(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS 2023/2024 ACADEMIC YEAR

FOURTH YEAR FIRST SEMESTER EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF SCIENCE IN (COMPUTER SCIENCE)

COURSE CODE: BCS 461E

COURSE TITLE: PROGRAMMING WITH C#

DATE: 08/12/ 2023 **TIME:** 8:00 – 10:00 AM.

INSTRUCTIONS TO CANDIDATES

Question ONE (1) is compulsory
Answer THREE (3) questions
This is a Closed Book Exam

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

Question One (30 Marks- Compulsory)

a) Write a program in C# that prompts the user to enter an integer and checks whether the number is divisible by both 5 and 6, or neither of them, or just one of them. Here are some sample runs for inputs 10, 30, and 23. [4 Marks]

10 is divisible by 5 or 6, but not both

30 is divisible by both 5 and 6

23 is not divisible by either 5 or 6

b) Explain what the program segment below works [2 Marks]

```
public Car()
{
   Console.WriteLine("Constructor with no parameters called!");
}
public Car(string color) : this()
{
   this.color = color;
   Console.WriteLine("Constructor with color parameter called!");
}
```

c) Use a switch statement to rewrite the following if statement and draw the flow chart for the switch statement: [3 Marks]

```
if (a == 1)
x += 5;
else if (a == 2)
x += 10;
else if (a == 3)
x += 16;
else if (a == 4)
x += 34;
```

d) Write a C# program that will be able to print the pattern shown [3 Marks]

```
1     1     1     1
3     3     3
5     5
7
```

e) Consider a Student Class that has the following attributes: registration number, first name, last name, gender, dateOfBirth, phone number. There is a Child class Postgraduate that has additional attributes including: supervisor and project title. There are two Constructors Postgraduate (String reg) and Postgraduate (String reg, String supervisor) which can only be called at run time

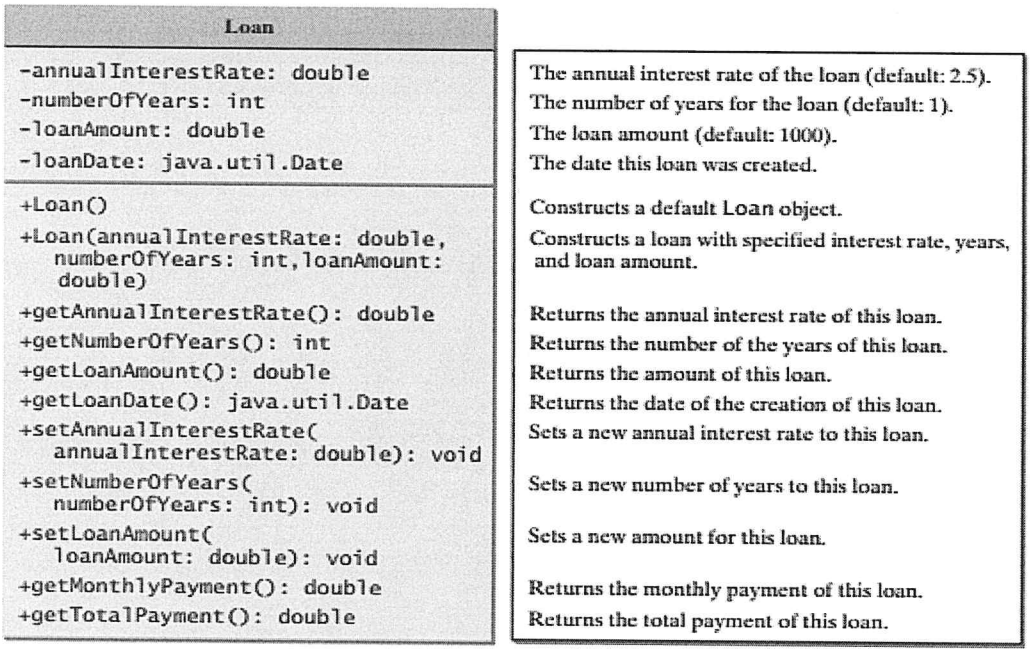
Required:

i. Draw UML of Student and Postgraduate class [4 Marks]
ii. Implement the UML [9 Marks]
iii. Write a driver class StudentTest that creates objects of type Student and Postgraduate. Ensure that a user can be prompted to key in the values or details for each student. [5 Marks]

SECTION TWO (40 Marks): ANSWER ANY TWO QUESTIONS

Question #2 [20 Marks]

a) The UML diagram in below serves as the contract for the **Loan** class. A specific loan can be viewed as an object of a **Loan** class. Interest rate, loan amount, and loan period are its data properties, and computing monthly payment and total payment are its methods. When you buy a car, a loan object is created by instantiating the class with your loan interest rate, loan amount, and loan period. You can then use the methods to find the monthly payment and total payment of your loan.



