SCHOOL OF COMPUTING
Faculty of Engineering

UNIVERSITI TEKNOLOGI MALAYSIA

TEST 2 – QUESTION 2 (FLOWCHART)

SEMESTER I 2021/2022

SUBJECT CODE	**: SECJ/SCSJ1013**
SUBJECT NAME	**: PROGRAMMING TECHNIQUE I**
YEAR/COURSE	**: 1 (SECJ/ SECV/ SECB/ SECR/ SECP)**
TIME	**: 08:35 PM – 09:20 PM MYT (45 minutes)**
DATE	**: 11th JANUARY 2022 (Tuesday)**

INSTRUCTIONS TO THE STUDENTS:

- Please read the ***General Guidelines for the Programming Technique I Test 2*** that is shared in UTM e-learning
- Read the problem and instructions carefully
- You are given **45 (FOURTY-FIVE) MINUTES** to complete the test inclusive of the submission of your program (**35 minutes to answer** the question and **10 minutes to submit** the answer).
- Your program must follow the input and output as required in the text and shown in the examples. You must test the programs with (but not limited to) all the input given in the examples.

IMPORTANT NOTES:

- All the **COMMENT STATEMENTS** in the submitted program **WILL NOT BE EVALUATED**.

SUBMISSION PROCEDURE:

- Only the source code is required for the submission (do not need to compress the file)
- File name format for **INTERIM** submission: **Test2Q2*_Name_matricsNo_section-interim*.cpp** (i.e., Test2Q2*_AinaAli_A20EC018_01-interim*.cpp)
- File name format for **FINAL** submission: **Test2Q2*_Name_ matricsNo_section-final*.cpp** (i.e., Test2Q2*_AinaAli_A20EC018_01-final*.cpp)
- Submit the source code file via the **UTM's e-Learning System**.

Question 2 [30 Marks]

Quadratic equations are particularly interesting especially for teaching the concepts of roots of nonlinear equations. Given a quadratic equation in **standard** form, ax^2 + bx + c = 0, we can determine whether the quadratic equation has two real roots, one real root, or a complex root by calculating the discriminant as:

1) Two real-roots: b^2-4ac > 0
2) One real-root (repeating roots): b^2-4ac = 0
3) Complex roots: b^2-4ac < 0

For cases 1 and 2 above, we can compute the quadratic roots by the following formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

where we just plug in the coefficients a, b, and c into the above formula.

Figures 1(a) and 1(b) are the flowcharts to create quadratic equation in standard form, and compute and display its discriminant and roots (if it has two-real roots or one-real root).

