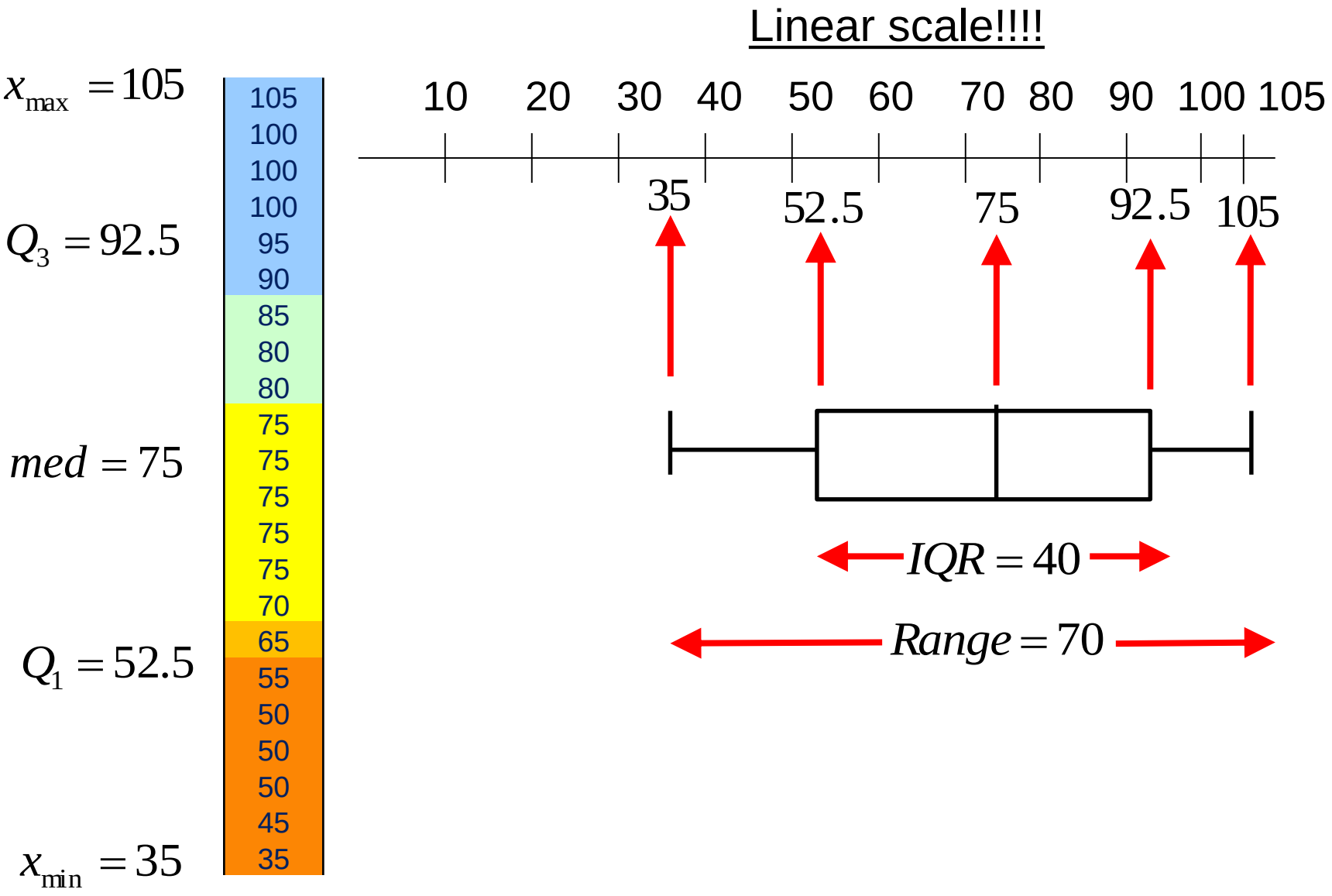






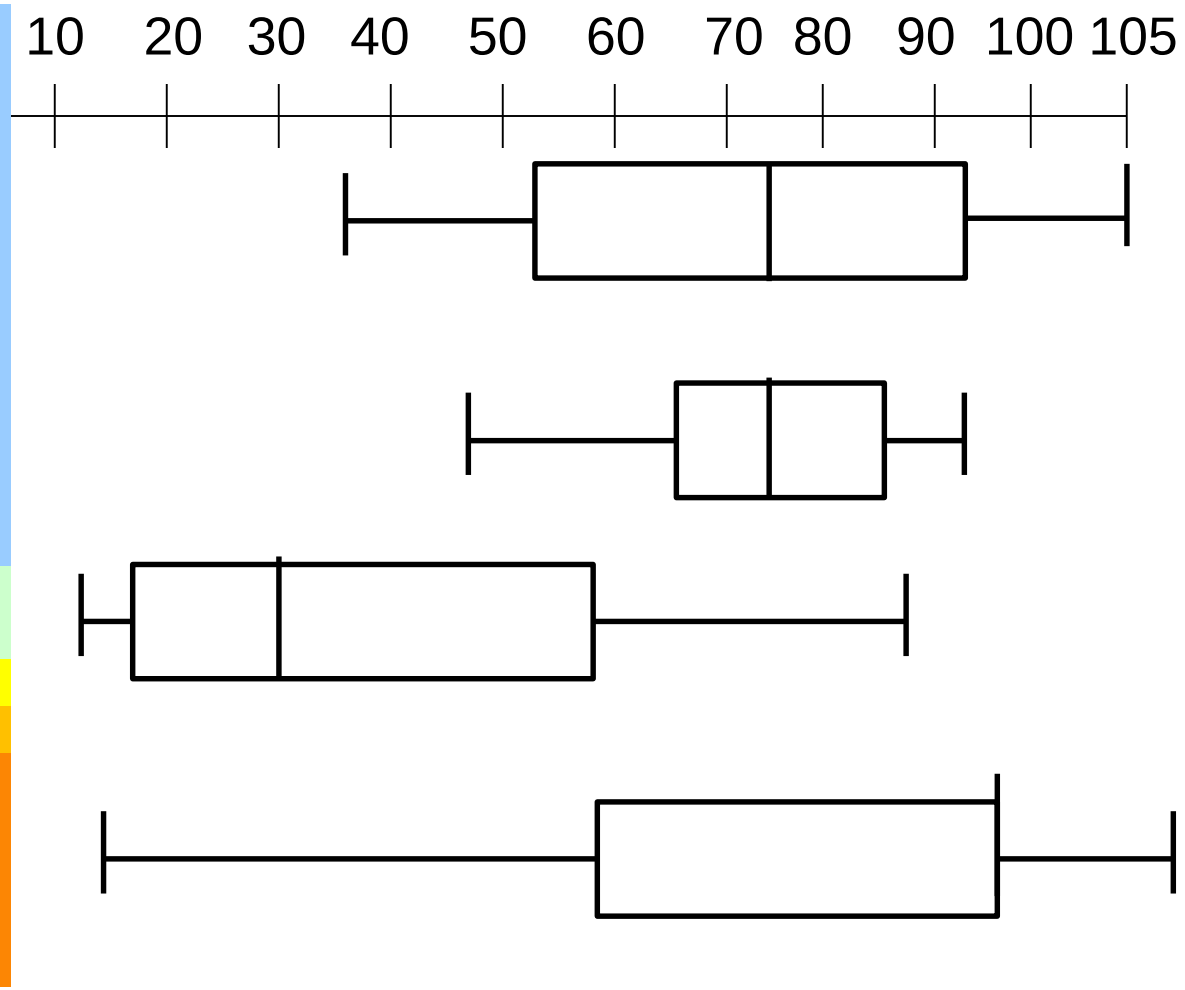


Box and Whisker Plot: a graphical representation of Min data point, Q1, median, Q3, max data point.

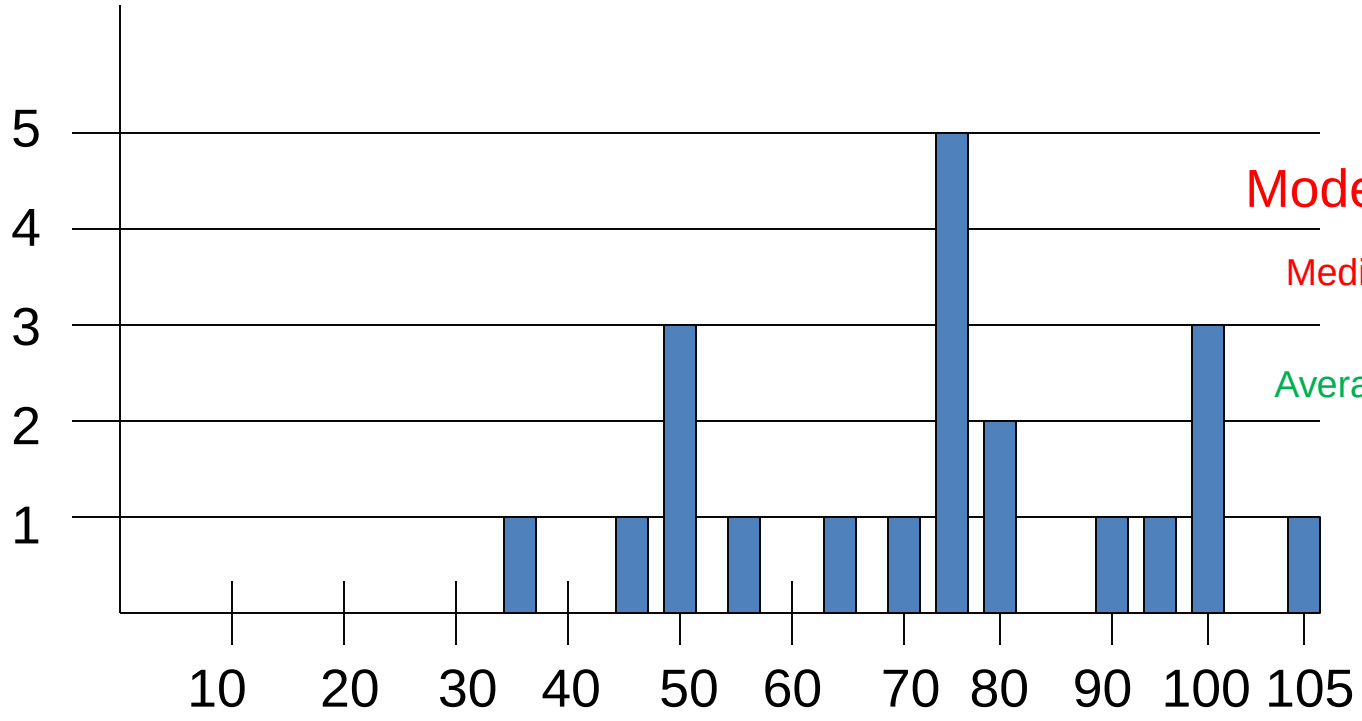


Box and Whisker Plot: Help us to compare data visually.

105	91	88	107
100	86	79	107
100	86	68	107
100	86	60	93
95	82	55	93
90	82	48	93
85	82	44	93
80	77	33	93
80	77	33	93
75	73	25	93
75	68	25	93
75	68	25	86
75	64	21	86
75	64	13	79
70	50	13	64
65	45	13	57
55		13	57
50		11	43
50			36
50			14
45			
35			



Frequency Distribution graph:



