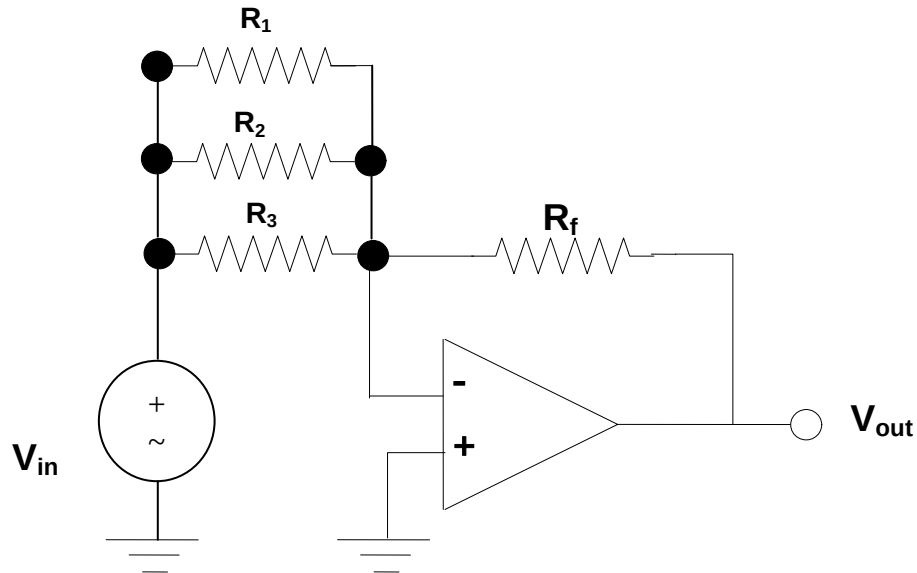


Unit: Introduction to Programming

Assignment

Problem 1 : The summing Amplifier

Design and build a program to model the following circuit



Where the output may be described by the following expression;

$$V_{out} = - \left(\left(\frac{R_f}{R_1} \right) + \left(\frac{R_f}{R_2} \right) + \left(\frac{R_f}{R_3} \right) + \dots + \left(\frac{R_f}{R_n} \right) \right) (V_{in})$$

The program is to;

- Declare the variables R_1 , R_2 , R_3 , R_f , V_{in} and V_{out} as data types of your choice.
- Allow the user to enter the value for V_{in} and values for each of the resistors (ensuring that they only enter positive values)
- Calculate the value of V_{out} (what happens if V_{out} exceeds the supply voltage?, Read supply voltage from user)

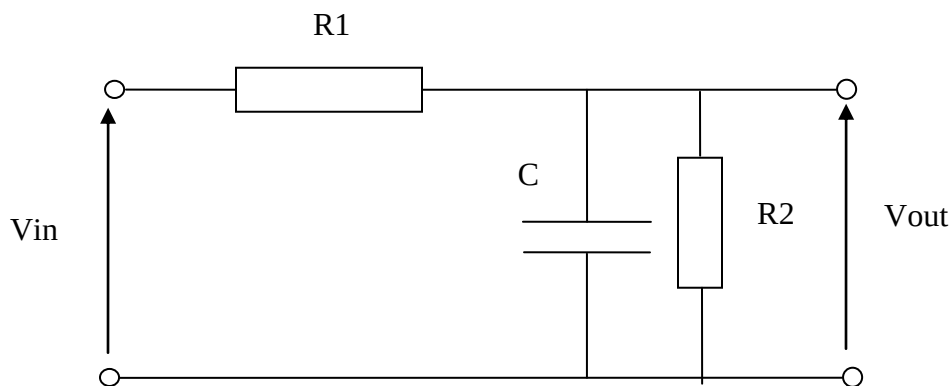
- d) Display all of the voltage values to the screen using appropriate formatting
- e) Ask the user if they would like to enter another set of values. If the response is 'yes' then repeat for the new values; otherwise end the program.

Additional features include further development of the program either in efficiency and/or functionality, such as:

- The use of functions to improve program efficiency and structure
- Allow the user to specify the number of inputs to be used (up to a maximum number)

Problem 2: Step Response

Consider the following RC circuit;



The step response of this circuit may be expressed as follows;

$$V_{out} = V_{in} * \frac{R_2}{R_1 + R_2} \left(1 - e^{-t * \left(\frac{R_1 + R_2}{CR_1 R_2} \right)} \right)$$

where t =time (in seconds)

Part A

Write a program to examine the circuit containing the following elements;

1. Write a function to calculate and return the value of V_{out} when given; the input voltage, the resistor values, capacitor value and time.
2. Using an array write an additional function to calculate and store the first 50 values of V_{out} when given the values for; V_{in} , C , R_1 , R_2 and the time increment by which time is to be increased.

In each case the program is to request the user for the necessary variable values and to display all information.

Part B

Repeat the above, this time making use of files.

An input file contains several lines where each line has the values of V_{in} , C , R_1 , R_2 and the time increment (in seconds) separated by space.

V_{in}	C	R_1	R_2	time increment
10	50	100	120	0.5
50	20	50	60	1.0
60	100	120	150	1.5

Write a program to examine the circuit containing the following elements:

1. Program that read the data from the file and store values in an array.
2. Using the above array calculate and store the first 50 values of V_{out} when given the values for; V_{in} , C , R_1 , R_2 and the time increment by which time is to be increased.
3. Store the output in a file named output.txt.

Deliverables

1. A printed report containing
 - a. Assignment Cover Sheet
 - b. Marking Scheme Sheet
 - c. Program Design using Flow-chart
 - d. Analysis of the work done. How you solved the problem what the difficulties you faced and how you overcome the difficulties.
 - e. Reference list. (books and web links)N.B... Use A4 sheet the font must Times New Roman 12pt.
2. A CD disc containing your report and source code (the .cpp file) with comments wherever necessary and the data file.

The disc must be clearly marked with your name, student Id.

N.B... The discs should be firmly attached, so that they cannot be removed easily or without causing damage.

Additional Marks will be allocated for the following

Program Efficiency:	Making effective use of variables, good program structure and efficiency of code.
Sophistication:	Capabilities of the system, additional features, increased functionality

In addition to the program script and report, the assignment is to be assessed via demonstration in the lab session

All work must be your own. If evidence of collusion/copying is found, then **such collusion will be penalised, severely if appropriate!** If there is some doubt about the authenticity of a piece of work, then the person submitting it will be expected to give a detailed explanation of his/her work, including reasons for programming decisions taken.

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