

# Shifting and Standardizing Data

Homework: Read and Take Notes pages 104-112

Complete #1,3 on page 129

# What are some measure of spread and position?

- Minimum
- Quartiles
- Median
- Mean
- Standard Deviation
- IQR
- Range

# Problem 1:

The current weekly salaries of 8 part-time employees are: \$110, \$118, \$140, \$165, \$180, \$180, \$185, \$202.

Find the 5 number summary, IQR, mean, standard deviation and range of the data.

# Problem 1 Continued:

The store manager wants to reward the employees with a bonus.  
He is considering 2 options:

Option 1: Give every employee a \$30 bonus.

Option 2: Give each employee a bonus equal to 20% of their weekly salary.

How will each option change the measures you found?

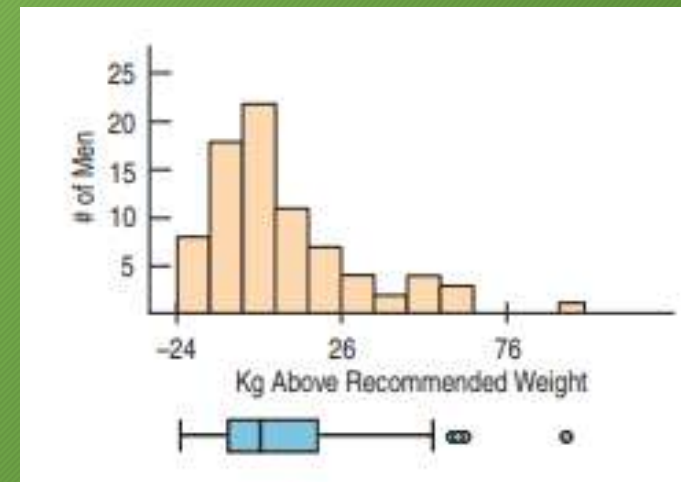
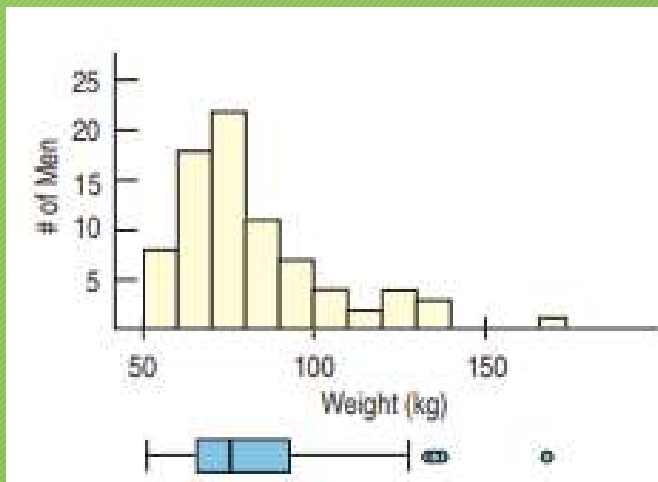


# Findings

- How did adding a constant value to every point in the data set change the measures of position and spread?
- How did multiplying every point in the data set by a constant value change the measures of center and spread?

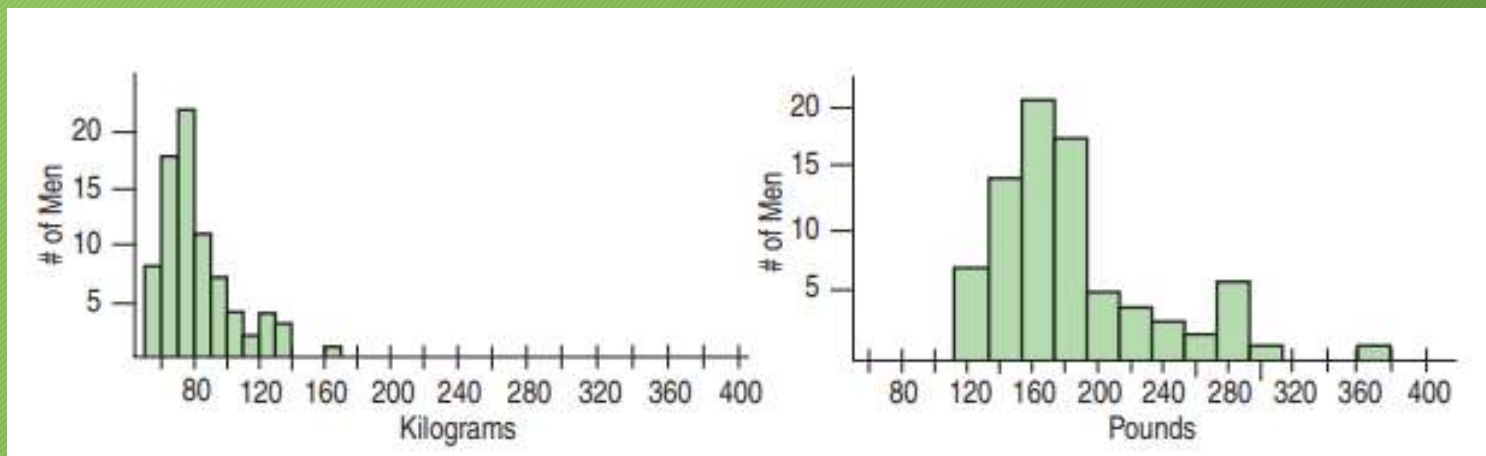
# Shifting Data

- When we shift the data by adding or subtracting a constant to each value:
  - all measures of position (center, percentiles, minimum, maximum, etc.) will increase or decrease by the same constant.
  - all measures of spread remain the same
  - the shape of the distribution is maintained.



# Shifting Data

- When we shift the data by multiplying or dividing all values by a constant:
  - all measures of position (center, percentiles, minimum, maximum, etc.) will be multiplied or divided by the constant
  - all measures of spread (range, IQR, standard deviation) will be multiplied or divided by the constant
  - the shape of the distribution is maintained.



# Practice: Complete the table.

Statistic	$x$	$x + 10$	$2x$	$1.5x - 2$	$3x + 50$
minimum	10				
Q1	14				
median	18.5				
Q3	25				
maximum	32				
range	22				
mean	20				
IQR	11				
std. dev.	7.2				

# Apply It!

The times in the men's combined event at the Winter Olympics are reported in seconds. The mean and standard deviation of the slalom times are 94.2714 seconds and 5.2844 seconds, respectively.

- Can you determine the mean and standard deviation of the times in minutes without the individual times?

## Problem 2:

A set of twin sisters, Megan and Molly, are juniors in high school. Megan decided to take the SAT and Molly chose the ACT. The girls have just received their score reports. Megan got a 680 on the SAT and Molly got a 29 on the ACT. They want to determine who performed better.

The mean SAT score is 500 with a standard deviation of 100 and the mean ACT score is 21 with a standard deviation of 5.

Which sister performed better? Justify your answer.

# Standardizing Scores

- To compare data values that are measured on a different scale, we can examine how many standard deviations (the z-score) each value is from the mean.

$$z = \frac{y - \bar{y}}{s}$$

- Z-scores have no units!
- The sign of the z-score shows direction and the absolute value represents how extreme or unusual the data point is.

# Explain what each z-score tells us:

- $z = 1.5$
- $z = -0.2$
- $z = 8.6$