FST 3-6 Notes
Topic: Scale Changes of Data
GOAL
Investigate the effects of scaling data on the display, the measures of center, and the
measures of spread.

SPUR Objectives

H Use scale changes to describe and
analyze data and statistics.

Vocabulary

scale change of a data set

scale factor

scale image

Warm-Up

From 1995 to 2005 in U.S. cities, on the average, prices of food went
up 25.1%, prices of medical care rose 46.6%, and rents went up 37.8%.
Estimate the 2005 price of the following items, whose 1995 prices are
given.

1. a carton of cereal that cost $3.39 $3.39(1+.251) = \$4.24$
2. rent that was $850/month $850(1+.378) = \$1171.30$
3. a hospital room that was $1000 for one night $1000(1+.466) = \$1466$

Example
1) Find the standard deviation and median of the data set:

$L1 =$ 5, 7, ①, 4, 6, 3, ⑦, 2   mode = 7   mean = 4.375

S_x standard deviation = 2.26 median = 4.5 range = 6 $var = 2.26^2$
     $= 5.11$

2) Find the standard deviation and median of the data set:

$L2 =$ 60, 84, ⑫, 48, 72, 36, ⑧④, 24   mode = 84   mean = 52.5

standard deviation = 27.17 median = 54 range = 72 $var = 27.17^2$
     $= 738.21$

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

Multiplied by 12

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

Multiplied by 12

5) How do you think the modes and means will compare?

Multiplied by 12

6) What about the range and variance?

multiplied by 12   multiplied by 12^2

Activity

The Consumer Price Index in 1998 was about 496. Here are average prices of some grocery items in that year.

$L1$ $L2 = L1 \times 1.322$ $L3$ $L4 = L3 \times 1.322$

Items	1998 costs	2008 costs		1998 statistics	2008 statistics	1998 statistics x scale factor
Coffee 1 pound	$4.03	5.33	Mean	1.787	2.362	2.362
Eggs 1 dozen	$1.12	1.48	Median	1.365	1.805	1.805
Gasoline 1 gallon	$1.13	1.49	Range Max-Min	3.01	3.978	3.979
Orange Juice 12oz can	$1.60	2.12	Variance	1.306	2.283	1.727
Ground Beef 1 pound	$1.82	2.41	Standard Deviation	1.143	1.511	1.511
Chicken 1 pound	$1.02	1.35				

1) Calculate the scale factor needed to predict costs of items in 2008 from 1998 prices (CPI in 2008 was 655.5) $\dfrac{655.5}{496} = 1.322$

2) Enter the price data for 1998 into L1

3) Go to L2 enter L2 = L1 x scale factor. Round answers to hundredths and fill in 2008 cost column.

4) Go to STAT →CALC: 1-var statistics for L1. Complete the 1998 statistics column.

5) Go to STAT →CALC: 1-var statistics for L2. Complete the 2008 statistics column.

6) Enter 1998 statistics data in the calculator into L3

7) Go to L4 enter L4 = L3 x scale factor

8) Compare the results.

2008 Statistics = 1998 statistics x scale factor

2008 Variance = 1998 Variance x scale factor²

Measures of Center of Scaled Data

measures of center x scale factor

Theorem (Centers of Scaled Data)

Multiplying each element of a data set by the factor a multiplies each of the mode, mean, and median by the factor a.

Measures of Spread of Scaled Data

measures of spread x scale factor

Theorem (Spreads of Scaled Data)

If each element of a data set is multiplied by a > 0, then the variance is a^2 times the original variance, the standard deviation is a times the original standard deviation, and the range is a times the original range.

Variance x scale factor^2

Additional Example 2

To give an approximate conversion from kilograms to pounds, you can multiply the number of kilograms by 2.2. A local grocery store gets a shipment of cheese imported from France. Each pre-packaged piece is labeled with the weight in kilograms, and must be relabeled with the weight in pounds. What will be the effect of changing from kilograms to pounds on:

1 kg = 2.2 pounds

a) the upper quartile of the data?   *Q3*

Multiply by 2.2

b) the ~~variance~~ of the data?

Multiply by 2.2^2

c) the standard deviation on the data?

Multiply by 2.2