**STATS PROJECT #3 – THE NORMAL DISTRIBUTION**

**NAME:**

**CLASS:**

**DATE**: June 16, 2019

**PART A – CONCEPTS, TERMS AND DEFINITIONS**

A1 Go to <https://www.mathsisfun.com/data/standard-normal-distribution.html> and review.

What is a “normal distribution” in your own words?

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Name 3 things that closely follow a normal distribution.

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What are 3 characteristics of a normal distribution?

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A2 Search the internet using “68-95-99.7 rule”. In your own words, what is the rule about?

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Website URL:

A3 Research the internet using keywords “statistics outlier” and define outlier in your own words.

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Website URL:

A4 Unlike the median, the mean is very sensitive to outliers as we saw in the last project on center. How do you know if you have an outlier? You can expect an outlier if it falls outside a certain range. Further investigation will lead you to determine if the outlier should or should not be included in further analysis. If the data is normally distributed, 95% of the data should fall within 2 standard deviations of the mean.

Go to <https://goodcalculators.com/empirical-rule-calculator/> and scroll down the box titled “Empirical Rule Calculator”. Enter 200 for the mean (M), 20 for the standard deviation (SD), then hit “Calculate”. Look at the results in the yellow box. Based on these results, when should you suspect an outlier?

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We can describe this interval as [M – 2\*SD, M + 2\*SD]. Explain in your own words what this means.

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A5 Research the internet using keywords “statistics sample population” and describe the differences between sample and population.

>

Website URL:

**PART B – TEACHERS SALARIES**

B1 Without using a map or the internet, list 10 of the states of the United States of America.

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| --- | --- |
| **State** | **Salary** |
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B2 Go to <https://nces.ed.gov/programs/digest/d17/tables/dt17_211.60.asp> and review the table. Find and list the average annual salary of teachers in public elementary and secondary schools for 2016-17 for each of the states you listed above. Copy the data from the table above to cells A5:B14 of the spreadsheet named “Stats Normal Distribution Spreadsheet”.

B3 Excel will calculate the mean and standard deviation.

What is the mean?

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What is the standard deviation?

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B4 Excel will also calculate the 95% Outlier Criteria.

What is the lower limit?

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What is the upper limit?

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Do any of your states fall outside of this interval? If so, which ones? Why do you think this is the case?

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B5 Understanding (or trying to understand) Excel.

Click on cell **B20** and look at the text box on the top of the page.

What does it say?

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Describe what this cell is trying to compute?

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B6 Look at the next page of the spreadsheet named “10 State Histogram”. Does it appear to be normal? Or, is it skewed left, skewed right, or is it some other shape?

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B7 Look at the next page of the spreadsheet named “All States”.

What state pays the most and what is the salary?

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Which state pays the least and what is the salary?

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What is the mean for All States

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What is the standard deviation for All States?

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How does the mean and standard deviation for All States compare to the values for your 10 states? Describe any differences and why they may exist?

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Do any of the 50 states (plus the District of Colombia) fall outside the 95% Outlier Criteria above? If so, which ones? Why do you think this is the case?

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B8 Look at the next page of the spreadsheet named “All States Histogram”. Does it appear to be normal? Or, is it skewed left, skewed right, or is it some other shape?

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B9 If you are a teacher in Arizona, how would you feel about using the mean of All States to describe your salary?

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What could you do to better incorporate a “measure of center” that is more appropriate for an Arizona teacher?

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**PART C – CPI, COLA AND INFLATION**

C1 Go back to <https://nces.ed.gov/programs/digest/d17/tables/dt17_211.60.asp> and look closely at the top rows of the table and footnote 1.

What is the 1969-70 current dollar salary for Arizona?

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What is the 1969-70 constant 2016-17 dollars salary for Arizona?

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C2 Go to <https://www.bls.gov/cpi/questions-and-answers.htm> and review.

What is the CPI?

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What are two uses for the CPI?

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Which households are included in the CPI-U?

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Which households are included in the CPI-W?

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How does the Social Security Administration use the CPI?

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C3 Go to <https://www.investopedia.com/terms/c/consumerpriceindex.asp> and review.

According to the page, who is and who is not covered by the CPI statistics?

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What are the 8 major groups that make up the “basket of goods”?

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C4 Go to <http://cpiinflationcalculator.com/> and review.

Enter the 1969-70 current dollar salary for Arizona in the top left box, enter 1969 in the top right box, and enter 2016 is the lower right box. What does the CPI Calculator give you in the lower left box?

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How does this figure compare with the constant 2016-17 dollars salary for Arizona?

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What does this difference indicate?

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C5 Go back to <https://nces.ed.gov/programs/digest/d17/tables/dt17_211.60.asp> and look at the far right column.

What state fared the best in terms of keeping up with inflation?

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What state fared the worst in terms of keeping up with inflation?

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**PART D – PROBABILITY AND THE NORMAL DISTRIBUTION**

Since the Normal Distribution is one of the most important distributions, there are many tools to work with it. Texas Instrument (TI) calculators, Casio calculators, online calculators, apps for your phone, and Excel can help you calculate probabilities associated with the Normal Distribution. These tools are much more convenient than converting the Normal Distribution to the Standard Normal Distribution via z-scores and using tables to calculate probabilities as we did in the “old days”. In order to answer probability questions, you need to know the mean, the standard deviation, the lower value in question, and the upper value in question. Sometimes you need to make up a lower or higher value if not given.

D1 Based on your 10 state mean and standard deviation, what is the probability that a state chosen at random would have a salary between $50k and $60k? (note that this can be found on the page named “Probabilities” on your spreadsheet)

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D2 Based on your 10 state mean and standard deviation, what is the probability that a state chosen at random would have a salary less than $55k? (Note: this can be found on the page named “Probabilities” on your spreadsheet)

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D3 Based on your 10 state mean and standard deviation, what is the probability that a state chosen at random would have a salary greater than $65k? (Note: this can be found on the page named “Probabilities” on your spreadsheet)

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D4 Save this Word document and the Excel spreadsheet as firstname.lastname.normaldistribution (different extensions) and email both to me.