Mode = 75%

Median 75 %

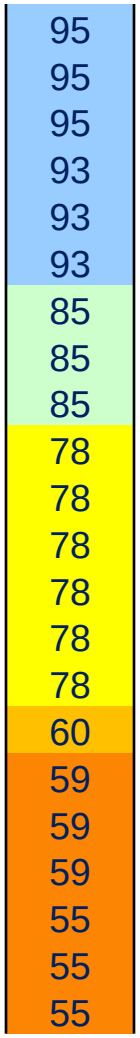
Average 74 %

105
100
100
100
95
90
85
80
80
75
75
75
75
75
70
65
55
50
50
50
45
35

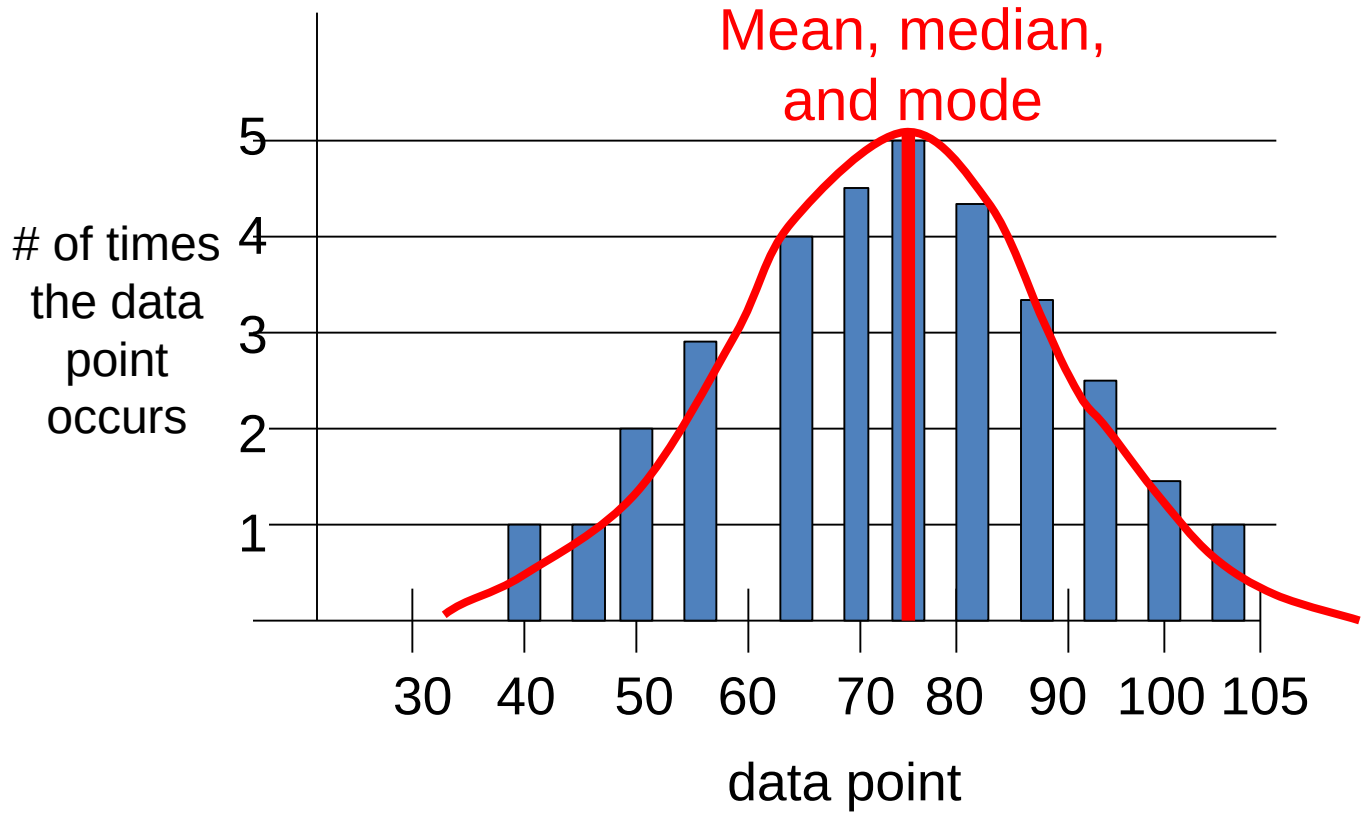
# of occurrences	1	1	3	1	1	1	5	2	1	1	1	3	1
Grade	35	45	50	55	65	70	75	80	85	90	95	100	105

Data Distribution

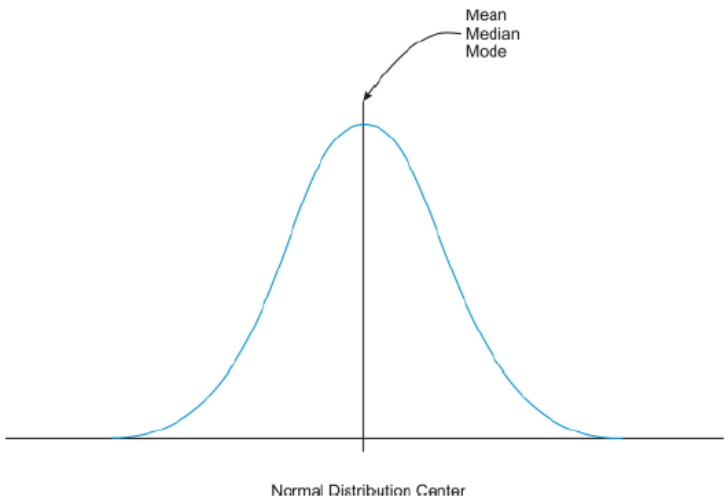
Build a frequency distribution graph for the following test data.



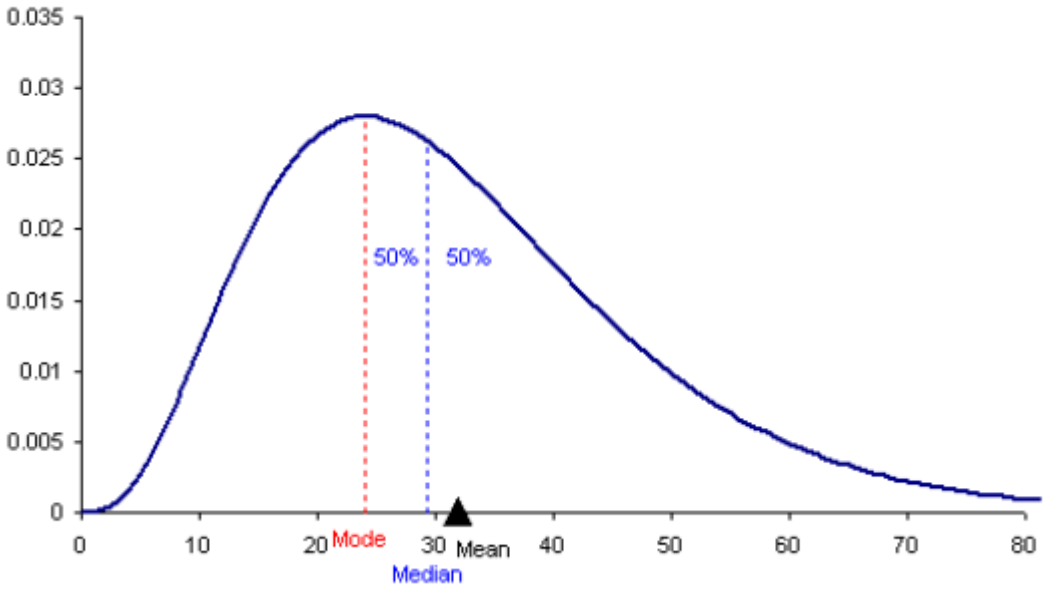
Bell curve: general shape of a frequency distribution curve that is "normally distributed" (when you have a lot of data).



