East West University

Faculty of Science and Engineering

Department of Electrical and Electronic Engineering

Post Lab 06, Fall 2023

EEE 105 Computer Programming Section: 01

Course Teacher: Kamanashis Saha

Full Marks: 10 **Due Date of Submission : 11:59 PM, 30th November, 2023**

Answer all the questions.

[The marks on the right hand side in square brackets indicate marks allocated for that question only]

1. Write down a single C program that will perform any of four specific operations depending on the user's instruction. [4.0]

   (i) Firstly, the program will ask the user to enter the length (***n***) of an integer array and then to enter the elements of the array, ***number[n]*** one by one.

   (i) Then the program will first ask the user to enter a character as input instruction. This character must be S, L, A or D (uppercase).

   (ii) If the entered character is 'S', your program will determine the smallest number from the array, ***number[n]*** and display it on the console window.

   (iii) If the entered character is 'L', your program will determine the largest number from the array, ***number[n]*** and display it on the console window.

   (iv) If the entered character is 'A', your program will sort the numbers of array, ***number[n]*** in ascending order and display them on the console window.

   (v) If the entered character is 'D', your program will sort the numbers of array, ***number[n]*** in descending order and display them on the console window

   (vi) If the given Character is none of S, L, A or D, the program will show - "You have entered a wrong instruction".

2. In data communication system, there is a modulation technique called Double Sideband Full Carrier (DSBFC) Modulation where mathematical relation between a message signal, $m(t)$ and carrier signal, $c(t)$ is as below: [6.0]

$$s(t) = [DC + m(t)] \times c(t)$$

   Here, $s(t)$ signal is called modulated wave and DC is a constant voltage.

   Assume, the message signal is $m(t) = 5\cos(2\pi f_m t)$ and the carrier signal is $c(t) = \cos(2\pi f_c t)$.

   Now write down a generalized program in C which will calculate the numerical values of the modulated wave, $s(t)$ for different time instances. Your C program will perform the following tasks sequentially,

   (i) Firstly, the program will take four inputs:

   - Value of the frequency, f_m : f_m is the frequency of message signal, m(t).
   - Value of the frequency, f_C : f_C is the frequency of the carrier signal, c(t). value of f_C must be at least 20 times greater than f_m"
   - The number of time instances, $t + 1$: Take an integer, t as input such

that $(t+1)$ denotes the number of the time instances (points of time) at which the program will calculate the values of the message signal, $m(t)$ in one cycle/period.

- Value of DC : DC is a float value which must be equal to or greater than the amplitude of the message signal, $m(t)$. So, here DC value must be greater than 5. Your program must show a instruction to the user such as "Enter the DC value (Value must be equal to or greater than 5 for DSBFC modulation) : "

(ii) Remember, the value of f_C must be at least 20 times greater than f_m. If this condition is not satisfied, your program will display: "The value of f_C must be at least 20 times greater than f_m", will wait for the new outputs and will continue to the next step if the entered f_C value is at least 20 times greater than f_m.

(iii) Now, the program will determine $(t+1)$ numbers of equidistant time instances in one cycle of message signal, $m(t)$ and store them in a 1-D array named **time[t+1].** The range of **time[t+1]** array will be $0\ to\ 1/f_m$.

(iv) Then the program will calculate the values of $m(t),\ c(t)\ and\ s(t)$ for all the $(t+1)$ numbers of time instances from **time[t+1]** array and store those values in three different arrays. Calculate the values of $s(t)$ for only one cycle of message signal.

(v) Finally, the program will display all the values of $m(t)\ and\ s(t)$ for the $(t+1)$ numbers of time instances on the console window.

(vi) At the end, your program will perform a suitable DC value check for DFCFC modulation. If the $DC\ value < Amplitude\ of\ message\ Signal\ (5V)$, the program will display a notification : "$Overmodulation\ occurs\ due\ to\ a\ DC\ value\ smaller\ than\ 5$". Otherwise, the program won't show any message.

Try the Program No. 02 with the following input sets:

1. $f_m = 2000Hz,\ f_C = 40000Hz,\ t = 500,\ DC = 6V$
2. $f_m = 1000Hz,\ f_C = 50000Hz,\ t = 200,\ DC = 5V$
3. $f_m = 2000Hz,\ f_C = 4000Hz,\ t = 500,\ DC = 12V$
4. $f_m = 2000Hz,\ f_C = 40000Hz,\ t = 400,\ DC = 4V$

Note: You should include the C codes and display results for various possible inputs through the screenshots in your post lab report.