



The University of Fiji



School of Science and Technology

Department of Computer Science/ Information Technology

ITC215

Data Structures and Algorithms

Semester I, 2011

FINAL EXAMINATION QUESTION PAPER

Time Allowed: 3 Hours [10 Minutes Extra Allowed For Reading the Paper]
Weighting: 50%
Total Marks: 100 marks.

Part 1:

Question 1	-	10 marks
Question 2	-	10 marks
Question 3	-	15 marks
Question 4	-	10 marks
Question 5	-	10 marks

Part 2:

Question 1	-	20 marks
Question 2	-	25 marks

Total

100 marks

Instructions

- Show your answers clearly in each question to gain maximum marks.
- You may ask for extra sheets from the supervisors if the need arises.
- Do not forget to write your name and ID number on all the extra sheet(s) attached.
- Programmable calculators are not allowed.

big deal

Part 1 (55 marks)

Question 01 (10 marks)

Problem Specification for RealEstateInvestment.

How much cash flow profit is a rental investment generating? Create an application to determine what the cash flow is for a real estate investment used as a rental.

Design an object-oriented solution. Use two classes.

For the real estate property class, characteristics such as the year the home was built, purchase price, and street address will help identify the current state of an object. The real estate object also has a monthly income amount from rent and a monthly expense characteristic. Include a method to determine what the monthly earnings, or cash flow, is based on deducting the total monthly expenses from the monthly rental income.

In the second class, instantiate an object of the real estate property class. Call the constructor that creates an object using year built, purchase price, and street address. Allow the user to input the yearly taxes and insurance expenses. The monthly utilities costs should also be considered. In this application class, calculate a monthly expense based on the inputted values. Set the appropriate data field in the real estate property object.

Write code in the application class to display the property address and the expected cash flow for a given month.

- i. Analyze the Problem: List the Data items needed for the RealEstateInvestment in terms of Instance variables and Local variables. **(3 marks)**
- ii. Design the desired output to display the address of a property and the expected cash flow for a given month. **(1 mark)**
- iii. Draw the Class Diagram for the RealEstateInvestment problem. **(3 marks)**
- iv. As you have learned that properties are new to C# and reduce the need to write mutators and accessors for the private instance variables. List the data members that will have properties defined and indicates whether both get and set are needed. **(3 marks)**

Question 02 (10 marks)

- I. How do bugs differ from exception? Try...catch...finally program constructs are used within exceptions. What does each of these constructs used for. **(3 marks)**
- II. Define an array ADT. The Array class provides several properties for retrieving metadata about an array. List three of those properties. **(3 marks)**

III. Write the output of the following Lines of Codes. (4 marks)

```
using System;
using System.Collections;
class class1
{
    static void Main()
    {
        ArrayList names = new ArrayList();
        names.Add("Mike");
        names.Add("Beata");
        names.Add("Raymond");
        names.Add("Bernica");
        names.Add("Jennifer");
        Console.WriteLine("The original list of names: ");
        foreach (Object name in names)
            Console.WriteLine(name);
        Console.WriteLine();
        string[] newNames = new string[] { "David", "Michael" };
        ArrayList moreNames = new ArrayList();
        moreNames.Add("Terrill");
        moreNames.Add("Donnie");
        moreNames.Add("Mayo");
        moreNames.Add("Clayton");
        moreNames.Add("Alisa");
        names.InsertRange(0, newNames);
        names.AddRange(moreNames);
        Console.WriteLine("The new list of names: ");
        foreach (Object name in names)
            Console.WriteLine(name);
    }
}
```

Question 03 (15 marks)

- I. How do we declare a variable of string type and initialize a value of it in C#? (2 marks)
- II. What does these lines of codes are doing: (2 marks)

```
int charCode;
charCode = (int)'a';
```

- III. Write the output for the following line of codes (2 marks)
using System;

```
class chapter7
```

- IV. Define Hashing and Hashing uses what kind of data structures? (2 marks)