Normal



Not Normal

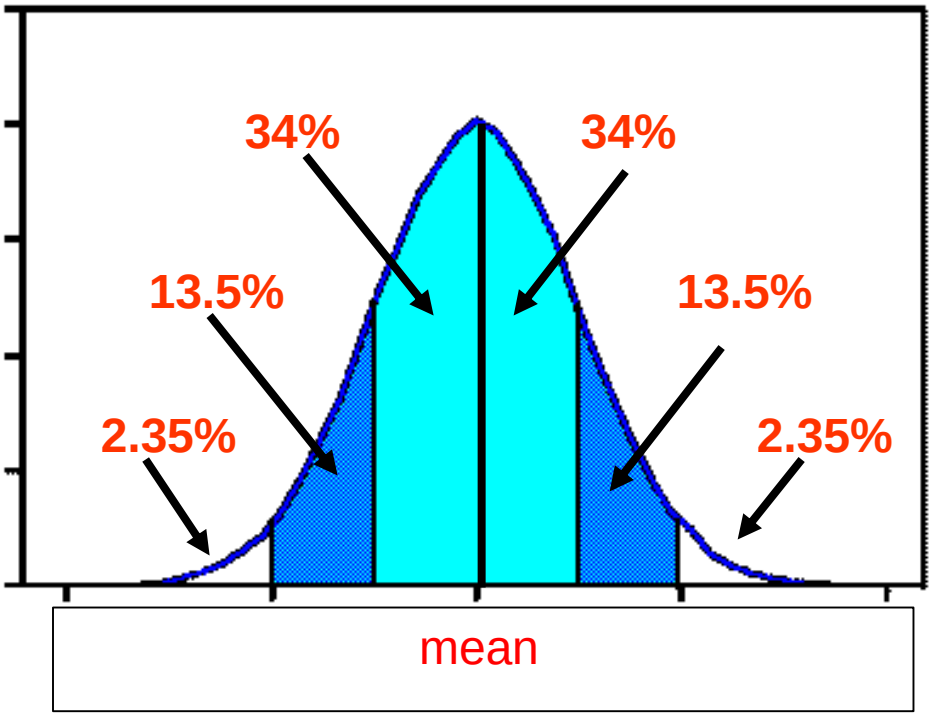


Standard deviation a number that describes the spread of the data.

Standard deviation 68% of the data will be within one standard deviation of the mean.

probability of a data point being within two standard deviations of the mean.

= 13.5 + 13.5 + 34 + 34 = 95%



probability of a data point being within three standard deviations of the mean.

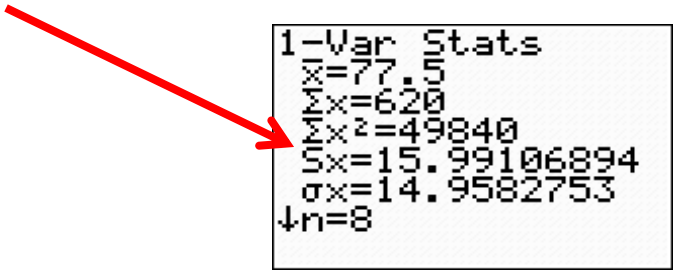
= 68 + 27 + 4.7 = 99.7 %

Standard Deviation

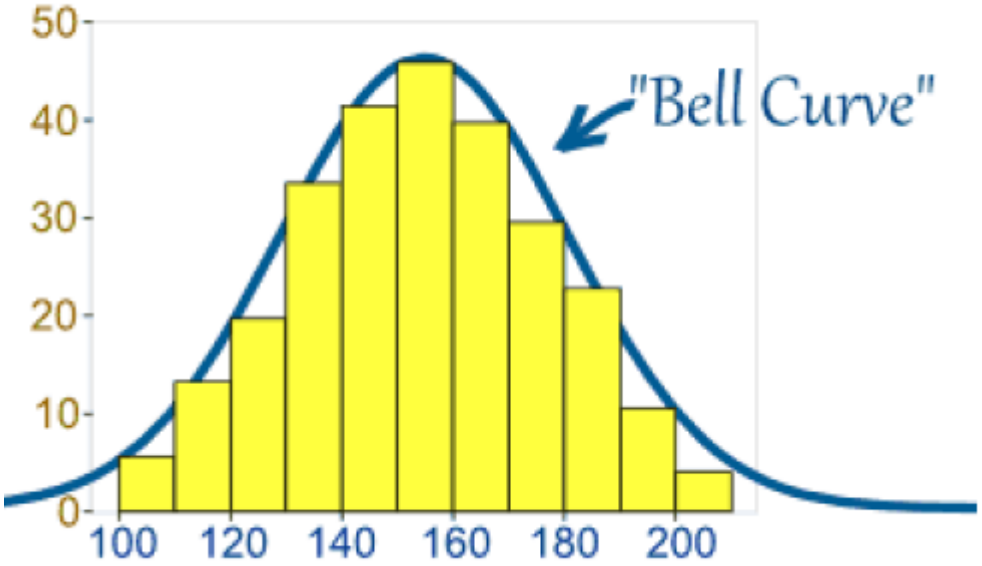
Standard deviation: a measurement of spread of the data from the mean. The calculator does this for you.

