AP Statistics

Chapter 2: Modeling Distributions of Data

Day 3

HW: p. 131, #41, 43, 45, 46

p. 107-08, #19, 21, 23, 31, 32

19.

(a) The mean and the median both increase by 18 so the mean is 87.188 and the median is 87.5.

$$\text{Mean}_{\text{New}} = \frac{\text{sum of student heights standing on chairs}}{\text{number of students}}$$

$$= \frac{(\text{height of first student} + 18) + \ldots + (\text{height of last student} + 18)}{\text{number of students}}$$

$$= \frac{\text{sum of student heights standing on floor} + 18 * \text{number of students}}{\text{number of students}}$$

$$= \text{Mean}_{\text{Old}} + 18 = 69.188 + 18 = 87.188.$$

The median is still the height of the middle student. Now that this student is standing on a chair 18 inches from the ground, the median will be 18 inches larger.

(b) The standard deviation and *IQR* do not change. For the standard deviation, note that although the mean increased by 18, the observations each increased by 18 as well so that the deviations did not change. For the *IQR*, Q_1 and Q_3 both increase by 18 so that their difference remains the same as in the original data set.

21.

(a) To give the heights in feet, not inches, we would divide each observation by 12 (12 inches = 1 foot). Thus

$$\text{Mean}_{\text{New}} = \frac{\frac{\text{height of first student (inches)}}{12} + \ldots + \frac{\text{height of last student(inches)}}{12}}{\text{number of students}}$$

$$= \frac{1}{12}\left(\frac{\text{height of first student (inches)} + \ldots + \text{height of last student (inches)}}{\text{number of students}}\right)$$

$$= \frac{1}{12}\text{Mean}_{\text{Old}} = \left(\frac{1}{12}\right)69.188 = 5.77 \text{ feet.}$$

The median is still the height of the middle student. To convert this height to feet, we divide by 12:

$$\text{Median}_{\text{New}} = \frac{69.5}{12} = 5.79 \text{ feet.}$$

(b) To find the standard deviation in feet, note that each deviation in terms of feet is found by dividing the original deviation by 12.

$$\text{standard deviation}_{\text{New}} = \sqrt{\frac{(\text{first deviation (ft)})^2 + \ldots + (\text{last deviation (ft)})^2}{n\text{-}1}}$$

$$= \sqrt{\frac{(\text{first deviation (in)})^2 + \ldots + (\text{last deviation (in)})^2}{n-1}}$$

$$= \frac{1}{12} * \text{standard deviation}_{\text{Old}} = \frac{3.2}{12} = 0.27 \text{ feet.}$$

The first and third quartiles are still the medians of the first and second halves of the data; these values must simply be converted to feet. To do this, divide the first and third quartiles of the original data set by 12: $Q_1 = \frac{67.75}{12} = 5.65$ feet and $Q_3 = \frac{71}{12} = 5.92$ feet. So the interquartile range is $IQR = 5.92 - 5.65 = 0.27$ feet.

23. To find the mean temperature in degrees Fahrenheit multiply by $\frac{9}{5}$ and add 32 so we get $\text{Mean}_f = \frac{9}{5}(25) + 32 = 77$ degrees Fahrenheit. To find the standard deviation, we just multiply by $\frac{9}{5}$ since adding 32 just shifts the distribution and does not affect the spread. So we get $\text{standard deviation}_f = \frac{9}{5}(2) = 3.6$ degrees Fahrenheit.

31.

(a) Mean is C, median is B (the right skew pulls the mean to the right).

(b) Mean is B, median is B (this distribution is symmetric).

32.

(a) Mean is A, median is A (the distribution is symmetric).

(b) Mean A, median B (the left skew pulls the mean to the left).

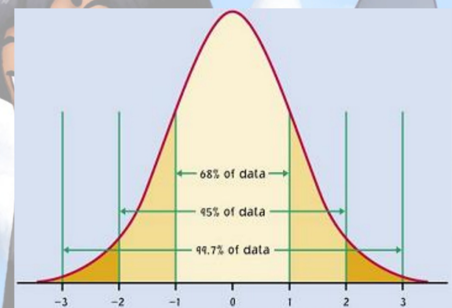
Empirical Rule

The 68-95-99.7 rule (empirical rule) gives some benchmarks for understanding how data are distributed under a normal curve.

- About 68% of the area (observations) under the curve falls within 1 standard deviation of the mean.
- About 95% of the area (observations) under the curve falls within 2 standard deviations of the mean.
- About 99.7% of the area (observations) under the curve falls within 3 standard deviations of the mean

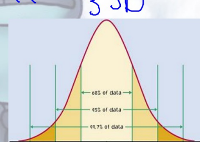
Normal Distributions

- Therefore, only 0.3% (about one outcome in 330) will be more than 3 standard deviations from the mean.

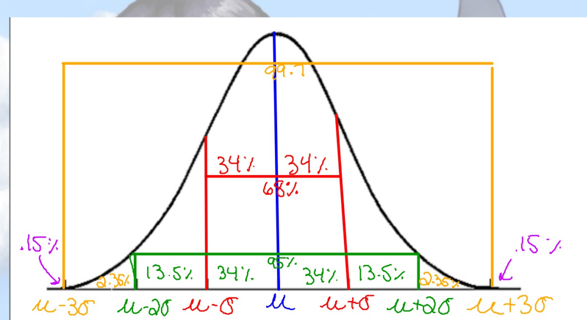


Normal Distributions

- How can you tell if a distribution is approximately normal using the 68-95-99.7 rule?
  - mean and median have to be very close
  - Roughly symmetric curve.
  - 68% of observations are w/in 1 SD
  - 95% " 2 SD
  - 99.7% " 3 SD



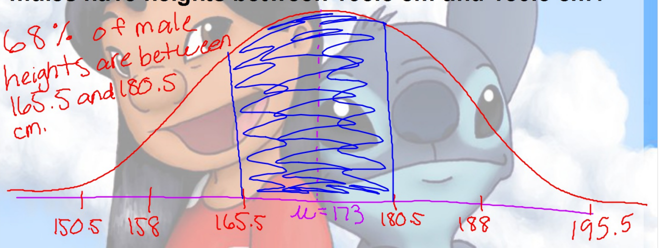
Normal Distributions



Example

American adult males have heights that are approximately distributed with a mean of μ = 173 cm and a standard deviation of σ = 7.5 cm. What percent of males have heights between 165.5 cm and 180.5 cm?

68% of male heights are between 165.5 and 180.5 cm.



Example

American adult males have heights that are approximately distributed with a mean of μ = 173 cm and a standard deviation of σ = 7.5 cm. What percent of males have heights over 188 cm?

2.5% of male heights are over 188cm.

Example

A particular college entrance exam has two parts: math and verbal. The distribution of math scores is normal with a mean of 500 and a standard deviation of 100. Between which two values will the middle 99.7% of all test scores roughly be?

99.7% of test scores will roughly be between 200 and 800