Faculty of Electrical and Electronics Engineering
Control and Automation Engineering Department

Introduction to Programming Language (C) (EEF 110E)

MIDTERM EXAM

Question 1

Write a function that swaps the two halves of an integer array.

As an example, the function should transform {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} into {6, 7, 8, 9, 10, 1, 2, 3, 4, 5} and {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11} into {7, 8, 9, 10, 11, 6, 1, 2, 3, 4, 5}. Your function should take the array and its size as arguments and should have a return type of void.

```
void swapHalves(int *arr, int numElements)
{
    ...
}
```

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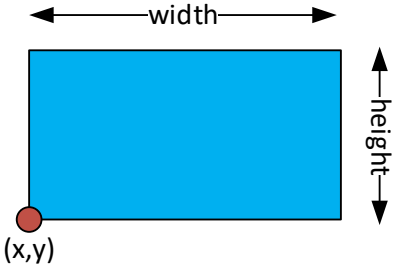
Question 2

Write a function that calculates the colliding area if two rectangles are colliding in a 2D space. Your function should take two arrays that hold the dimensions of the rectangles (see Figure 1) and return the colliding (overlapped) area if there is a collision, and zero otherwise (see Figure 2).




```
float rect[4] = {x, y, width, height}
```

Figure 1: Input data type for rectangles.

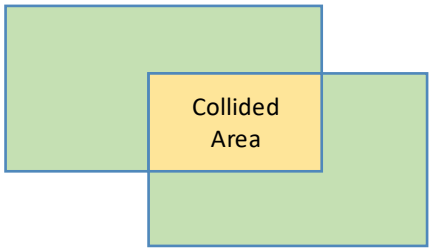


Figure 2: Colliding rectangles and colliding area.

```
float calculateCollision(float rect1[4], float rect2[4])
{
    ...
}
```

Test yourself:

float R1[4] = { 2.2F, 1.0F, 3.0F, 4.4F }, R2[4] = { 3.0F, 2.0F, 5.5F, 5.0F };

printf("Area: %.2f %%", calculateCollision(R1, R2)); // Prints "Area: 7.48"

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Question 3

Write a function (see below) that finds the minimum (or maximum) element of the given array. Here, if the input "isMin" is zero (0), then the function will return the maximum element, otherwise it will return the minimum element.

```
double findMinMax(double *arr, int numElements, int isMin)
{
    ...

}
```

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Question 4

Suppose that you are working on a communication protocol. At each time step, a single byte is sent to the receiver side. Each message in the protocol consists of three consecutive bytes in the form of characters. For example, receiving 'a', then 'b' and 'c' starts the communication according to the table below. The receiver listens for the possible commands and acts accordingly only if the communication is started.

Message Name	Bytes	Description
Start	"abc"	Start communication and print "Started"
End	"cba"	End communication and print "Ended"
Task 1	"def"	Print "Task 1" if communication is started
Task 2	"ghi"	Print "Task 2" if communication is started
Task 3	"jkl"	Print "Task 3" if communication is started
Quit	"xyz"	Print "Quitting" and quit the application

Write a program that implements the receiver side of this protocol. Simulate the listening process using the **getchar** or **scanf** functions inside an endless loop**.** In each cycle, read only a **single** byte (i.e., a character). Your program should terminate if "Quit" message is received at any time. Otherwise, it should perform the tasks given in the table above.

Test yourself:

Consider the stream [d, e, f, v, v, a, b, c, d, e, e, f, g, h, i, c, b, a, a, b, c, x, y, z]. Note that the first received byte in the stream is 'd' and the last received one is 'z'. The receiver side should print "Started", "Task 2", "Ended", "Started" and "Quitting" respectively before terminating.