

Question: 1

Write a function which inserts an element (x, y) to a two-dimensional array at any given index. Create a simple C program to test the function.

```
void insertAt(double arr[ ][2], int numElements, double x, double y, int insertIndex)
{
    ...
}
```

For example,

```
arr[][2] = {{0, 0}, {0, 0}, {0, 0}, {0, 0}};
```

```
insertAt(arr, 4, 4.2, 0.4, 2); // {{0, 0}, {0, 0}, {4.2, 0.4}, {0, 0}};
```

```
// This should add (4.2, 0.4) to the location of 3rd element (index=2); therefore, the rest of the
// elements should be shifted down (The 3rd element will now be the 4th element, etc.). So the last
// element may be lost if there is not enough space
```

```
insertAt(arr, 4, 1.0, 3.3, 1); // {{0, 0}, {1.0, 3.3}, {0, 0}, {4.2, 0.4}};
```

Faculty of Electrical and Electronics Engineering
Control and Automation Engineering Department
Introduction to Programming Language (C) (EEF 110E)

Final Exam

ITU



Question: 2

Write a function

SolveEqn(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. The roots of the equation can be complex; therefore, your function should be able to handle this case!

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 xk, double xk_1)

to find a root of any given function f (x_k and x_{k-1} are initial points to be provided).

b) Test your algorithm on the following function by writing an appropriate C program.

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

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