



**Problem number (1) (15 Marks)**

**Q1-A) /2 points/** What is meant by computer program, then state the factors that effect on its running time

**Q1-B) /3 points/** Write a C# program that accept a 2-D array, the output of the program is largest value located at the diagonal.

**Q1-C) /2 points/** What is meant by algorithm, then state *Properties of an Algorithm*

**Q1-D) /3 points/** State the (similarities/ differences) between the following pairs

(Program and Application) – (Program and Algorithm) – (Array ADT and List ADT) – (Flow Chart and Algorithm) -

**Q1-E) /5 points/** Give 3 example of recent applications that use computer in your field? For each application state the suitable ADT then complete the following table

ADT	application	Def.	C# Implementation			Meme. map	Special	Pros	cons	Comment
-			DEC	access	method					
-----										
-----										

**Problem number (2) (20 Marks)**

**Q2-A) /6 points/** Find the output of the following Three Pieces of code

using System;

using System.Collections.Generic;

public class MainClass {

public static void Main() {

string[] presidents = {"HE", "SH", "AM",  
"Ar", "af", "at"};

string name = presidents.Last();

Console.WriteLine(name);

}

I

class Program

{

static void Main()

{

string[] array = { "red", "blue", "green" };

// Loop with foreach and write colors with string interpolation.

foreach (string color in array)

{

System.Console.WriteLine(\$"Color = {color}");

}

}

II

using System;

using System.Collections;

using System.Collections.Generic;

class GFG {

// Driver code

public static void Main()

{

// Creating a LinkedList of Strings

LinkedList<String> myList = new LinkedList<String>();

// Adding nodes in LinkedList

myList.AddLast("A");

myList.AddLast("B");

myList.AddLast("C");

myList.AddLast("D");

myList.AddLast("E");

// To check if a value is in LinkedList

Console.WriteLine(myList.Contains("B"));

}

}

III

**Q2-B) /2 points/** For the following declaration `int y[3][4] = { 3,5,3,4,0,14,8,6,7,11,12,08}`

what is the value of : `y[2][0]`, `y[0][3]`, `y[2][2]`, `y[1][3]`, `y[4][3]`

**Q2-C) /4 points/** Write a piece of code for printing the contents Array, List, Stack, and Queue ADT

**Q2-D) /3 points/** Assume that you have four variable HE- SHAM – ARA – FAT ; Write (using C#) a piece of code That declare the first variable as an 2 D array Data structure, the second as an List Data structure.

Then (i) initialize each of them by any value (ii) Apply three suitable methods for each

**Q2-E) [5 points]** Write a C# program that accepts a 5 elements within a linked list (A,B,C,D,E) , then displays the number of elements and Display the linked list contents

**Problem number (3) (22 Marks)**

**Q3-A) [2 points]** Find the output of the following code

```
int[] intArray = new int[5] { 8, 10, 2, 6, 3 };
Array.Sort(intArray);
foreach (int i in intArray) Console.Write(i + " ");
```

**Q3-B) [3 points]** For an empty Queue Complete the following table

Operation	Front	Rear	output	Q
Enqueue (5)				
Dequeue ()				
Enqueue (5)				
Enqueue (7)				
Enqueue (9)				
Dequeue ()				
Front ()				
IsEmpty()				
Enqueue (15)				
Size ()				
Enqueue (5)				

**Q3-C) [3 points]** For an empty Queue Complete the following table

Operation	Top	output	Stack
Push (5)			
Pop ()			
Push (5)			
Push (9)			
Pop ()			
Size ()			
IsEmpty()			
Push (15)			
Top()			
Push (5)			

**Q3-D) [2 points]** Draw the expression tree of this equation  $\{a * (b + c) - (d - (e + g / h))\}$

**Q3-E) [4 points]** Here is an array of the following integers:


(37 28 51 9 32 39 54 4 17 30 36 38 44 11 44 7)

apply linear search and binary search for checking if there is a value (33) within it or not , for each specify the no of comparison required to determine the sol.