$$S = \sqrt{\frac{(x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + \ldots + (x_n - \bar{x})^2}{n}}$$

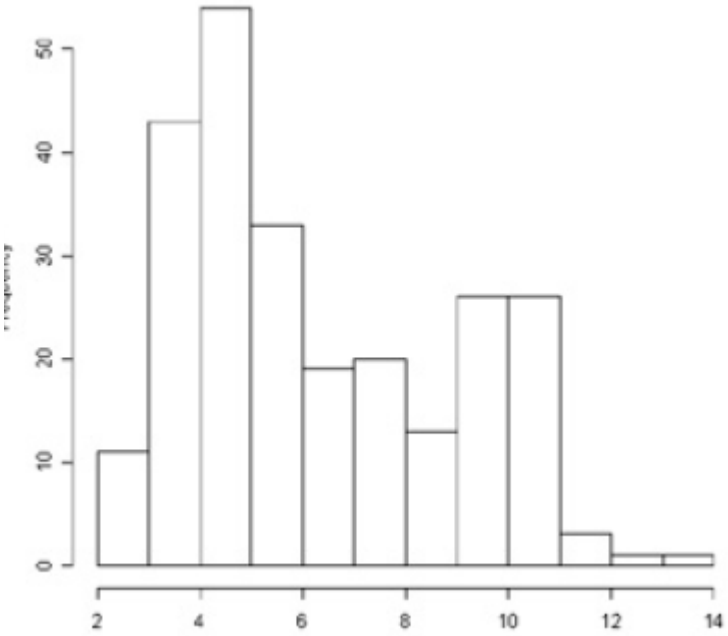
This gives the sdev of the data "sample".