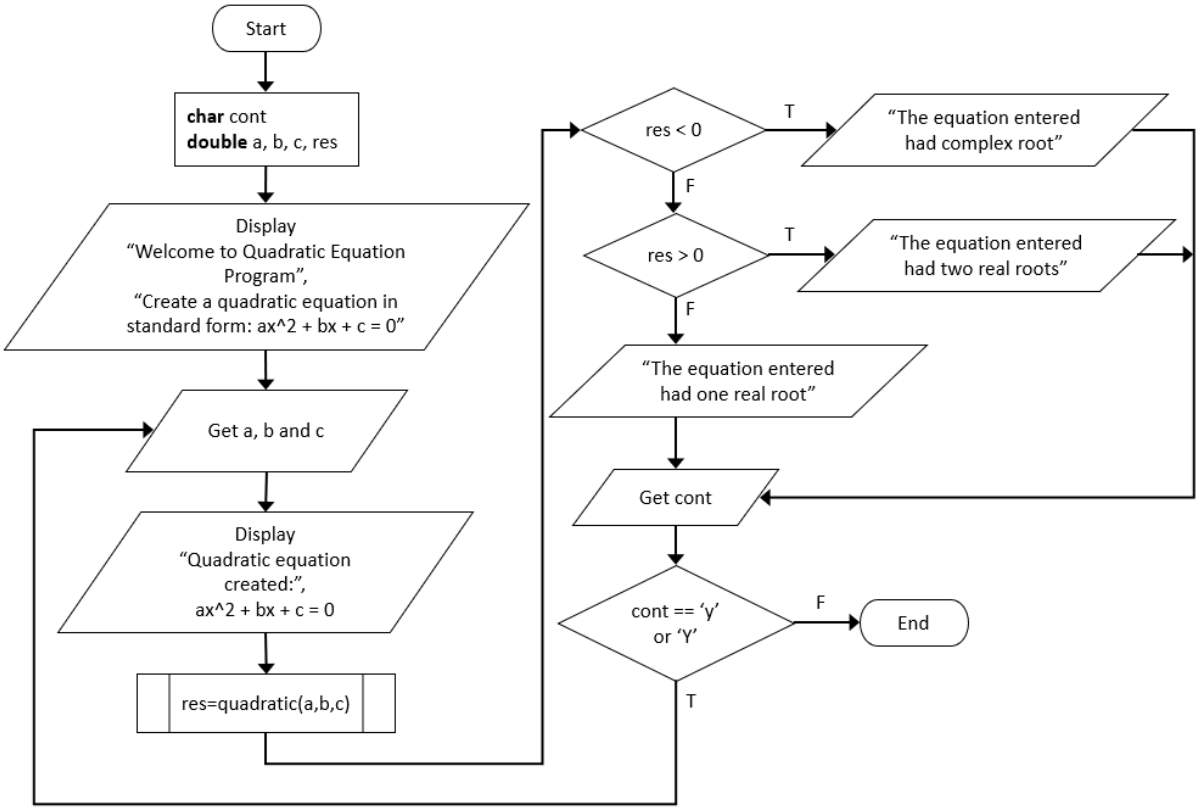

Figure 1(a): Flowchart to create and compute quadratic equation

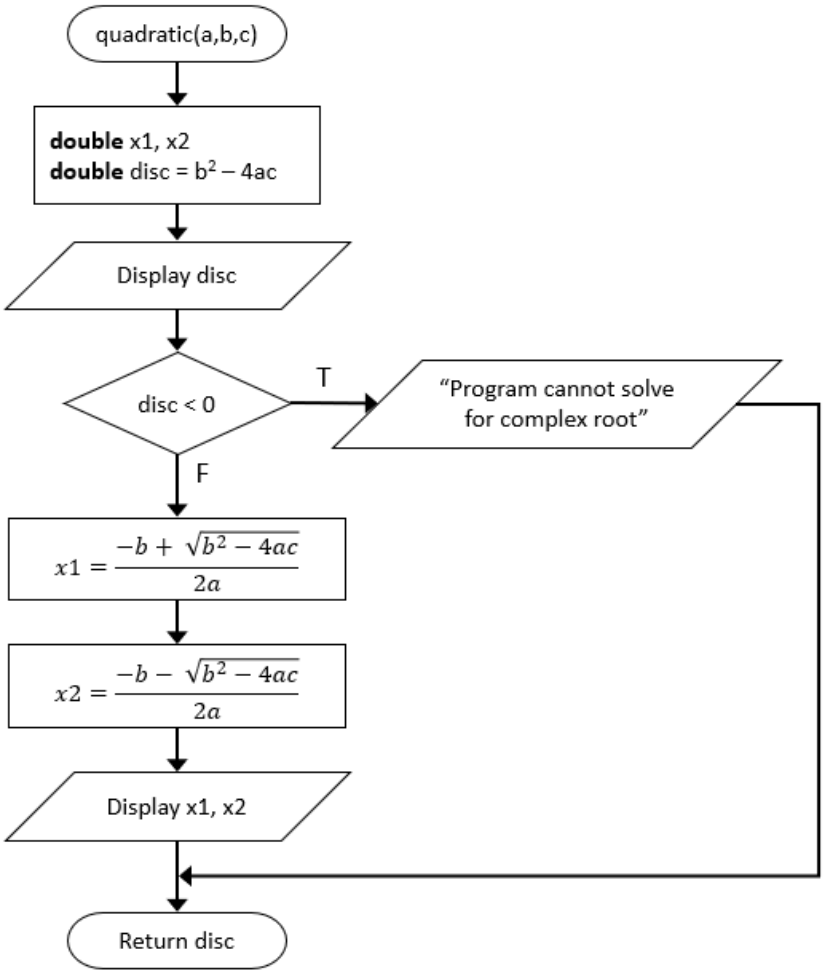

Figure 1(b): Flowchart to create and compute quadratic equation

Write a C++ program to implement the computation of standard quadratic equation as specified by the above flowcharts. Table 1 is the test cases that you can use to test the program and the details of the input/output style of the program.

Table 1: Test cases to run and test the program (user inputs are shown in **red-bold** text)

TEST CASE 1

```
Welcome to Quadratic Equation Program

Create a quadratic equation in standard form:
ax^2 + bx + c = 0

Enter the values of a, b, and c: 1 -6 2

Quadratic equation created: 1x^2 + -6x + 2 = 0
Discriminant of the Quadratic equation is: 28
The roots are, x1 = 5.64575, x2 = 5.64575

The equation entered had two real roots

Do you wish to continue? (y/n): y
```

TEST CASE 2

```
Welcome to Quadratic Equation Program

Create a quadratic equation in standard form:
ax^2 + bx + c = 0

Enter the values of a, b, and c: 1 2 3

Quadratic equation created: 1x^2 + 2x + 3 = 0
Discriminant of the Quadratic equation is: -8
Program cannot solve for complex root

The equation entered had complex root

Do you wish to continue? (y/n): y
```

TEST CASE 3

```
Welcome to Quadratic Equation Program

Create a quadratic equation in standard form:
ax^2 + bx + c = 0

Enter the values of a, b, and c: 1 4 4

Quadratic equation created: 1x^2 + 4x + 4 = 0
Discriminant of the Quadratic equation is: 0
The roots are, x1 = -2, x2 = -2

The equation entered had one real root

Do you wish to continue? (y/n): y
```