V. What does these lines of codes do: (2 marks)

- VI. How collision occurs in hashing? List down some of the techniques we can use when a collision occurs? (2 marks)

VII. What will be the output for the following program? (3 marks)

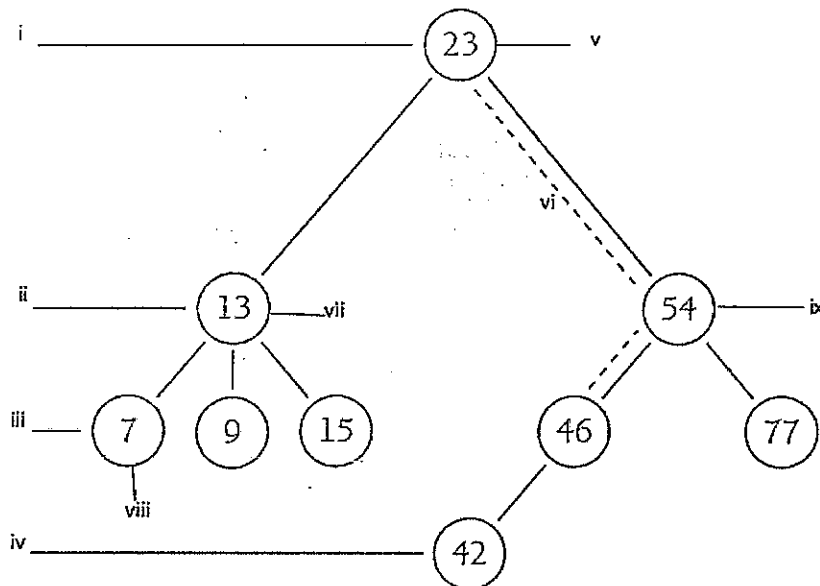
}

Question 04 (10 marks)

- I. Define what linked list is and what it is made up of. What is a major difference between an array and a Linked List? **(2 marks)**
- II. A node is made up of two data members: Element, which stores the node's data; and Link, which stores a reference to the next node in the list. we need at least two constructor methods in our node class. We definitely want a default constructor that creates an empty Node, with both the Element and Link members set to null. We also need a parameterized constructor that assigns data to the Element member and sets the Link member to null. Write C# codes to implement the node class and the two constructor methods? **(5 marks)**
- III. Removing a node from a linked list is extremely easy using an Iterator class. The method simply sets the Link field of the previous node to the node pointed to by the current node's Link field. Write C# method for removing the node from a list? **(3 marks)**

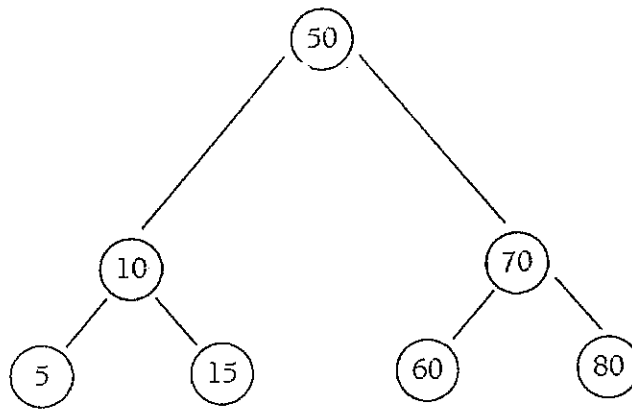
Question 05 (10 marks)

- I. Label the diagram given below: **(4 marks)**



- II. Visiting all the nodes in a tree in some particular order is known as a tree *transversal*. There are three traversal methods used with BSTs: *inorder*, *preorder*,

and *postorder*. List down inorder, preorder and postorder for the following BST.
(3 marks)