**Q3-F) [8 points]** Here is an array of the following integers:

5 11 3 8 9 1 7 15 0 33 6 13 4 57

Use four Sorting algorithms for; each determine the no of iterations and the no of swaps (validate your answer by draft sketch)

Mansoura University- Faculty of Engineering		Department: Computers Engineering And Systems	BME Program MTE Program
Total Marks: 50 Marks			

Course Title: Introduction to Data Structure and Algorithm  
Date: May 2019 (Second term)

Allowed time: 120 Mins

Final Exam

No. of Pages: (2)

**Problem number (1) (15 Marks)**

**Q1-A) /2 points/** What is meant by computer program, then state the factors that effect on its running time

Series of instructions submitted to a computer to accomplish a task

Instructions must be written in a way the computer can understand

factors that effect on its running time

- algorithm itself
- input data
- computer system used to run the program

**Q1-B) /3 points/** Write a C# program that accept a 2-D array, the output of the program is largest value located at the diagonal.

using System;

max = 0;

namespace MultiDimensionalArrays

{  
public class TesterMultiDimensionalArrays

{  
static void Main()  
{  
const int rows = 4;  
const int columns = 3;  
int[,] rectangularArray = new int[rows, columns];  
for (int i = 0; i < rows; i++)  
{  
for (int j = 0; j < columns; j++)  
{  
if i=j and rectangularArray[i,j] > max;  
max = rectangularArray[i,j];  
}  
}  
}  
}

**Q1-C) /2 points/** What is meant by algorithm, then state *Properties of an Algorithm*

*Step by step procedure for solving a problem*

*The prop*

- Has zero or more inputs.
- Has at least 1 output.
- Each instruction is unambiguous.
- Terminates after a finite sequence of instructions.
- Each step is doable.

**Q1-D) /3 points/** State the (similarities/ differences) between the following pairs  
 (Program and Application) – (Program and Algorithm) – (Array ADT and List ADT) – (Flow Chart and Algorithm) –

The same

Program implemented algorithm vi programming lang.

No of element is known while list can shrink and grew

Graphical representation and text description

**Q1-E) /5 points/** Give 3 example of recent applications that use computer in your field? For each application state the suitable ADT then complete the following table

ADT	application	Def.	C# Implementation			Meme. map	Special	Pros	cons	Comment
			DEC	access	method					
Array	Lib		Int [] name	Name[#n]	Get type Length Sort		1 D 2D 3D			
List	Lib of unknown no		List < > name		Count		Circular Double			
Stack	Expression		Stack S		Size Push Pop					
queue	Buffer manag		Queue M		Enque Dequeue size		Circuler			

**Problem number (2) (20 Marks)**

**Q2-A) /6 points/** Find the output of the following Three Pieces of code

**I**

```
using System;
using System.Collections.Generic;
public class MainClass {
    public static void Main() {
        string[] presidents = {"HE", "SH", "AM",
                                "Ar", "af", "at"};
        string name = presidents.Last();
        Console.WriteLine(name);
    }
}
```

**II**

```
class Program
{
    static void Main()
    {
        string[] array = { "red", "blue", "green" };
        // Loop with foreach and write colors with string interpolation.
        foreach (string color in array)
        {
            System.Console.WriteLine($"Color = {color}");
        }
    }
}
```

**III**

```
using System;
using System.Collections;
using System.Collections.Generic;

class GFG {
    // Driver code
    public static void Main()
    {
        // Creating a LinkedList of Strings
        LinkedList<String> myList = new LinkedList<String>();

        // Adding nodes in LinkedList
        myList.AddLast("A");
        myList.AddLast("B");
        myList.AddLast("C");
        myList.AddLast("D");
        myList.AddLast("E");

        // To check if a value is in LinkedList
        Console.WriteLine(myList.Contains("B"));
    }
}
```

