Financial Lit Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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 WS Assessment

 Target 24:

Measure of center and variation

**I can:**

* Calculate and describe the measures of center: mean and median
* Analyze the relationship of the mean and median to the shape of the data
* Calculate and describe the measures of variation: standard deviation, range and interquartile range (IQR)
* Calculate the 5-number summary and construct boxplots by hand and/or using technology (boxplots using technology may be modified or not)
* Compare distributions with side-by-side boxplots and percentiles
* Calculate and apply Z-scores

**Unit 11 Math Topics:**

* Statistical Process
* Summary of Statistic: Measure of center and spread

**Relative Frequency Tables**

An insurance company determines vehicle insurance premiums based on known risk factors. If a person is considered a higher risk, their premiums will be higher. One potential factor is the color of your car. The insurance company believes that people with some color cars are more likely to get in accidents. To research this, they examine police reports for recent total-loss collisions. The data is summarized in this table.

**Bar graph** in desmos and spreadsheet for stamp

****

**Pie graph**

****A natural way to visualize relative frequencies is with a pie chart. A pie chart is a circle with wedges cut of varying sizes like slices of pizza or pie. The size of each wedge corresponds to the relative frequency of the category. The slices add up to 100%, just like relative frequencies.

Stamp

**Histograms**

A histogram is like a bar graph, but the horizontal axis is a number line. Unlike a bar graph, there are no spaces between the bars.

The modality of a distribution indicates the number of peaks or hills in its histogram.

• It is unimodal if it has one peak.

• It is bimodal if it has two peaks.

• It is multimodal if it has multiple peaks.





 Symmetry and Unimodal Symmetry and bimodal



 Skew left (negative), unimodal Positively skewed graph

 Longer tail on left

The **normal distribution** has a very specific shape. It is unimodal and symmetric with a bell-shaped graph

Studies are often done by pharmaceutical companies to determine the effectiveness of a treatment. Suppose that a new cancer drug is currently under study. Of interest is the average length of time in months patients live once starting the treatment. Two researchers each follow a different set of 40 cancer patients throughout their treatment. The following data (in months) are collected.

Researcher 1: 3, 4, 11, 15, 16, 17, 22, 44, 37, 16, 14, 24, 25, 15, 26, 27, 33, 29, 35, 44, 13, 21, 22, 10, 12, 8, 40, 32, 26, 27, 31, 34, 29, 17, 8, 24, 18, 47, 33, 34

Researcher 2: 3, 14, 11, 5, 16, 17, 28, 41, 31, 18, 14, 14, 26, 25, 21, 22, 31, 2, 35, 44, 23, 21, 21, 16, 12, 18, 41, 22, 16, 25, 33, 34, 29, 13, 18, 24, 23, 42, 33, 29

Create a histogram (desmos) for each dataset and describe its distribution modal, using the same intervals = 5 and scales so you can compare them. Stamp. Compare and contrast the two distributions.

In addition to graphical and verbal descriptions, we can use numbers to summarize quantitative distributions. We want to know what an “average” value is (where the data is centered), and how spread out the values are. Together, **the center and spread** provide important information which can be used estimate our population parameters.

One hundred families from a particular neighborhood are randomly selected and asked to give their annual household income. The results are shown in the frequency table.

Stamp (spreadsheet)

Find its mean, median

**The Relationship Between the Mean and the Median**

If a distribution is skewed, the mean is pulled in the direction of the skew. In a right skewed distribution, the mean is greater than the median, while in a left skewed distribution, the mean is less than the median. If the distribution is symmetric, the mean and the median will be approximately equal.



Use the following table is the cost of purchasing a car at a local dealership. Some of the cars sold were new and some were used. Stamp (spreadsheet)

Find its mean, median

Based on the mean and the median, would you expect the distribution to be symmetric skewed left or skewed right? Explain.

**Measures of Variation**

In addition to the mean and median, which are measures of center or the "average" value, we also need a measure of how "spread out" or varied each data set is.

There are several ways to measure the variation of a distribution. In this section we will look at the standard deviation, range and the interquartile range (IQR).

**Standard Deviation**

The sample standard deviation, s, is a measure of variation that tells us how far, on average, the data values deviate, or are different from, the mean. The mean and standard deviation are paired to provide a measure of center and spread for symmetric distributions.

 

Modified Boxplot: Using 1.5\*IQR outlier rule

A group of diners were asked how much they would pay for a meal. Their responses were: $7.50, $25.00, $10.00, $10.00, $7.50, $8.25, $9.00, $5.00, $15.00, $8.00, $7.25, $7.50, $8.00, $7.00. $12.00.

Find mean, and standard deviation of this data. Explain what the mean and standard deviation tell you about how much the group of diners would pay for a meal.

Find the five-number summary for this data.

Calculate the range and IQR for this data

Create a modify boxplot, histogram and normal curve. Sketch all three and stamps

**Percentiles** is defined as the data’s value with that percentage of values below it.

**Z-Scores** is a method commonly used with unimodal and symmetric distributions (called normal or nearly normal distributions). Z-scores may be used with any data, but if the distribution is skewed, then the distribution of Z-scores will also be skewed.

 Formula $Zscore=\frac{data value - mean }{standard deviation}$

 Spreadsheet Zscore = STANDARDIZE(data value, mean, standard deviation)

**Assessment Target 24**

**I can…** calculate and describe the measure of center and variations

An experiment compared the ability of three groups of participants to remember briefly-presented chess positions. The data are shown. The numbers represent the average number of pieces correctly remembered from three chess positions.

Calculate the range and IQR for each group.

Create side-by-side boxplots, compare and contrast. Sketch, stamp

Calculate mean and the standard deviation of each group.

Create normal curves, compare and contrast. Sketch, stamp

You scored an 89 on a math test where the class mean and standard deviation are 75 points and 7 points respectively. You scored a 65 on an English test where the mean and standard deviation are 53 points and 4 points, respectively. In which class did you do better? Explain your answer using Z-scores and percentiles. Sketch, stamp