Department of Computer Science and Engineering

Assignment 2

Subject : Programming and Data Structure (CS19003)

Instructions:

- Give the name of the programs files as <Your roll>_<assignment number>_<question number>.c. For example, 21XX12345_A1_Q1.c for question 1 of assignment 1 of a student with roll 21XX12345. **Follow the file naming convention strictly**.
- Apart from the main .c file for each program, you should also upload one additional temporary .c file for each program (such as when you have finished half of the code). The naming for the temporary file should be in the format <Your roll>_<assignment number>_<question number>_temp.c. For example, 21XX12345_A1_Q1_temp.c **Make sure that your main code do not deviate much from its temporary code for each program**.
- You should upload the main .c file and the temporary .c file individually to the Moodle course web page once you finish answering each question. No need to zip the files.
- The **deadline** to upload the programs is 12:00PM. Beyond that, submission will be closed (No extensions will be granted).
- If you do not follow the instructions, your marks may be deducted.

Answer all the questions. **[20 + 20 + 30 + 30 = 100 Marks]**

1. Read three real numbers, i.e., a, b, and c, which represent the coefficients of a quadratic equation and display them in the exact form $ax \hat{} 2 + bx + c = 0$. Hence check whether the roots are real, coincident, or complex according to the rules of quadratic equation and display it. No need to find out the roots separately. Additionally if the roots are complex, determine the quadrant (i.e 1^{st} quadrant/2^{nd} quadrant/3^{rd} quadrant/4^{th} quadrant) of the 2D Argand plane in which the first complex root of the form $a + ib$ lies. Note that complex roots occur as conjugate pairs $a+ib$ and $a-ib$, consider only the root in the form $a+ib$ and determine in which quadrant it lies.

   Example1:
   (Please take the input and display the output as shown)

   Input:

   a:5

   b:2

   c:1

   Output:

   Equation: $5x \hat{} 2 + 2x + 1 = 0$

   Roots: Complex

   Quadrant of 1st complex root: 2nd [Reason: The first complex root is $-0.2 + 0.4i$ as per the given example, hence it lies in the 2nd quadrant]

Example2:

(Please take the input and display the output as shown)

Input:

a:1

b:2

c:-3

Output:

Equation: $x \hat{} 2 + 2x - 3 = 0$

Roots: Real **[20]**

2. Steel is an alloy that is built of iron with typically a few tenths of a percent of carbon for improving its strength as well as fracture resistance in comparison to other forms of iron. Let us consider that a certain grade of steel is graded as per the given condition:

   Firstly, the hardness of the steel should not be less than equal to 60. Secondly, the content of the carbon in the steel should be greater than 0 and less than 0.65.

   Finally, strength of tensile must be greater than 6400

   The grades are as follows: Grade is 10 - on satisfying all the three conditions

   Grade is 9 - on satisfying conditions (ii) and (iii)

   Grade is 8 - on satisfying conditions (i) and (ii)

   Grade is 7 - on satisfying conditions (i) and (iii) are satisfied

   Grade is 6 - if none of the conditions are satisfied

   Grade is 5 - if only one condition is satisfied

   Write a program, to take the values of hardness, carbon content and tensile strength of the steel under consideration as input from the user and output the grade of the steel. You can check for the respective grade of the steel in the same order as given in the question.

   Example1:
   (Please take the input and display the output as shown)

   Input:

   Hardness: 80

   Carbon content: 0.30

   Tensile strength: 5000

   Output:

   Grade: 8 **[20]**

3. An aeroplane can travel at a speed of 700km/h from a source A either eastwards or westwards. If it travels east, the time advances at a rate of 1 hour per 500 km and if it travels west time recedes back at the equal rate, with respect to the starting point A. Write a program to take input i) the starting time of the aeroplane in hours and minutes only (you can consider 24 hour clock so 1PM becomes 13 hour 0 minutes), ii) the duration of the flight (you can assume the maximum duration to be 6 hours) and iii) a character representing eastward or westward travel (like 'e' for eastwards and 'w' for westwards). Hence perform the following,

(A) Check whether the starting time is a valid time or not. If the starting time is invalid, print "Error" and you can exit from the program.

(B) Depending on the duration of flight and eastward or westward direction of travel, display the local time of arrival (i.e the local time at the arrival point) in the same 24 hour format. Consider the case of adjusting the time of arrival as per the standard 24 hour day format and take care of hour overflow (in case of eastward travel) or underflow (in case of westward travel).

(C) Also print "same day" or "previous day" or "next day" depending on the day of arrival with respect to the starting day

Assume that the aeroplane travels in the given speed uniformly from source to destination. Also you can assume all integer values.

Example1:
(Please take the input and display the output as shown)

Input:

Starting hour: 14

Starting minute: 15

Duration: 5

Direction: e

Output:

Starting time is valid

Arrival time hour: 21

Arrival time minute: 15

Arrival day: same day

Example2:
(Please take the input and display the output as shown)

Input:

Starting hour: 26

Starting minute: 15

Duration: 6

Direction: w

Output:

Starting time is invalid **[30]**

4. The litres of fuel sold on a day depends on which day of the week it is. Consider Monday as Day 1, Tuesday as Day 2, ..., Sunday as Day 7. Let s be the number litres of fuel sold on a day and v be the number of vehicles sighted on that day across the highway. The number of litres can also be a fraction.

(A) For Monday, **s** is given by one-third of the number of vehicles sighted in the highway across, i.e **v**

(B) For Wednesday, **s** is **2v/7**, rounded off to the nearest lower integer.

(C) For Tuesday, Thursday, and Friday, **s** is $\mathbf{v^2 + 2v}$

(D) For the weekends, s is thrice the formula as that used for Tuesday

Take the day (1 to 7) and **v** as input and calculate the amount of fuel sold **s** on that day, and display it. Also calculate the total price of the fuel sold on that day by assuming that the price of fuel = Rs 120/litre and the GST on the fuel as 25% on the base price. **You HAVE to use 'switch-case' for this question**.

Example:

(Please take the input and display the output as shown)

Input:

Day: 3

Vehicles sighted: 100

Output:

Fuel sold '**s**': 28

Total price: 4200

[Reason: 28*120 + 25% GST on (28*120)] **[30]**