**I Hesham Arafat**

**II**

### Output

```
Color = red  
Color = blue  
Color = green
```

III true

**Q2-B) [2 points]** For the following declaration `int y[3][4] = { 3,5,3,4,0,14,8,6,7,11,12,08}` what is the value of : `y[2][0]`, `y[0][3]`, `y[2][2]`, `y[1][3]`, `y[4][3]`

- 7  
- 4  
- 12  
- 8

Not available

**Q2-C) [4 points]** Write a piece of code for printing the contents Array, List, Stack, and Queue ADT  
`foreach (string item in alphabet) {  
    Console.Write(item);  
}`

`foreach(char ch in ll)  
    Console.Write(ch + " ");  
    Console.WriteLine("\n");`

**Q2-D) [3 points]** Assume that you have four variable HE- SHAM – ARA – FAT ; Write (using C# ) a piece of code That declare the first variable as an 2 D array Data structure, the second as an List Data structure. Then (i) initialize each of them by any value (ii) Apply three suitable methods for each (iii) Write the statement that helps in printing the contents of each of them

**Q2-E) [5 points]** Write a C# program that accepts a 5 elements within a linked list (A,B,C,D,E) , then displays the number of elements and Display the linked list contents

**Problem number (3) (22 Marks)**

**Q3-A) [2 points]** Find the output of the following code

```
int[] intArray = new int[5] { 8, 10, 2, 6, 3 };  
Array.Sort(intArray);  
foreach (int i in intArray) Console.Write(i + " ");
```

2 3 6 8 10

**Q3-B) [3 points]** For an empty Queue Complete the following table

Operation	Front	Rear	output	Q
Enqueue (5)	5	5	non	{5}
Dequeue ()	null	null	5	{}
Enqueue (5)	5	5	non	{5}
Enqueue (7)	5	5	non	{5,7}
Enqueue (9)	5	5	non	{5,7,9}
Dequeue ()	7	7	5	{7,9}
Front ()	7	7	5	{7,9}
IsEmpty()	7	7	false	{7,9}
Enqueue (15)	7	7	non	{7,9,15}