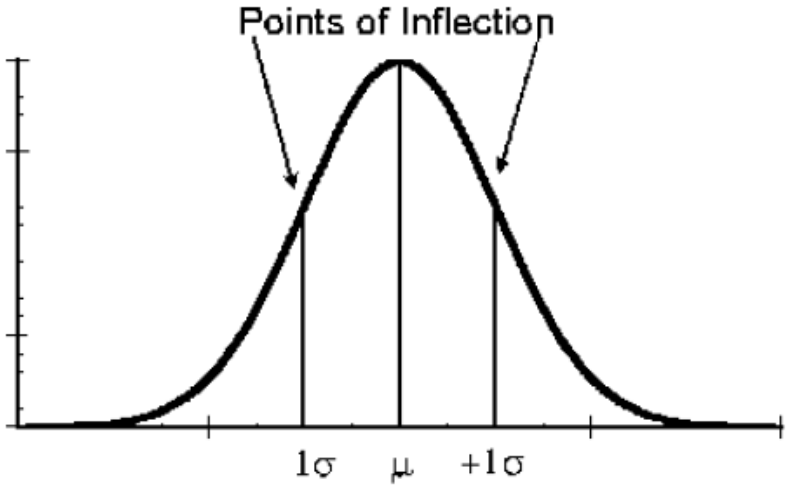


Normal

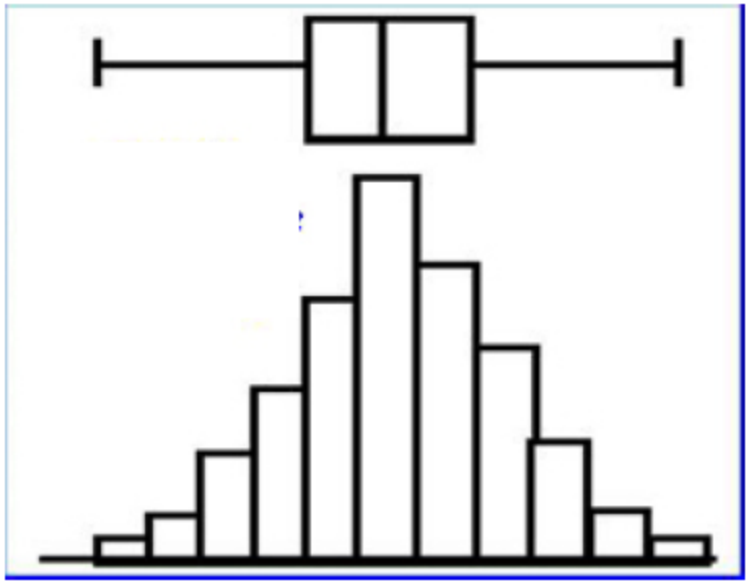


Not Normal

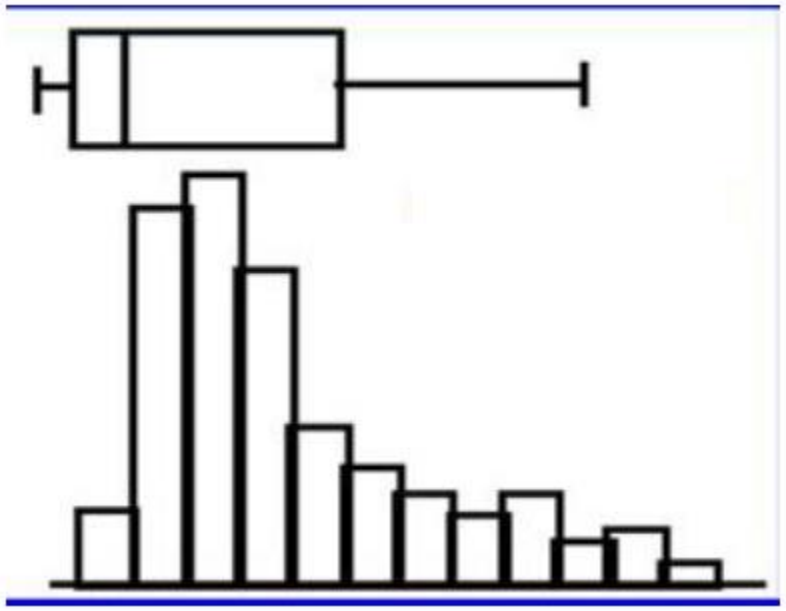




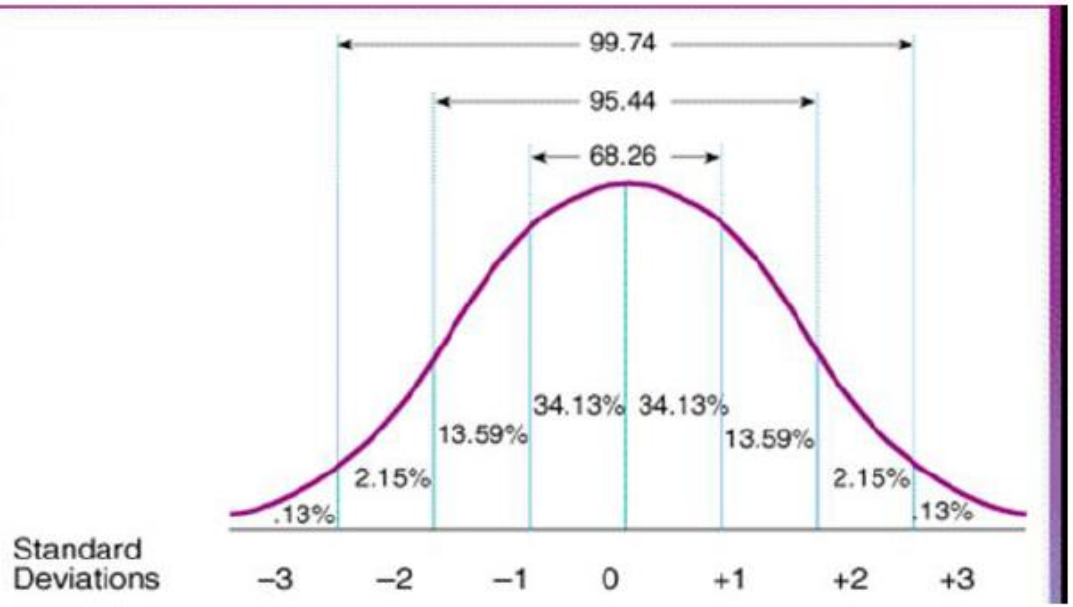
Normal



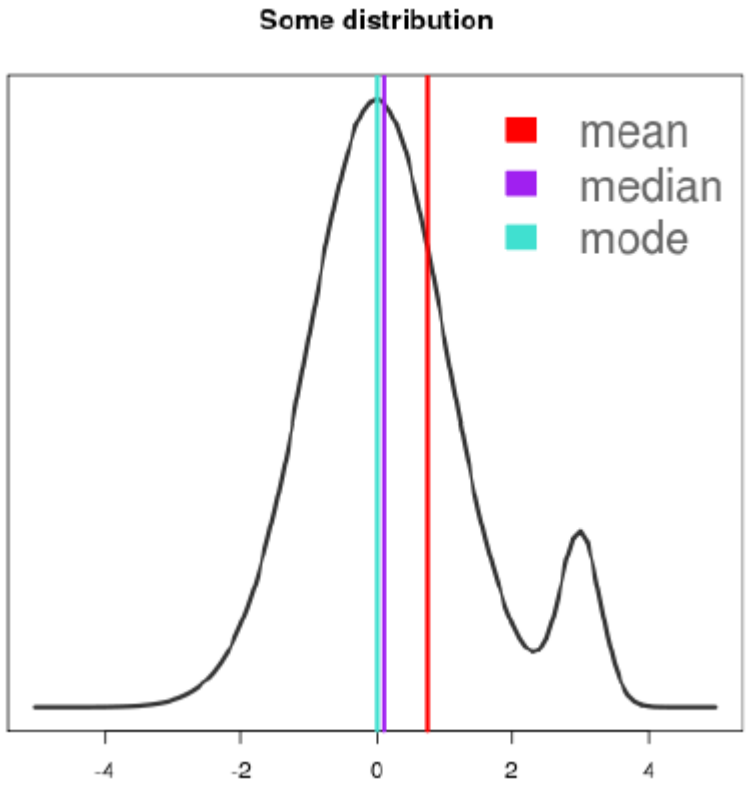
Not Normal



Normal

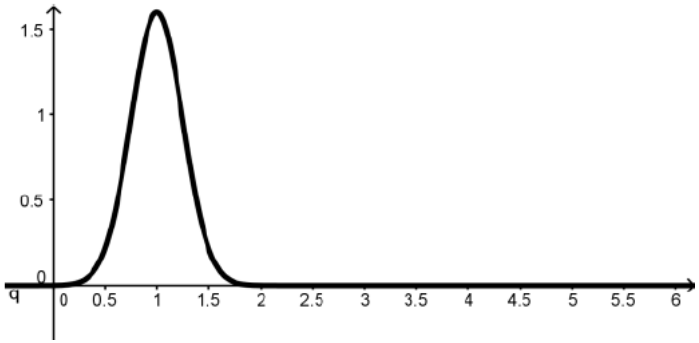


Not Normal

