

### FST 3-3 Notes

Topic: Translation of Data

#### GOAL:

Emphasize the parallel ideas of translating graphs and translating data. Investigate the effects of adding a constant to each data value on the displays of those values, on measures of center, and on measures of spread.

#### SPUR Objectives

H Use translations to describe and analyze data and statistics.

#### Vocabulary

invariant UNCHANGED BY A PARTICULAR TRANSFORMATION

#### Warm-up

1) Find the range and mean of the data set:

L1 101, 102, 103, 104, 105, 106, 107, 108, 109, 110

$$\text{RANGE (MAX - MIN)}: 110 - 101 = 9$$

$$\text{MEAN } (\bar{x}): 105.5$$

2) Find the range and mean of the data set:

L2 136, 137, 138, 139, 140, 141, 142, 143, 144, 145

$$\text{RANGE}: 145 - 136 = 9$$

$$\text{MEAN } (\bar{x}): 140.5$$

3) How do the values in data set #1 compare to the values in data set #2?

EACH # IN SET 2 IS 35 MORE THAN SET 1.

4) Explain how the answers from #1 can be used to determine the answer to #2.

- RANGE IS THE SAME
- MEAN IS 35 MORE

5) How do the IQR, standard deviation and variance compare?

SAME

SET 1

$$\text{IQR: } 108 - 103 = 5$$
$$S_x: 3.03$$
$$V: 9.18 \quad (3.03)^2$$

SET 2

$$\text{IQR: } 143 - 138 = 5$$
$$S_x: 3.03$$
$$V: 9.18 \quad (S_x)^2$$

**ACTIVITY**

In the United States, the passage of the 19th amendment to the Constitution in 1920 gave women the right to vote. This activity compares the year in which women earned the right to vote in the U.S. to the year women achieved that right in other countries.

Step 1 Enter the years below into a statistics utility. Label the column year .

1893	New Zealand	1920	United States	1949	China	1974	Jordan
1902	Australia	1921	Sweden	1950	India	1976	Portugal
1906	Finland	1928	Britain	1954	Colombia	1989	Namibia
1913	Norway	1928	Ireland	1957	Malaysia	1990	Western Samoa
1915	Denmark	1931	Spain	1962	Algeria	1993	Kazakhstan
1917	Canada	1944	France	1963	Iran	1993	Moldova
1918	Austria	1945	Italy	1963	Morocco	1994	South Africa
1918	Germany	1947	Argentina	1964	Libya	2005	Kuwait
1918	Poland	1947	Japan	1967	Ecuador		
1918	Russia	1947	Mexico	1971	Switzerland		
1919	Netherlands	1947	Pakistan	1972	Bangladesh		

Source: New York Times

- 1) Enter the years in L1.
- 2) In L2, Calculate  $L2 = L1 - 1920$ .
- 3) Calculate the 1-variable Statistics of L1 and L2. Record the results.

L1 data

L2 data

L2: Mean, Median and Mode are 1920 units less than L1 data

$\bar{x}$  Mean 1947.02  
 Median 1947  
 Mode 1918, 1947  
 Range ~~2005~~ - 1893 = 112  
 IQR 1969 - 1918.5 = 50.5  
 Standard Deviation 29.16  
 $S_x$

Mean 27.07  
 Median 27  
 Mode -2, 27  
 Range 85 - -27 = 112  
 IQR 49 - -1.5 = 50.5  
 Standard Deviation 29.16  
 $S_x$

4) Which values are the same? Which values are different?

Same = Range, IQR, S.D.      ★ Measures of Spread

Different = Mean, Median, Mode      ★ Measures of Center

### Additional Example

At a martial arts tournament, the 20 fighters weighed in before the tournament. All the fighters made weight and a statistician computed the following statistics:

$$\text{mean} = 191.125 \text{ lb, } - 0.25 = 190.875 \text{ lbs}$$

SAME standard deviation = 29.7 lb,

$$\text{median} = 194.5 \text{ lb, } - 0.25 = 194.25 \text{ lbs}$$

SAME IQR = 35.5 lb.

After finishing her calculations, it was brought to the statistician's attention that the scales were not correctly calibrated. The starting weight was set at 0.25 lb, not 0. Find the correct values for the mean, standard deviation, median, and interquartile range for the 20 fighters.

### Measures of Center of Translated Data

#### Theorem (Centers of Translated Data)

Adding  $h$  to each number in a data set adds  $h$  to each of the mean, median, and mode.

### Measures of Spread of Translated Data

#### Theorem (Spreads of Translated Data)

Adding  $h$  to each number in a data set does not change the range, interquartile range, variance, or standard deviation of the data.

**Invariant** Unchanged by a particular transformation.