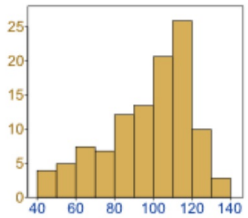
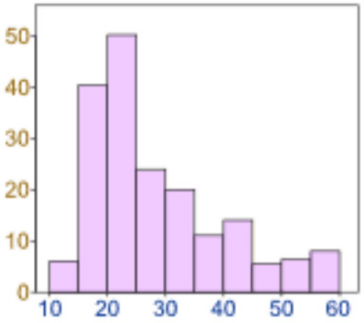
Sec 12-7: Normal Distributions

Data can be "distributed" (spread out) in different ways.

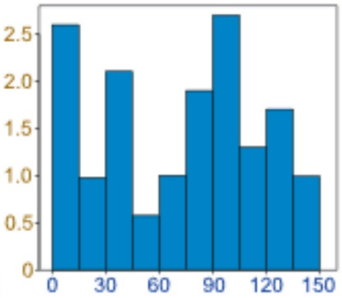
Data can be skewed to the right



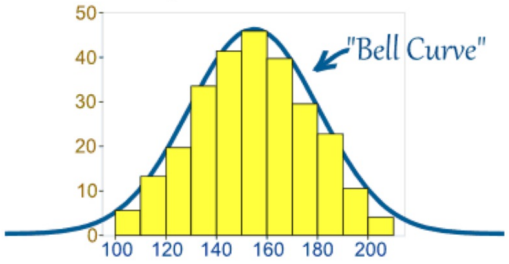
Data can be skewed to the left.



Or it can be all jumbled up



But there are many cases where the data tends to be around a central value with no bias left or right.



A Normal Distribution

http://www.mathsisfun.com/data/quincunx.html

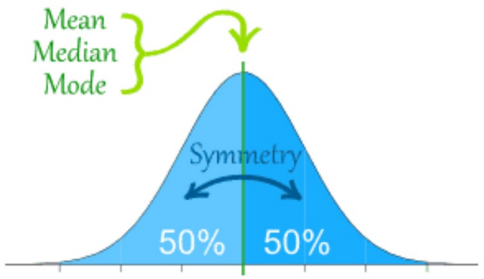
Many things closely follow a Normal Distribution:

- heights of people
- size of things produced by machines
- errors in measurements
- blood pressure
- marks on a test

We say the data is "normally distributed".

The Normal Distribution has:

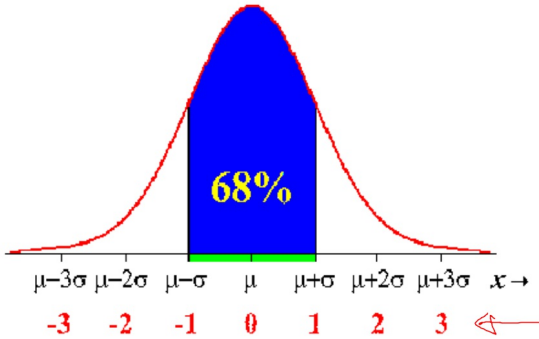
- mean = median = mode
- symmetry about the center
- 50% of values less than the mean and 50% greater than the mean



100

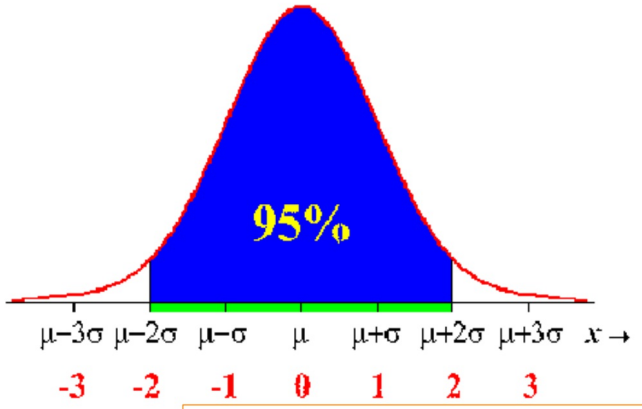
The 68-95-~~99.7~~ Rule
For Normal Distributions

Approximately 68% of the observations fall within 1 standard deviation of the mean