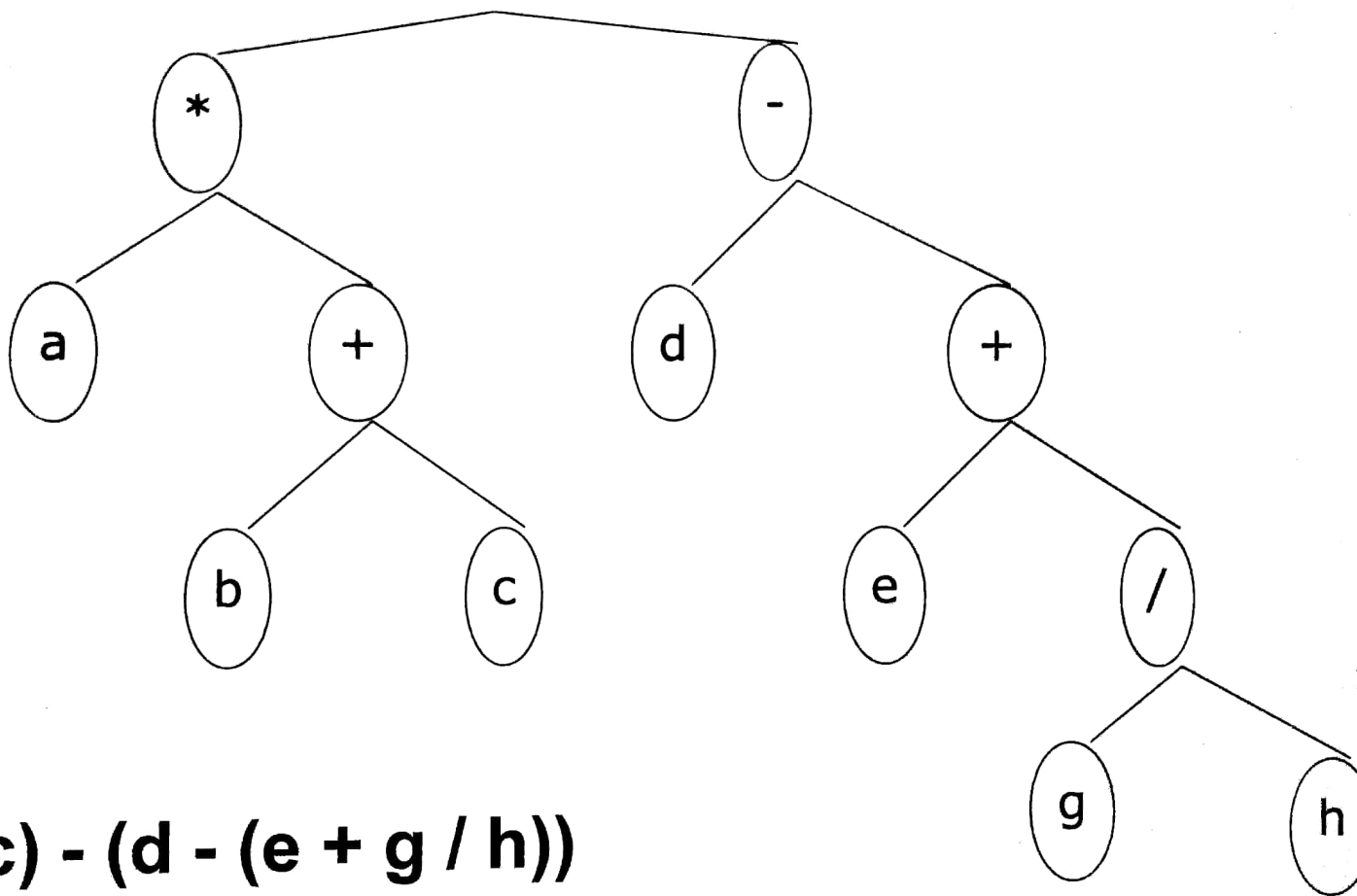


Size ()	7	7	3	{7,9,15}
Enqueue (5)				

Q3-C) [3 points] For an empty Queue Complete the following table

Operation	Top	output	Stack
Push (5)	5	null	{5}
Pop ()	Null	5	-
Push (5)	5	null	{5}
Push (9)	9	null	{5,9}
Pop ()	5	9	{5}
Size ()	5	1	{5}
IsEmpty()	5	F	{5}
Push (15)	15	null	{5,15}
Top()	15	15	{5,15}
Push (5)	5	5	{5,15,5}

Q3-D) [2 points] Draw the expression tree of this equation {a \* (b + c) - (d - (e + g / h))}



$$b + c) - (d - (e + g / h))$$

Q3-E) [4 points] Here is an array of the following integers:

(37 28 51 9 32 39 54 4 17 30 36 38 44)

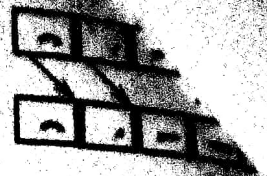
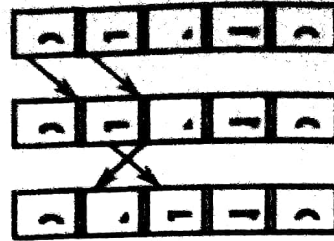
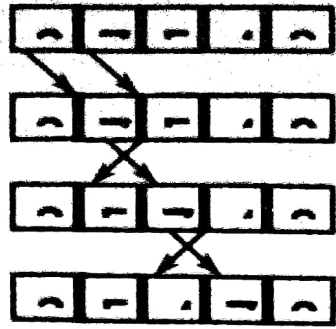
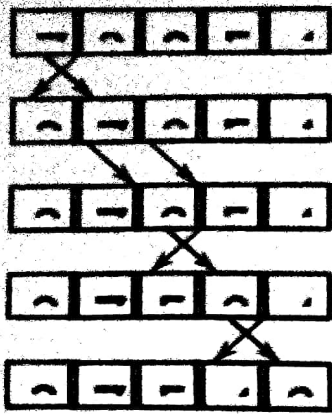
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13