Required:

i. Write a **Loan.cs** class that impliments the UML above [7 Marks]
ii. Write a driver program TestLoanClass.cs that creates object of type Loan. Consider sample output as shown below. [5 Marks]

```
Enter yearly interest rate, for example, 8.25: 2.5 Enter
Enter number of years as an integer: 5 Enter
Enter loan amount, for example, 120000.95: 1000 Enter
The loan was created on Sat Jun 10 21:12:50 EDT 2006
The monthly payment is 17.74
The total payment is 1064.84
```

b) State the output when the following program is executed [3 Marks]

using System;

```
struct Point
{
  public int x;
  public int y;

  public Point(int x, int y)
  {
    this.x = x;
    this.y = y;
  }

  public Point Add(Point pt)
  {     Point newPt;
        newPt.x = x + pt.x;
        newPt.y = y + pt.y;
    return newPt;
  }
}

class StructExample
{
  static void Main(string[] args)  {
    Point pt1 = new Point(1, 1);
    Point pt2 = new Point(2, 2);
    Point pt3;

    pt3 = pt1.Add(pt2);

    Console.WriteLine("pt3: {0}:{1}",pt3.x,pt3.y);
  }
}
```

c) Consider the definition of the class `C` shown below.

```
public class C
{
   int m;
   int n;
   public C(int mIn, int nIn)
   {
      m = mIn;
      n = nIn;
   }
   public int m1()
   {
      return m+n;
   }
}
```

Define a subclass of `C` named `B` that overrides method `m1()` so that it returns the difference between `m` and `n` instead of their sum. Provide the appropriate access modifier for the instance variables `m` and `n`. [5 marks]

Question #3 [20 Marks]

a) Design a class named **BankAccount** that contains:

i. A private **int** data field named **id** for the account (default **0**).
ii. A private **double** data field named **balance** for the account (default **0**).
iii. A private **double** data field named **annualInterestRate** that stores the current interest rate (default **0**). Assume all accounts have the same interest rate.
iv. A private **Date** data field named **dateCreated** that stores the date when the account was created
v. A no-arg constructor that creates a default account.
vi. A constructor that creates an account with the specified id and initial balance
vii. The accessor and mutator methods for **id**, **balance**, and **annualInterestRate**.
viii. The accessor method for **dateCreated**.
ix. A method named **getMonthlyInterestRate()** that returns the monthly interest rate.
x. A method named **withdraw** that withdraws a specified amount from the account.
xi. A method named **deposit** that deposits a specified amount to the account.

Required:

i. Draw the UML diagram for the class. Implement the class. (3 Marks)

ii. Write a test program that creates an **BankAccount** object with an account ID of 3456, a balance of Ksh 20,000, and an annual interest rate of 4.5%. Use the **withdraw** method to withdraw Ksh 2,500, use the **deposit** method to deposit Ksh 3,000, and print the balance, the monthly interest, and the date when this account was created. [6 Marks]

b) Write a program that computes the Fibonacci of an integer passed to a method Fibo( ) [3Marks]

c) State whether the following assignments is correct giving an explanation for your answer [8 Marks]

i.
```
class A {
  .....
    }
class B : A {
 public B(int x) {...}
 }
  B b = new B(3);
```

ii.
```
class A {
   public A() {...}
   }
```

```
class B : A {
public B(int x) {...}
}
B b = new B(3);
```

iii.
```
class A {
public A(int x) {...}
}
class B : A {
public B(int x) {...}
}
B b = new B(3);
```

iv.
```
class A {
public A(int x) {...}
}
class B : A {
public B(int x)
: base(x){...}
}
B b = new B(3);
```