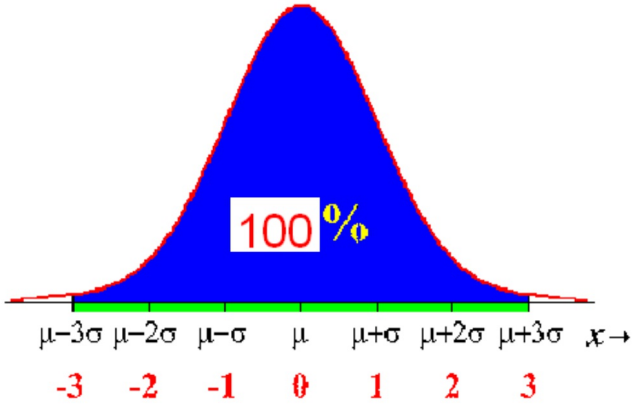


Z scores

Approximately 95% of the observations fall within 2 standard deviations of the mean

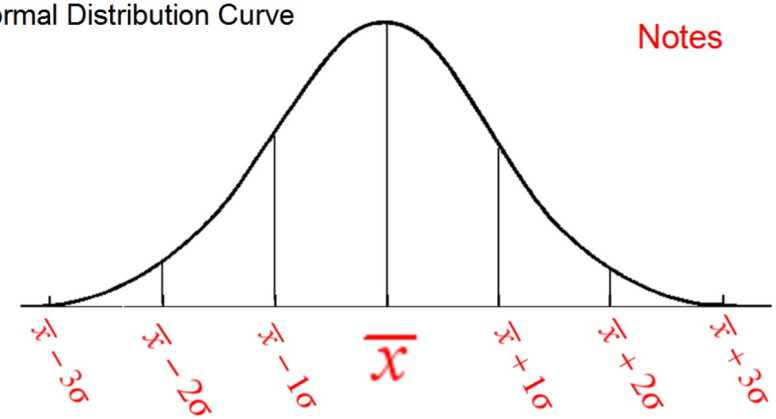


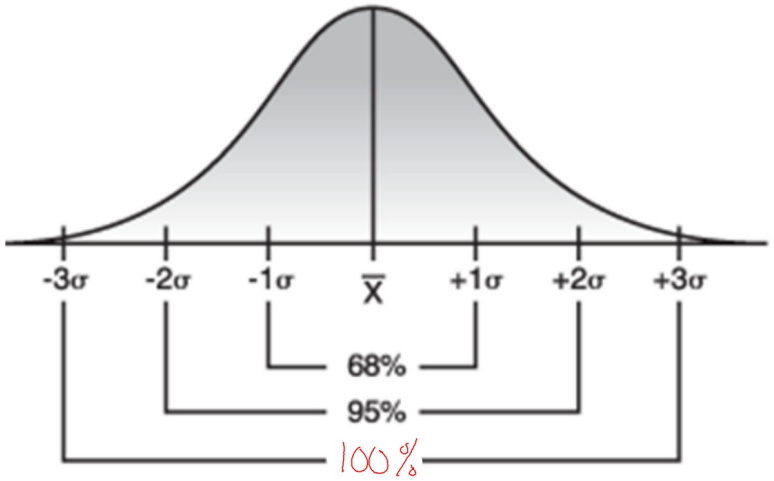
Approximately ~~99.7%~~ 100 of the observations fall within 3 standard deviations of the mean