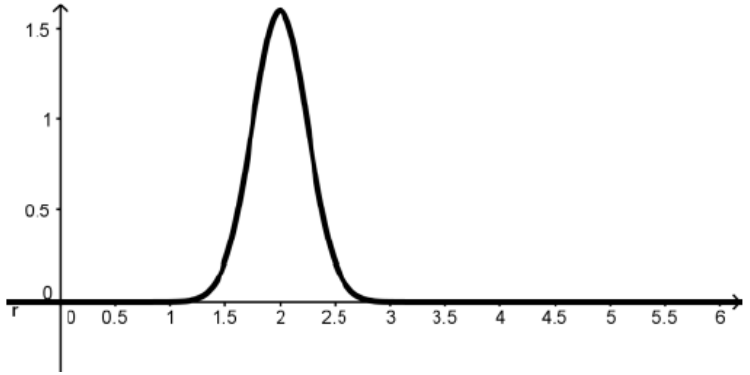


Same Std. Dev., different means

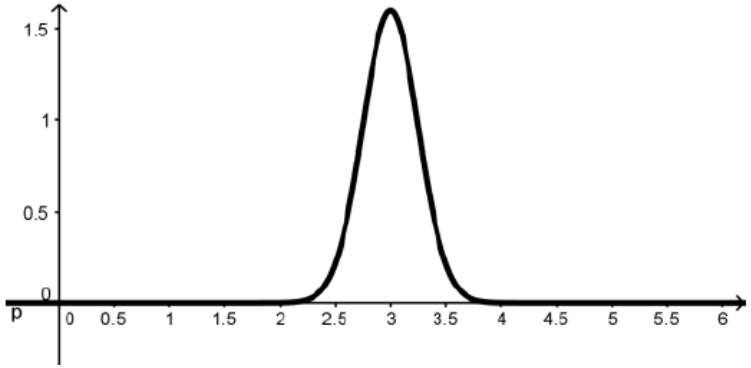
Mean = 1, Standard Deviation = 0.25



Mean = 2, Standard Deviation = 0.25

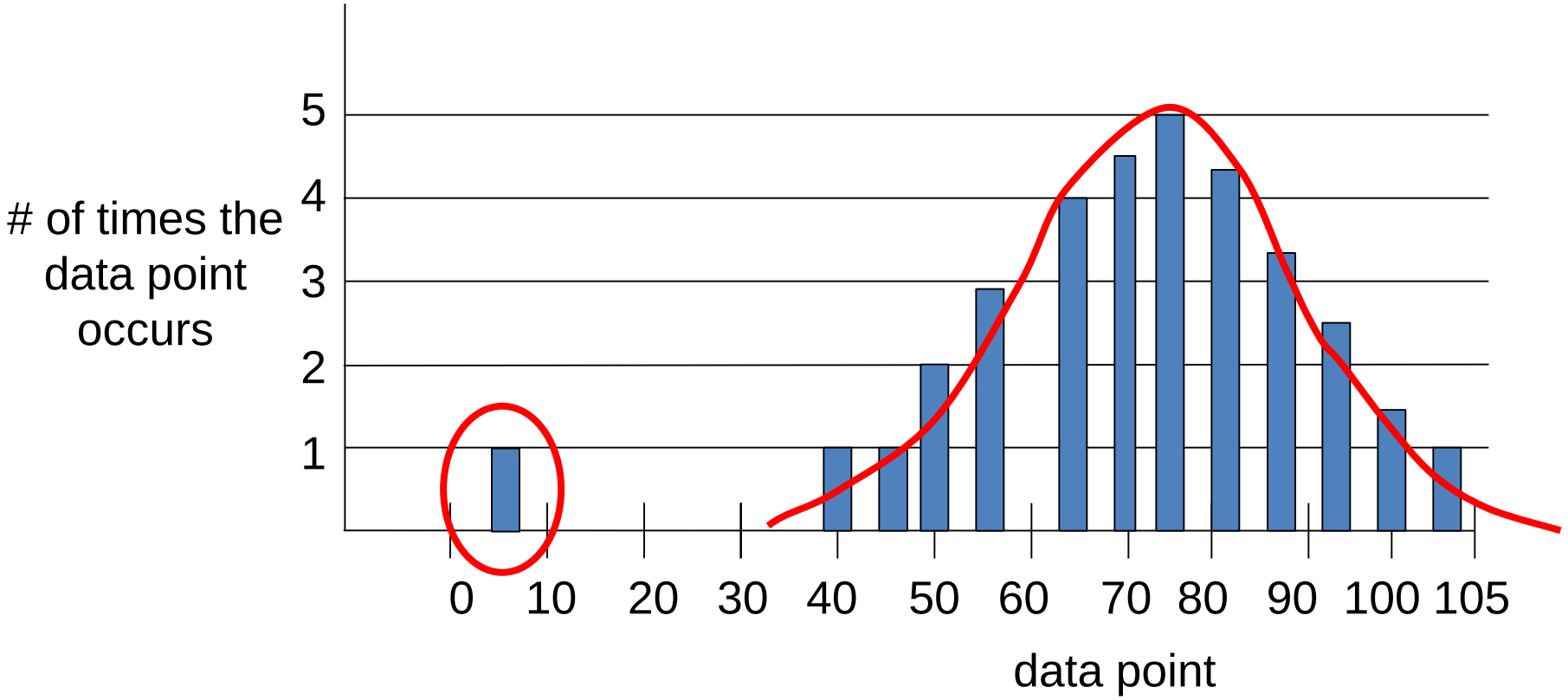


Mean = 3, Standard Deviation = 0.25

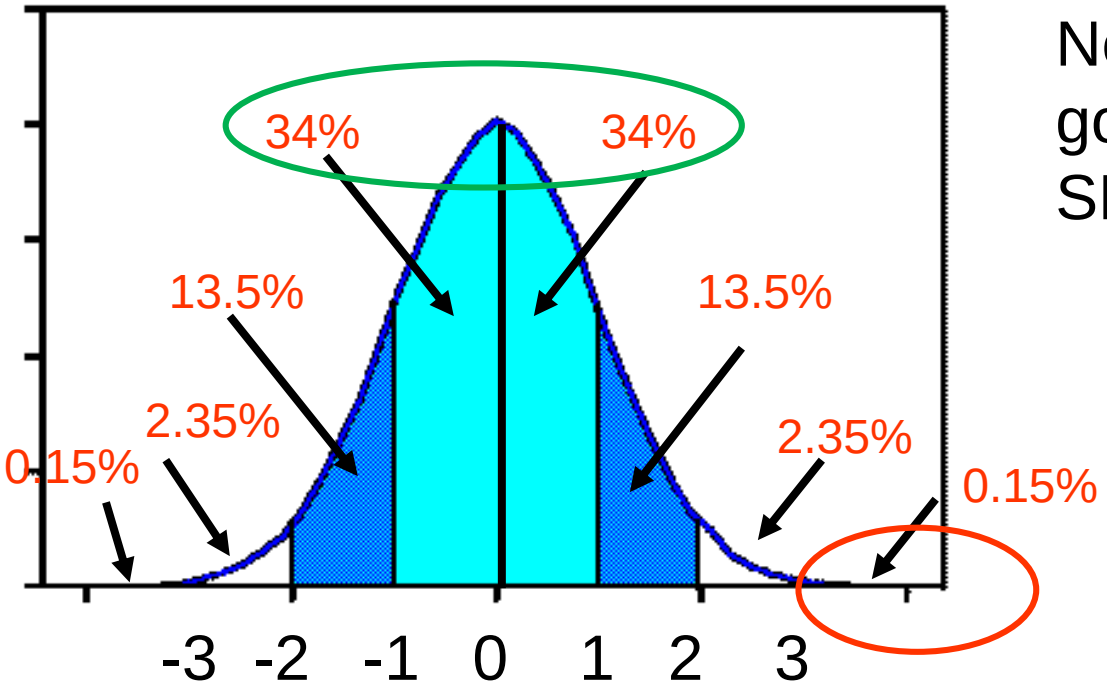


Same spread, different center point.

