

## ENGR 0012 – Spring 2019 – HW8

Acceptable behaviors for this assignment include:

- Consulting your textbook or other written material
- Asking your team members
- Asking your professor or TA

Note that consulting materials and asking others is only acceptable as long as they do not provide you with the solutions – you have to come to the solution on your own!

Unacceptable behaviors for this assignment include:

- Copying the solution(s) from a solution manual, book, or other written material
- Copying the solutions(s) from assignments submitted in previous semesters
- Providing the solutions to a classmate, student in other section, student in future section, or online solution banks
- Asking someone to complete the assignment for you

This assignment is to get you familiar with mathematical operations, looping and branching in C. Apply what we've learned about *looping* (**while**, **for**) and *branching* (**if – else**, **switch case**) to write a complete C program that:

1. Displays the following statement: “We in Team *Team Number*, *Your Names*, certify that we have completed this assignment in an honest manner.” Your assignment will not be graded if this statement is missing.
2. Displays the name of the class, your group number, your name, and your username. Have each piece of information on a new line.
3. Will allow the user to answer one of the following three options (a, b and c) based on the formula below. Note: the formula below is a Fourier Series that increases in accuracy as the number of terms in the series increases. For each option, include a prompt after the results have been displayed that asks the user if they would like to repeat that calculation by displaying **Again?** (Y/N)

$$V = \frac{3}{2} - \frac{12}{\pi^2} \sum_{i=1}^n \frac{1}{(2i-1)^2} \cos \frac{(2i-1)\pi}{3} t$$

where  $-3 < t < 3$ .

- a. This option will allow the user to calculate the voltage for a given value of time. Write the program in such a manner that the time ( $t$ ) and the number of terms in the series ( $n$ , where  $i = 1, 2, \dots, n$ ) are entered as input quantities. The program should display the values of  $t$ ,  $n$  and  $V$  to the screen.

Test your program with the following sets of data:

$t=2.4, n=5$   
 $t=2.4, n=9$   
 $t=-1.4, n=7$

- b. This option will accept only  $t$  and some value  $\epsilon$  as input quantities. Continue adding terms in the series until you reach a point where the absolute value of the term you are about to add is less than or equal to  $\epsilon$ . The program should display the values of  $t$ ,  $\epsilon$ ,  $V$  and display  $n$  the number of terms used to find  $V$ .

Test your program for the following sets of data:

$t=2.4, \epsilon=0.01$   
 $t=2.4, \epsilon=0.005$   
 $t=-1.4, \epsilon=0.02$

- c. This option will find the *change* in voltage between times  $t_2$  and  $t_1$ , where  $t_2 > t_1$ . Write the program in such a manner that the times ( $t_2$  and  $t_1$ ) and the number of terms in the series ( $n$ , where  $i = 1, 2, \dots, n$ ) are entered as input quantities. Display the values of both times  $t_2$  &  $t_1$ ,  $n$ , the voltage  $V$  at each time and the change in voltage ( $\Delta V$ ) for each data set.

Test your program for the following sets of data:

$$t_1 = 0 \quad t_2 = 2 \quad n = 5$$

$$t_1 = 0.5 \quad t_2 = 2 \quad n = 7$$

$$t_1 = -1.5 \quad t_2 = 0.5 \quad n = 9$$

Have the entire program in a loop to allow the user to do a different option (a, b or c).

Remember that your program must be mathematically correct and include comments, liberal use of whitespace, and proper indentation. In addition, the program should include prompts for the input data, and should display the output in a manner that is clearly labeled and unambiguous.

**This is a team assignment.** You need to submit the .c or .cpp file. Name your file Instructor\_Time\_HW8\_TeamNumber (e.g. Mena\_10am\_HW8\_Team33) and upload the file through your class computer using the official file submission link (found on the desktop of class computers in GSCC 138 or BEH 229 at the beginning of the class when this assignment is due).