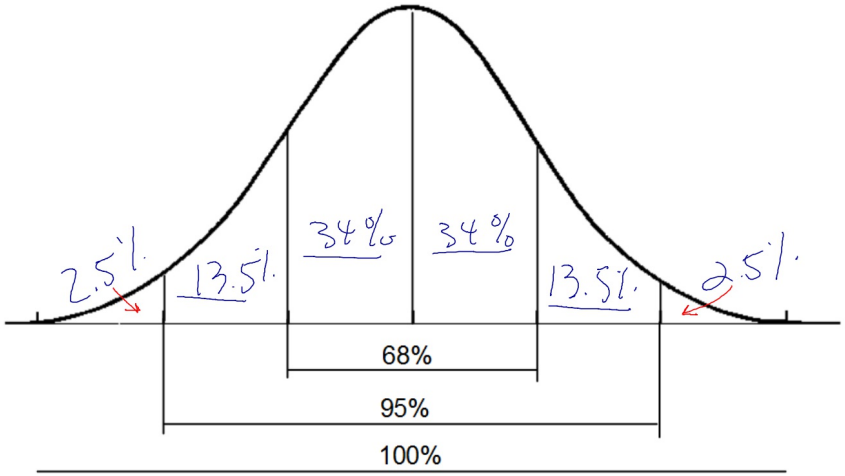


Normal Distribution Curve

Notes



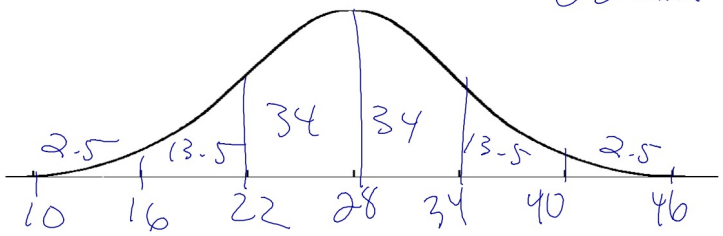




An employer surveyed its employees about commuting time to work. The mean commuting time was 28 minutes with a standard deviation of 6 minutes.

1. Within what range of times do 68% of the workers spend time commuting?

22 min — 34 min



2. Within what range of times do 95% of the workers spend time commuting?

16 to 40

3. What % of workers spend between 10 and 22 minutes commuting?

16%

4. What % of workers spend between 28 and 40 minutes commuting?

47.5%

~~5. 4. What % of workers spend between 28 and 40 minutes commuting?~~

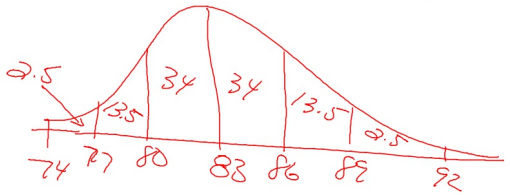
6. What % of workers spend less than 40 minutes commuting?

97.5%

A standardized test had the following statistics:
Mean = 83 Std Dev = 3

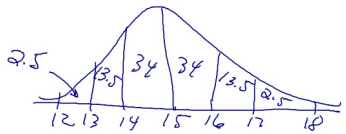
1. Your score was 89.
   a. Find your z-score. $z = \frac{89-83}{3} = 2$
   b. What % of the scores were less than yours? 97.5%

2. Your score was 80.
   a. Find your z-score. $z = -1$
   b. What % of the scores were better than yours? 84%



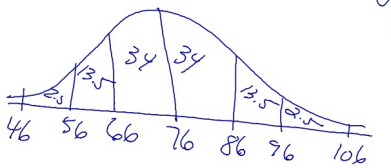
A cereal manufacturer samples some boxes of cereal which are supposed to weight 16 ounces.
The mean weight of the boxes sampled was 15 with a standard deviation of 1

1. What % of the boxes weighed less than 17 ounces? 97.5%
2. What interval contained 95% of the boxes? 13oz to 17oz
3. What % of the boxes contained from 13 to 15 ounces? 47.5%
4. A box is rejected if it is more than 2 ounces from the advertised weight. What % of the boxes were rejected. 16%



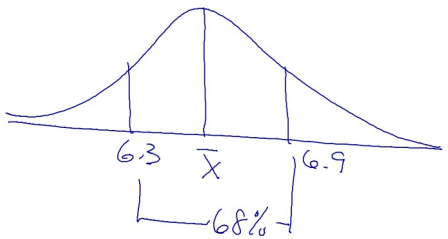
Scores on an exam are normally distributed with a mean of 76 and a standard deviation of 10. There were 230 tests taken.

1. How many students scored above 96? 2.5% → .025(230) = 6
2. How many students scored below 66? 16% → .16(230) = 37
3. How many students scored between 56 and 86? 81.5% → .815(230) = 187
4. You select an exam at random. What is the probability that the score is between 76 and 96? 47.5%



The weights of newborn babies is normally distributed with 68% of the newborns weighing from 6.3 pounds to 6.9 pounds.

Find the mean weight and the standard deviation of these newborns.



$\bar{X} = \frac{6.3 + 6.9}{2} = 6.6$

$\bar{X} + 1\sigma = 6.9$

$6.6 + \sigma = 6.9$

$\sigma = 0.3$