III. Discuss what these lines of codes are doing: (3 marks)

```
public Node Delete(int key)
{
    Node current = root;
    Node parent = root;
    bool isLeftChild = true;
    while (current.Data != key)
    {
        parent = current;
        if (key < current.Data)
        {
            isLeftChild = true;
            current = current.Right;
        }
        else
        {
            isLeftChild = false;
            current = current.Right;
        }
        if (current == null)
            return false;
    }
    if ((current.Left == null) & (current.Right == null))
    if (current == root)
        root == null;
    else if (isLeftChild)
        parent.Left = null;
    else
        parent.Right = null;
}
```

```

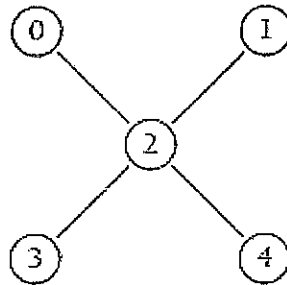
    // the rest of the class goes here
}

```

Part 2 (45 marks)

Question 01 (20 marks)

- I. Write down the balance properties that need to be satisfied all the time when drawing an AVL tree. **(3 marks)**
- II. Draw the appropriate adjacency Matrix for the given graph below: **(4 marks)**



- III. Draw the appropriate graph drawn by these lines of codes and also show the output by these codes: **(4 marks)**

```

static void Main()
{
    Graph aGraph = new Graph();
    aGraph.AddVertex("A");
    aGraph.AddVertex("B");
    aGraph.AddVertex("C");
    aGraph.AddVertex("D");
    aGraph.AddVertex("E");
    aGraph.AddVertex("F");
    aGraph.AddVertex("G");
    aGraph.AddVertex("H");
    aGraph.AddVertex("I");
    aGraph.AddVertex("J");
    aGraph.AddVertex("K");
    aGraph.AddVertex("L");
    aGraph.AddVertex("M");
    aGraph.AddEdge(0, 1);
    aGraph.AddEdge(1, 2);
    aGraph.AddEdge(2, 3);
    aGraph.AddEdge(0, 4);
}

```

```

        aGraph.AddEdge(4, 5);
        aGraph.AddEdge(5, 6);
        aGraph.AddEdge(0, 7);
        aGraph.AddEdge(7, 8);
        aGraph.AddEdge(8, 9);
        aGraph.AddEdge(0, 10);
        aGraph.AddEdge(10, 11);
        aGraph.AddEdge(11, 12);
        Console.WriteLine();
        aGraph.BreadthFirstSearch();
    }

```

- IV. Which of the following is the correct way of setting values into the structure variable e defined below? **(3 marks)**

```

struct Emp
{
    public String name;
    public int age;
    public Single sal;
}
Emp e = new Emp();

```

- V. What are the major data structures used in the following areas: RDBMS, Network data model & Hierarchical data model. **(3 marks)**

Question 02 (25 marks)

- I. Complete the following line of codes. **(5 marks)**

```

Line1: using System;
Line2: using System.Collections;
Line3: namespace ConsoleApplication1
Line4: {
Line5:     class Program
Line6:     {
Line7:         static void Main(string[] args)
Line8:         {
Line9:             int[] numbers = { 4, 3, 8, 0, 5 };
Line10:             Array.Sort(numbers);
Line11:             foreach (//write the codes here)
Line12:                 //write the codes here
Line13:             Console.ReadLine();
Line14:         }

```

Line15: }

Line16: }

- II. Write a C# program that will produce the output below:

The car is red

The car is green

Create a class for car and appropriate methods that will produce the desired output. **(10 marks)**

- III. Write a program in terms of an array that would be size of 6 and it should store its values in its index as its square values for example:

Numbers[0] = 0

Numbers[1] = 1

Numbers[2] = 4

Numbers[3] = 9

Numbers[4] = 16

Numbers[5] = 25

Write appropriate methods to show this together with a print method. Also include these methods with a call in the main program. **(10 marks)**

Hint: you may use the code skeleton given below:

```
using System;
class SingleDimArrayApp
{
    protected int[] numbers;
    SingleDimArrayApp()
    {
        numbers = new int[6];
        for ( condition )
        {
            // statements;
        }
    }
    protected void PrintArray()
    {
        for (conditions)
        {
            // statements
        }
    }
    public static void Main()
    {
        // write method call here
        Console.ReadLine();
    }
}
```

