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.

Vocabulary

SPUR Objectives

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

scale change of a data set   *MULTIPLIES ALL ITEMS BY SAME #*

scale factor   *THE MULTIPLIER*

scale image   *WHAT YOU GET AFTER MULTIPLYING*

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:

   5, 7, 1, 4, 6, 3, 7, 2

   standard deviation = *2.26*   median = *4.5*

   MODE: 7   MEAN: 4.375
   RANGE: 6   VAR: 2.26^2
                  = 5.11

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

   60, 84, 12, 48, 72, 36, 84, 24

   standard deviation = *27.17*   median = *54*

   MODE: 84   MEAN: 52.5
   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.

   Multiply 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 x 1.322   L3   L4 = L3 x 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	1.865	1.865
Gasoline 1 gallon	$1.13	$1.49	Range	3.61	3.979	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) $\frac{655.5}{496} = 1.322$

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 Stats: 1998 Stats x scale factor

2008 Variance: 1998 Variance x scale factor²

Measures of Center of Scaled Data

> **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 CENTER X SCALE FACTOR

Measures of Spread of Scaled Data

> **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.

MEASURES OF SPREAD X SCALE FACTOR

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:

a) the upper quartile of the data?   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