**DSO 522: HW 2 template**

**Due 11:59 PM September 17, 2021**

**Please list your team members (Official Last name, Official First name):**

**1.**

**2.**

**3.**

**Instructions:** Provide answers to HW questions. Do not include code in this file. Below in red **Answer:** helps you understand which questions you need to answer in this file. You will submit R code file separately. Use the link on blackboard **HW #2 word file submission link** to submit this file with your answers.

**Case 1**

**Questions and your answers:**

1. – See code.
2. – See code.
3. Create a graph of your KPI defined in the previous question and describe the pattern(s) you see in data.

**Answer:**

The points on the graph vary up and down (higher and lower KPI), which seems like noise. There is a slight downward trend with average KPI decrease and the year increases.

A picture containing chart

Description automatically generated

1. Meteorologist who study weather patterns, hired your consulting firm to help them quantitatively assess the hypotheses of global warming. It had been known since 1960 (judgmental call) that humans were increasing the amount of heat-trapping greenhouse gases in the atmosphere that led to the questions: Does this human activity warm the climate noticeably? Judgmentally1960 has been selected to be a year of a long term temperature change(You may ask your parents or grandparents why 1960). Does the data provide statistically significant evidence of global warming? Answer this question by assessing the significance in the abrupt change in KPI.

**Answer:**

Having only one trend line fits the observations, and the residuals all look like noise. All observations are correlated with the previous observations so there doesn’t seem to be abrupt change. When I graph auto-covariance of the data, only one point has a correlation coefficient that exceeds the blue dashed line which indicates that it may be significant. However, that points exceeds the blue line by such a small amount that I would argue that there is no significant abrupt change in KPI.

Chart, box and whisker chart

Description automatically generated

Looking at Pacf, we see the same singular point has significance.

Chart, box and whisker chart

Description automatically generated

Finally, looking at a graph of residuals, they all look like white noise, which would indicate there is no significance in ACF and that there is no significance in any abrupt change.

A picture containing text, antenna

Description automatically generated

1. Answer the previous question by assessing the significance of the gradual change in KPI.

**Answer:**

Running a linear regression gives a slope of -0.06682. This is a small number in magnitude so the human activity probably does not warm the climate noticeably. However, this warming (decrease in time before the ice breaks) is there because the slope is negative and statistically significant. It has a p-vale of .00825, which means we can conclude that the slope is less than 0 with 99.17% certainty. Therefore, the data provides statistically significant evidence of global warning.

Text, letter

Description automatically generated

Additionally, in the graph, you can see that the red trendline is sloped downward, indicating a reduction in the time before the ice breaks, which indicates significant gradual global warming.

Chart

Description automatically generated

1. Report and creatively interpret the estimates of both abrupt and gradual change in climate. Which one do you think it is more appropriate and meaningful?

**Answer:**

The estimate of climate change that we get from our data is -0.06682 days decrease in time before the ice breaks per year. This shows gradual ice melting. I think the estimate of gradual change is more appropriate and meaningful because climate does not change all at once, it happens over time. The ice melts faster and faster each year, but the ice isn’t abrupted all melted.

1. You recall from intro to business statistics course that statistical significance ≠ practical importance. Suggest and implement a way(s) to quantify the evidence of global warming from a practical perspective. If you use terms such as “result is statistically significant or in/nonsignificant”, many people won’t have a clue what they mean and will ask you to put it Layman terms.

**Answer:**

We can conclude with 99.17% certainty, that the ice is melting faster each year. In particular, we estimate that time to melt decreases by .067 days each year.

1. Compare your approach with the approach we used to assess the effectiveness of the batmobile program. Have you observed any differences? Briefly comment.

**Answer:**

1. Read the original article published by two Stanford professors:   
   [**https://science.sciencemag.org/content/sci/294/5543/811.full.pdf**](https://science.sciencemag.org/content/sci/294/5543/811.full.pdf)

And also a Critique of the article and the comments below the critique:   
[**https://www.john-daly.com/nenana.htm**](https://www.john-daly.com/nenana.htm)

**Write a commentary on the above articles. (One paragraph is enough. But don’t limit yourself!)**

**Answer:**

1. This summer I received an email from NASA National Snow and Ice Data Center, that the data set was update by including more data. The data set that contains the most recent information is in **Nenana2.txt**. Does the data set that includes more recent info provide statistically significant evidence of global warming? Answer this question by assessing the significance of both abrupt and gradual change in KPI. Does more recent that change your conclusions compared to the previous conclusions that you obtained using data in **Nenana1.txt**?

**Answer:**

**Case 2**

**Questions and your answers:**

1. -
2. Graph the data and describe the patterns you see in the data set?

**Answer:**

1. Does the data provide statistically significant evidence that the opening of the Golden State Freeway and the implementation of Rule 63 in 1960 reduced the pollution statistically significantly? Evaluate both the abrupt and the gradual changes? Report and interpret the estimates of both the abrupt and the gradual changes in ozone. Which one do you think it is more appropriate and meaningful?

**Answer:**

1. Does the data provide statistically significant evidence that the regulations implemented in 1966 requiring engine changes in new cars reduced the pollution statistically significantly? Evaluate both the abrupt and the gradual changes? Report and interpret the estimates of both the abrupt and the gradual changes in ozone. Which one do you think it is more appropriate and meaningful?

**Answer:**

1. Can you capture both interventions, the opening of the Golden State Freeway and the implementation of Rule 63 in 1960, and the regulations for new car engines implemented in 1966 in one model? Can you model both interventions and both abrupt and gradual changes? What insights do you gain from such model? Summarize the results.

**Answer:**