**Faculty of Electrical and Electronics Engineering**
**Control and Automation Engineering Department**

**Introduction to Programming Language (C) (KON 110E)**

**FINAL EXAM**

**Question: 1**

Write a function,

```
CheckCredentials(char[] email, char[] pw)
```

which checks the given e-mail and password such that the e-mail should contain the characters '@' and '.' in correct order, and the password should contain both numbers, capital and small letters. The function returns *1* if the given credentials are valid, otherwise returns *0*.

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**Question: 2**

Write a function,

```
Solve(double a, double b, double c)
```

which solves a second-order equation $ax^2 + bx + c = 0$ for a given *a*, *b* and *c* coefficients and returns the roots. Since the roots of the equation can also be complex, your function should be able to handle this case.

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**Question: 3**

Secant method is a numerical method for solving equations of the form $f(x) = 0$. The iteration rule for the Secant method is given as follows:

$$x_{k+1} = x_k - \frac{f(x_k)(x_k - x_{k-1})}{f(x_k) - f(x_{k-1})}$$

Here, the initials points $x_{k-1}$ and $x_k$ should be provided to obtain the solution.

**a)** Write a function

```
Secant(double (*f)(double), double eps, double *xInitials)
```

in order to find a root of any given function $f$.

**b)** Test your function on the following equation by writing an appropriate program.

$$x^2\left|\sin\sqrt{x}\right| = 10$$

(Set the initial conditions as $x = [1, 2]$ and the error tolerance as $\epsilon = 10^{-3}$)

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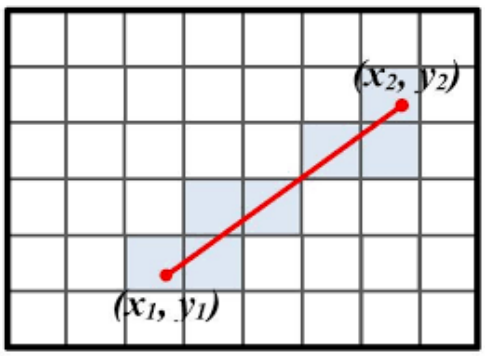
## Question: 4

Bresenham's line algorithm is a famous algorithm which draws a straight line to a discretized canvas as shown in the figure. The pseudo-code of this algorithm is given below.

```
Input: Integer x0, Integer x1, Integer y0, Integer y1, Integer canvas[HEIGHT][WIDTH]
Real Δx = |x1 – x0|
Real Δy = |y1 – y0|
Real error = 0
Integer y = y0, x = x0

If Δx ≥ Δy then
        For x from x0 to x1
                canvas[y][x] = "#"
                error += 2Δy
                If error ≥ 0 and Δx != 0 then
                        y = y + sign(y1-y0)
                        error -= 2Δx
Else:
        For y from y0 to y1
                canvas[y][x] = "#"
                error += 2Δx
                If error ≥ 0 and Δy != 0 then
                        x = x + sign(x1-x0)
                        error -= 2Δy
```




In your program, implement the given algorithm with a function. After that using your function construct a program that draws a triangle to the console output window.

**Hint:** In the beginning of your program, define a canvas in the form of 2D array and fill with empty ' ' characters. You will also need a function that draws your canvas.