Outlier: a data point that is much higher or lower than the other data points.



To build the Normal Distribution Graph, we start off with the standard scale. The x-axis scale is labeled with #'s of standard deviations from the mean.



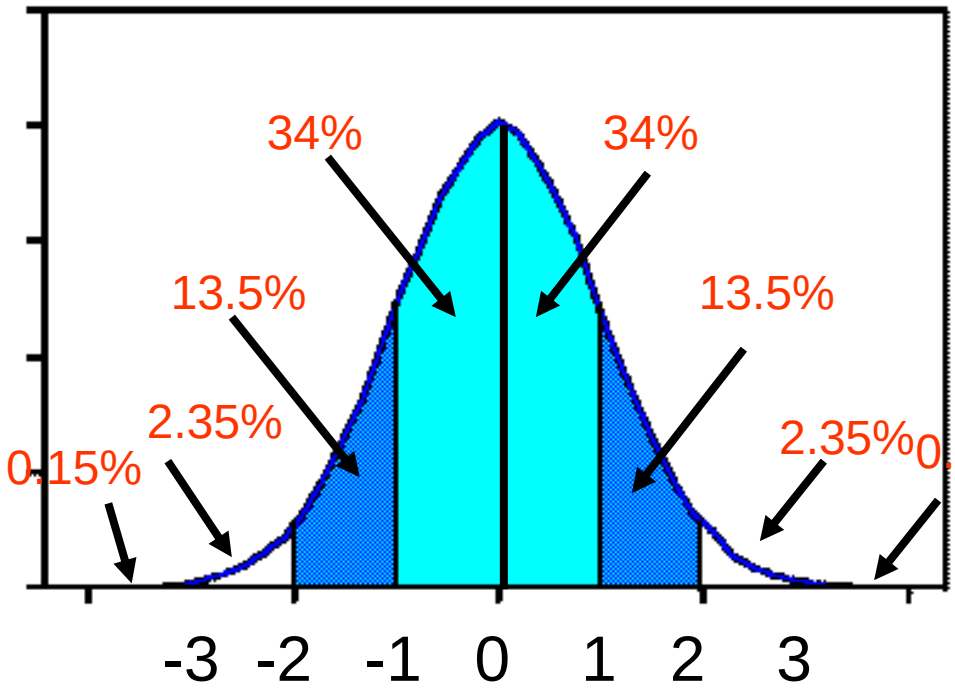
Notice: the scale only goes from -3 to +3 SDEV from the mean.

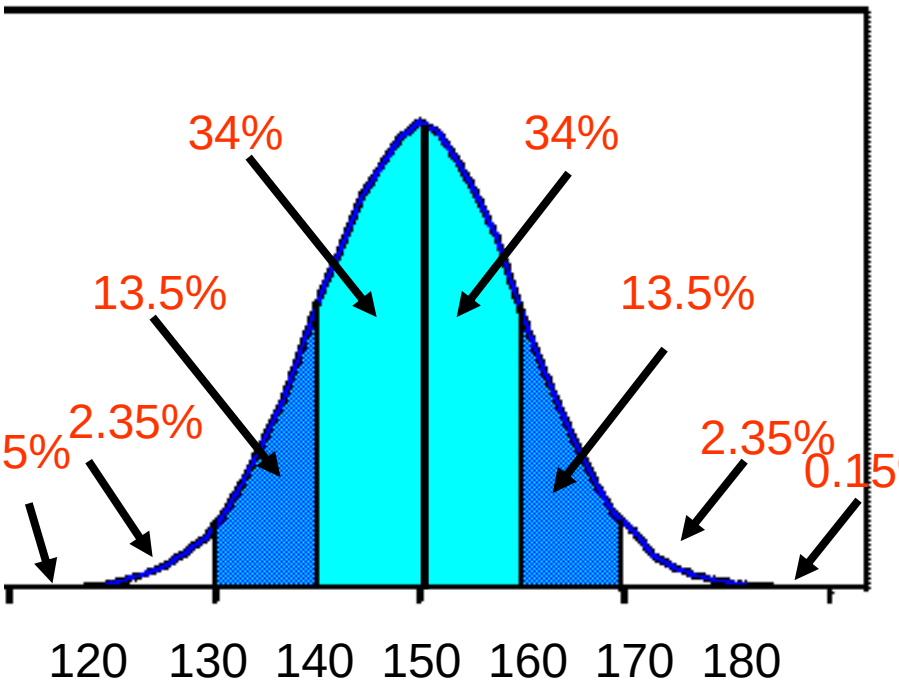
The portion of the data that falls within each region is labeled.

Only 0.15% of the data is greater than 3 sdev above the mean.

68% of the data falls between -1 sdev and +1 sdev of the mean.

To convert the standard scale of the Normal Distribution Graph to the data scale, we need (1) mean and (2) std. deviation. For example: $\bar{x} = 150 \quad S = 10$





68% of the data falls between -1 sdev and +1 sdev of the mean.

68% of the data falls between data values 140 and 160..

The standard deviation for some data is 7. The mean for this data is 42. Draw a bell curve and label the x-axis up to 3 standard deviations above and below the mean.

What is the probability that a data point will be in the range between 28 and 42?

What is the probability that a data point will be in the range between 21 and 28?

Comparing “apples to apples”

In math, Jordan scored a 53. The class average was 57. The standard deviation was 2. How many standard deviations below the mean did Jordan score?

In science, Jordan scored a 114. The class average was 126. The standard deviation was 6. How many standard deviations below the mean did Jordan score?

On which test did Jordan perform better on?