Question #4 [20 Marks]

a) Define the class BankAccount to store a bank customer's account number and balance. Suppose that account number is of type int, and balance is of type double. Your class should, at least, provide the following operations: set the account number, retrieve the account number, retrieve the balance, deposit and withdraw money, and print account information. **Add appropriate constructors.** (4 Marks)

b) Every bank offers a checking account. Derive the class checkingAccount from the class bankAccount (designed in part (a)). This class inherits members to store the account number and the balance from the base class. A customer with a checking account typically receives interest, maintains a minimum balance, and pays service charges if the balance falls below the minimum balance. In addition to the operations inherited from the base class, this class should provide the following operations: set interest rate, retrieve interest rate, set minimum balance, retrieve minimum balance, set service charges, retrieve service charges, post interest, verify if the balance is less than the minimum balance, write a check, withdraw (override the method of the base class), and print account information. **NB: Add appropriate constructors.** (5 Marks)

c) Every bank offers a savings account. Derive the class savingsAccount from the class bankAccount (designed in part (a)). This class inherits members to store the account number and the balance from the base class. A customer with a savings account typically receives interest, makes deposits, and withdraws money. In addition to the operations inherited from the base class, this class should provide the following operations: set interest rate, retrieve

interest rate, post interest, withdraw (override the method of the base class), and print account information. **NB: Add appropriate constructors.** (4 Marks)

d) Write a class that contains the following two methods:

/**convert from Celsius to Fahrenheit */

public static double CelsiusFahrenheit(double Celsius)

/**convert from Fahrenheit to Celsius */

public static double FahrenheitToCelsius(double Fahrenheit)

The formula for conversion is :

Fahrenheit=(9.05)*Celsius+32

Write a Test program that invokes these methods to display the following tables:

Celsius	Fahrenheit	Fahrenheit	Celsius
40.0	104.0	120.0	48.89
39.0	102.2	110.0	43.33
…			
32.0	89.6	40.0	4.44
31.0	87.8	30.0	-1.11

[7 Marks]

Question #5 [20 Marks]

a) Explain the output of the following program when executed [4 Marks]

```
// arrays.cs
using System;
class DeclareArraysSample
{
  public static void Main()
  {
    // Single-dimensional array
    int[] numbers = new int[5];
    // Multidimensional array
    string[,] names = new string[5,4];

    // Array-of-arrays (jagged array)
    byte[ ][ ] scores = new byte[5][];

    // Create the jagged array
    for (int i = 0; i < scores.Length; i++)
    {
      scores[i] = new byte[i+3];
    }
```

```
        // Print length of each row
        for (int i = 0; i < scores.Length; i++)
        {
          Console.WriteLine("Length of row {0} is {1}", i, scores[i].Length);
        }
      }
    }
```

b) Given the program below:

```
class Test
{
        public static void main( ){
        int [ ]nums={2, 4, 8};
        DoWork(nums);
        int count=0;
        foreach (int num in nums)
        {
                Console. WriteLine("The value of  a[{0}] is {1}",count++,num);
        }
public static void DoWork(int [ ]numbers)
{
        for( int i=0; i< numbers.Length; i++)
        numbers[i]++;
}
```

i) Identify if there is any error in the above program [2 Marks]

ii) State the output of the program when executed [3 Marks]

c) Write a C# Program that will be able to make use of structure type, to create objects of type Book with the properties: title, author, subject and book_id. The program prompts for book details and is able to displays the same. Sample output is as shown below [6 Marks]

Title : C Programming
Author : Nuha Ali
Subject : C Programming Tutorial
Book_id : 6495407

Title : Telecom Billing
Author : Zara Ali
Subject : Telecom Billing Tutorial
Book_id : 6495700

d) Write a C# code that is able to prompt for the particulars of a learner say: name, gender and age and besides prompts for the performance in 5 subjects including: mathematics, english, Kiswahili, science and technology and social studies. The program determines the total score, average and displays a message such that: if a learner gets an average of 70-100, the message displayed is excellent performance. If the learner gets, 55-69, the message is good performance and anything less than that, the program displays " you can do better.

Make use of Classes and constructor to initialize student admission number. [5 Marks]