NS102 Spring 2018
CLT1: Recitation worksheet

The aim of the recitation worksheet is to enhance conceptual understanding in the collaborative, student-centered learning environment through practice problem solving, hands-on experiments, and group discussions. Each of you should **write down your thinking process and solutions individually** on your notebook or a separate sheet of paper, for your maximum learning experience.

During the recitation, you will be evaluated on your effort and participation to the group discussions. In addition, a quiz will be given at the end of the recitation, which is worth 10 points (including a 2-pt self-evaluation question).

All the links in this worksheet and additional related resources are available on **SUCourse, Climate Module, Week 1.**

CLT Week 1: Why is there a "Climate Debate?" How to interpret data.

This week's learning objectives

By the end of this week, you should be able to:

Given a time dependent data, draw the best fitting line and apply this analysis to published data on Earth's temperature variations to assess if climate is changing

1. Given a time dependent data, make a data vs. time plot or given a time plot of a data, find the best-fitting line using spreadsheet software and comment on the type of data and degree of correlation.
2. Given the findings of various studies, find the conflicting data and use them to make an argument for global warming.
3. Given the effects of parameters on the outcome of an experiment, be able to determine the correlation or causation between two parameters.

After each week, evaluate your learning with respect to these learning objectives. This will prepare you for the exams.

Icebreaker activity [20 min]

Generating your own Meme: Work as a table! (one per table)

From this web-site (or from any other web-site or app) create a meme (one meme per table) which describes your NS experience so far. You may use the images available on the web-site or you may upload your own image.
Your MTA will project your meme to the class and the best meme will be decided according to your votes!

Questions

1. [Recommended time: 15 min] Correlation always implies causation. True/false? Discuss with your group and explain why by giving a few NEW examples.

2. [Recommended time: 30 min] The number of certain penguin species has been monitored for the last 30 years to study the effects of climate change. During this time, the temperature anomalies were recorded in the area. Data below shows the change in surface temperature and recorded number of penguins living in the habitat.

Time (years)	Surface temperature (°C)	Number of penguins
1	4.8	63000
4	5.1	62000
8	5.3	52000
12	5.3	43000
15	5.5	60000
19	6.0	42000
21	5.9	31000
24	6.2	24000
28	6.4	37000
30	6.7	26000

a. The number **0.071** written in scientific notation is **7.1E-2**. Now you write down the number of penguins at time 21 years in scientific notation. **Recall that when entering numbers on SUCourse quizzes, this notation will always be true;** you must use it especially for entering very large or very small numbers**.**

b. Go to your gmail account (=sabanciuniv email account). Click on the sign  that appears in the top right corner of your account, and select "Sheets." Start a Blank new spreadsheet.

Enter the data above to the spreadsheet; plot the number of penguins as a function of surface temperature by selecting the relevant data followed by clicking **Insert→Chart, Chart type→Scatter**. Look at the data and predict if the correlation is negative or positive. Explain why you think so.

c. Now click on the plot to open chart editor, and select **Customize** (or Customization). Go to **Series** section, then select **trendline**. Fit a linear line to your data. Then, select use equation as the label. What kind of information does that equation gives you?

d. Predict the number of penguins at a surface temperature of 7°C.

e. Is there a causation between the surface temperature and the number of penguins? Why or why not? Write down at least two possible scenarios leading to the observed correlation.

Note: If you'd like to save the spreadsheet with a particular name, click on "*Untitled spreadsheet*" on the top left corner of your sheet and type the name of the file before you close the sheet. Everything is automatically saved to your google drive.

3. [Recommended time: 20 min] You are a scientist studying the effect of climate change on ticks (parasites that carry the Lyme disease bacteria) by recording the geographic habitat range of ticks in a certain region in Europe throughout 10 years. During this time, you observed that the average temperature in this region increased ~1.5°C. The data below shows the average air temperature (summer) and the range of tick habitat that you measured. You would like to find temperature dependence of tick habitat range.

Temperature (°C)	**Range of Tick Habitat (km^2)**
24.0	250.0
24.2	253.5
24.3	254.2
24.6	256.0
24.6	258.5
24.9	261.8
25.3	263.5
25.1	267.1
25.3	270.4
25.5	272.6

a. Just by looking at the data table, can you tell whether or not the range of tick habitat is correlated with the temperature? Explain why or why not.

b. Using Google Sheets (or Excel), plot the tick habitat range as a function of temperature, and guess a functional form for the correlation (linear, polynomial, exponential or logistic).

c. Now, use 'trendline' to find the equation of the line/curve that fits the data best.

d. Is there causation between the two parameters? Explain.

e. Does this correlation directly mean that the incidence of Lyme disease in this region also depends on the temperature?