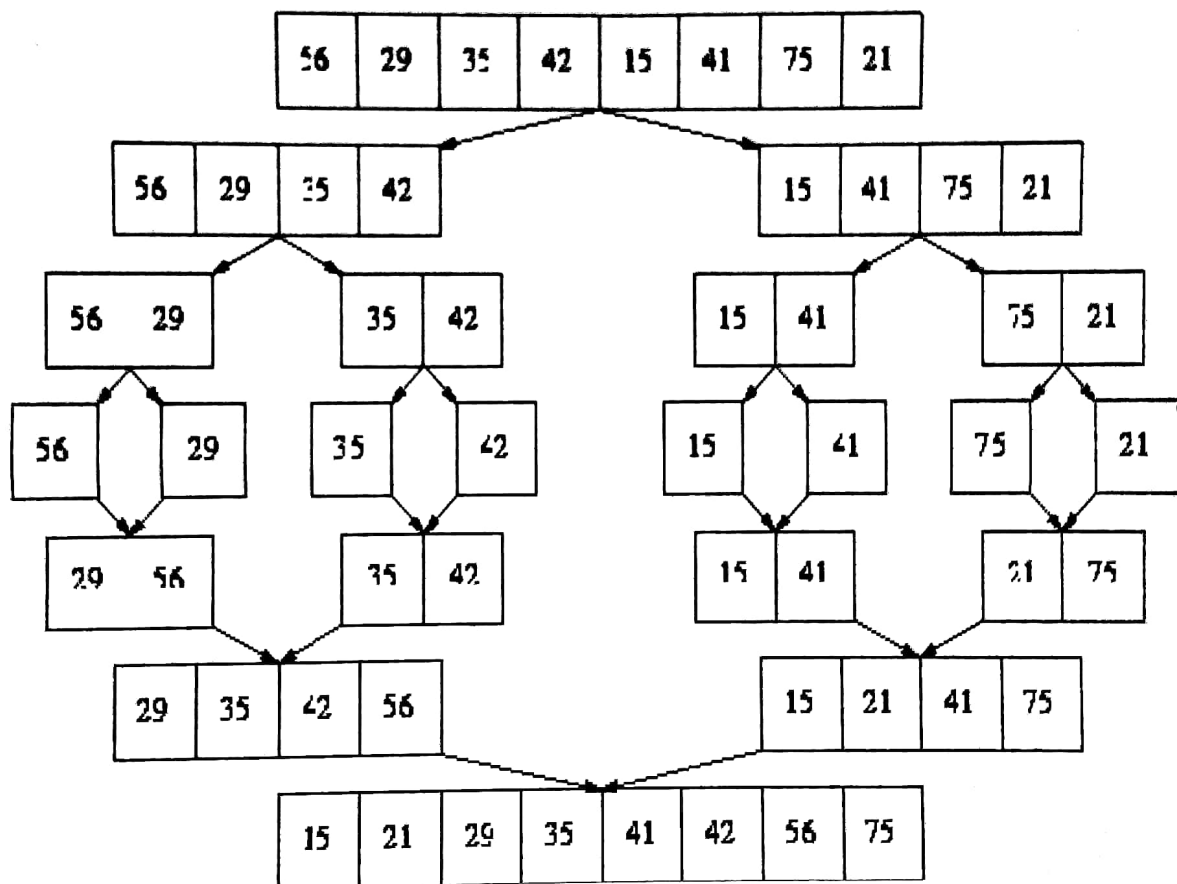
4

Q3-F) [8 points] Here is an array of the following integers:

5 11 3 8 9 1 7 15 0 2 6 13 4



Use four Sorting algorithms for; each determine the no of iterations and the no of swaps (validate your answer by draft sketch)



Best wishes

Prof. Dr Hesham Arafat