Stats – Fall Semester **name: _____**

Lesson Plan #12 – Shifting data, re-scaling data, and *z*-scores

The **standard deviation** is a measure of _____. Below, write a definition of standard deviation that you understand.

Shifting data

Example 1

A study measured the weights of 80 men who were between 19 and 24 years old and between 5'8" and 5'10" tall. For this age group, the maximum healthy weight is 74 kg.

Here are the summary statistics for this data.

mean = 82.36	upper quartile = 92.3	standard deviation = 22.27
median = 76.85	lower quartile = 67.3	interquartile range = 25

(a) Is the mean weight of these men over or under the maximum healthy weight? By how much?

(b) The summary statistics above show the weight of the men in kg. Change the summary statistics so that instead they show the amount over or under the maximum healthy weight. Your answer to (a) will help you with one. Some values might be negative.

mean = _____ upper quartile =_____ standard deviation = _____

median =_____ lower quartile =_____ interquartile range = _____

(c) Do all of the summary statistics change? Which ones did not change? Why not?

When data is shifted by adding or subtracting all values by a constant, all measures of _____

change in the same way, but measures of _____ remain unchanged.

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Re-Scaling data
Example 1 – continued

(d) Re-express the summary statistics in pounds. (1 kilogram = 2.2 pounds)

mean = _____ upper quartile =_____ standard deviation = _____

median =_____ lower quartile =_____ interquartile range = _____

(e) Compare the distribution of Weights in kg to Weights in lbs.

(f) Do all of the summary statistics change? Which ones did not change? Why not?

(g) Describe what happens to measures of center and to measures of spread when data is re-scaled by multiplying all values by a constant

(h) How does the shape of the distributions change?

Example 2
In a class of 30 students, the mean height is 5'8" and the mean weight is 140 pounds. The standard deviation for the height is 3 inches and the standard deviation for the weight is 10 pounds.

(a) What can you say about a student who is 5'11" and weighs 150 pounds?

What is a ***z*-score**?

A *z*-score can be either _____ or _____.

What are the units of a *z*-score?

In Example 2, the student's *z*-score for both height and weight was +1 because the student was one standard deviation above the mean and one standard deviation above the weight.

We can standardize values using *z*-scores.

Example 2 - continued

(b) Find the *z*-scores using the information from Example 2.

i. Height of 5'5"

ii. Weight of 135 pounds.

iii. Height of 6'0".

Formulas for *z*-score. Below, write down the *two* formulas for finding the *z*-score using mean and standard deviation.

$z =$ $z =$

Example 3

(a) Find the *z*-scores for Weight in kg data from Example 1.

(b) Find the *z*-scores for Weight in lbs data.

(c) Find the mean and standard deviation of the *z*-scores.

z-scores both shift and re-scale data.

- *z*-scores shift the mean to _____.
- *z*-scores re-scale the standard deviation to _____.

Homework #9

- Read pp. 111-116 in Chapter 6.
- *ActivStats* Section 6-1
- Exercises p. 134: 1, 5