ENED 1200 – Spring 2024
Homework 10.1: VBA Sequential

INDIVIDUAL ASSIGNMENT: See the course syllabus for a definition of what constitutes an individual HW assignment.

Task 1 (of 2): Einstein's Theory of Special Relativity

Time Dilation is among the fundamental concepts in Einstein's Theory of Special Relativity.

Time Dilation

According to special relativity, time appears to pass differently for objects in motion relative to each other. The satellites in orbit around the Earth are moving at high speeds relative to observers on the ground. As a result, time dilation occurs, meaning that the clocks on the satellites tick slightly slower than clocks on the Earth's surface.

The equation for time dilation is as follows:

$$t = \frac{t^o}{\sqrt{1 - \left(\frac{v}{c}\right)^2}}$$

Where:

- t is the time interval measured by the stationary observer.
- t^o is the time interval measured by the moving observer.
- v is the relative velocity between the two observers.
- c is the speed of light ($3 * 10^8$ m/s).

For this homework task, suppose we have a spaceship traveling at a significant fraction of the speed of light (c). On this spaceship, there is a clock (Clock A) that measures time intervals for the travelers onboard (t^o). Another clock (Clock B) measures time on Earth (t). Develop a VBA Macro called **Einstein** using the starter file HW_10p1_Task1. It takes inputs: t (measured by the observer on Earth in years), while the velocity of the spaceship (v) is some fraction of the speed of light (c). The output is the t^o which is the years passed in the time frame of the astronauts in the spaceship (Clock A).

Test case:

Inputs: t = 4.86 years, v = 0.9c, and c

Output: t^o = 2.12 years

Submit the file to your section site with the following name:
HW_10p1_Task1_UCusername.xlsm where *UCusername* is your 6+2.

Task 2 (of 2): Simple Standard Deviation Calculator for a Sample

For this task, you will be implementing the basic steps used to find the standard deviation for up to 5 datapoints sample of a population using the appropriate formula from the following.

$$\text{Sample} \qquad s = \sqrt{s^2} = \left[\left(\frac{1}{n-1}\right)\sum_{i=1}^{n}(x_i - \bar{x})^2\right]^{\frac{1}{2}}$$

Where:

- n is the number of data points.
- x_i represents individual data points.
- $\bar{x}$ is the sample mean.
- μ is the population mean.

Please follow the steps below to develop a VBA Macro called S_Dev using the starter file called HW_10p1_Task2.

Step 1: Find the mean of all data points. Use WorksheetFunction.Average(Range("D6:D10"))

Step 2: Find the difference between the data points and the mean. Since there are only 5 data points, you do not need to use a loop for this calculation. Loops will be covered in a couple weeks.

Step 3: Square each difference.

Step 4: Find the mean of these squares.

Step 5: Take the square root of the mean of the squares to find the standard deviation.

Remember this is a sample standard deviation. The average is different than the average of a population. At the end, use the sample standard deviation formula in Excel to compare your results.

Inputs: Five data points.

Output: average and sample standard deviation.

Test Cases

Put all "x" values the same. The average will be "x" while the standard deviation will be Zero.

Submit the file to your section site with the following name:
HW_10p1_Task2_UCusername.xlsm where *UCusername* **is your 6+2.**