00201

The Open University of Sri Lanka
Faculty of Natural Sciences
B.Sc./ B. Ed. Degree Programme

Department	: Computer Science
Level	: 4
Name of the Examination	: Final Examination
Course Code and Title	: CSU4616, Object Oriented Programming using C++ and JAVA
Academic Year	: 2020/2021
Date	: 11.12.2021
Time	: 1.30 p.m. -4.30 p.m.
Duration	: 3 hours

General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **06** questions in **07** pages.
3. Answer **any four (4) questions** only. All questions carry equal marks.
4. Answer for each question should commence from a new page.
5. Involvement in any activity that is considered as an exam offence will lead to punishment.
6. Having any unauthorized documents/ mobile phones in your possession is a punishable offense
7. Use blue or black ink to answer the questions.
9. Clearly state your index number in your answer script.

Q1) a) i) What is Object Oriented Programming (OOP)?
ii) How does it differ from Procedure Oriented Programming? Explain briefly by using three (3) facts.

b) Explain the following terms in brief by giving a suitable example for each.

i. Encapsulation ii Polymorphism iii. Exception

c) Define a class in **Java** to represent an **Employee** with the following data members and methods. Use access specifiers and data types appropriately

i. Data members – Employee number, Name and Salary.

ii. Default constructor with default values with Employee number set to E000.

iii. Selector method for salary member variable

iv. Modifier method for Employee name member variable.

v. Write a main class called **Test** to test the Employee class. Creating an object and call all the methods defined in the Employee class.

d) What is an **Abstract Method?** Write three differences between an Abstract Method and a Normal Method.

e) How you archive the data abstraction of a program. Illustrate it by redefining the employee class appropriately(No need to write the whole class again).

f) State whether the following statements are **TRUE** or **FALSE** with respect to C++. If a statement is **FALSE** correct it by explaining the reason.

i. Following statement outputs the memory address of the variable num.

```
*num;
```

ii. Following is a valid constant variable declaration.

```
#define num =25;
```

iii. Following is a valid variable declaration.

```
String ar[];
```

iv. The following statement creates an automatic object of the circle class.

```
Circle c1= new circle();
```

v. New and delete operators in C++ are similar to malloc() and free() functions in C.

Q2 a) Explain how JAVA has achieved platform independence compared to C++.

b) Define a class in **JAVA** to represent a **Book** with the following data members and methods. Use access specifiers and data types appropriately

i. Data members – Book ISBN, Book Title

ii. Define default, parameterized and copy constructors

c) i. How do the three (3) constructors you have implemented in Q2)b behave when creating objects. Explain briefly by providing example JAVA statements for each case.

ii. Has this program achieved **constructor overloading?** Give reasons to support your answer.

d) i. What is a destructor in C++? Explain by providing an example.

ii. Differentiate between constructer and destructor in C++.

e) i. Redefine the Book class given in Q2 (b) in C++, including data members and an inline function to print the data members.

ii. Explain the disadvantage of having an inline function.

Q3) a) A JAVA class called **Pet** consists of **Mammal** class and **Bird** class. For all pets, **pet name** and **pet age** are common attributes. **Mammal** and **Bird** classes have additional attributes, **mammal Id** and **bird Id,** respectively.

i. Write suitable complete class definitions for the above classes (Include any additional variables and methods if necessary).

ii. Define methods appropriately to show the method overriding in inheritance

b) What is inheritance? Explain the purpose of using inheritance in OOP, giving a suitable example from Q3 (a).

c) State whether the following statements are **TRUE** or **FALSE** with respect to C++. If a statement is FALSE, explain the reason.

i. An interface contains constructors and abstract methods.

ii. Classes can extend to multiple classes in JAVA.

iii. Subclasses inherit those superclass members declared as private or protected.

iv. Every individual Object created from the Class will share the instance method(s) of that Class.

v. The keyword final is used as a modifier for a class to inherit to another class.

d) Write C++ statements considering the explanation given in Q3(a). Implement the **Pet** class, including the following additional methods.

- Default constructor
- Selector method for Pet age variable
- Modifier method for Pet name member variable.

e) What is meant by **operator overloading**?

State two (2) operators that can be overloaded and two(02) operators that cannot be overloaded.

Q4) a) Clearly explain the differences and the purpose of the following terms by giving suitable examples for each term.

i. Class and Object ii. Class method and Instance method

b) Define a class in C++ to represent a **Circle** with the following data members and methods. Define access specifiers, data types and input parameters appropriately.

i. Data members – radius , colour , PI =3.1415

ii. Define default, parameterized and copy constructors.

iii. A method called **area()** to return the area of the circle.

(Hint : Area of the circle = πr^2 , where r is the radius)

iv. Define **print()** method to print the details.

c) Define a **C++** class called **Sphere** which is derived from the **Circle** class created in Q4(b) , which has the following functionalities.

i. A parameterized constructer to initialize the data members of the class.

ii. Redefine the **area()** method to compute the area of the sphere.

(Hint : Area of the Sphere= $4 \pi r^2$, where r is the radius)

iii. Override the **print()** method to print the radius and area of the sphere.

d) What is the purpose of using final keyword when declaring methods and classes in good Object-oriented design? Explain briefly providing suitable examples for each.

e) State three (3) differences between C++ and JAVA.

Q5) a) Explain the process of converting a JAVA standalone program (source code) into the machine language.

b) Write a **C++** class named **Complex** to represent a complex number which includes real and imaginary parts in floating point value. Include the following member functions to the class.

i. A constructor to initialize all its data members to zero.
ii. A constructor to initialize its data members to given user inputs.
iii. A member function to display the complex number.
iv. A member function for overloading "+" operator to add two complex numbers.

c) Write a suitable main method to test the class defined in part(b).

i. Create an object called *com1* that initializes the data members to zero.
ii. Create two objects called *com2* and *com3* and initialize them to (3.5, 4.3) and (5.2, 6.7), respectively.
iii. Add *com2* to *com3* using the operator overloaded member function and display the results.

d) Explain the following relationships between classes using appropriate examples.

i)Association ii) Aggregation iii) Composition

e) List three (3) differences between an Abstract class and a Normal class.

Q6) a) What are the two types of inheritance supported by C++? Explain them by giving suitable examples.

b) Define a class in **JAVA** to represent a **Squre** with the following data members and methods. Define access specifiers, data types and input parameters appropriately.

i. Data members – Width and Length
ii. Define suitable methods to illustrate the **Method Overloading.**
iii. Define a suitable print method.

Write a main class called Test. Create an object of Squre class and call all methods defined in part(b-ii,iii)

c) Write C++ statements for the following

i. Create a dynamic object called **c1** from class **circle** and call the print method.
ii. Class **student** derived from class **course** and class **exam**.
iii. Create an automatic object **x1** from class **employee** and call the print method.

d) Filling the blanks using the appropriate term from the list given below.
(this, static, final, super, instance, class, private, protected)

i. ……can be used to invoke current class methods and constructors.
ii. …… can be used to invoke the parent class constructor within the child class constructor.
iii. JAVA does not allow the use of …… keyword inside the …… method block.
iv. private , ……..and ……. methods cannot be overridden as they are local to the class.
v. The only fields that can appear in an interface must be declared as …… and …….

e) State whether the following statements are **TRUE** or **FALSE** according to the given program below. If a statement is FALSE, explain the reason by providing a suitable example from the program.

```
private class xyz{
    protected int number;
    private xyz(){}
}
public class TestMain {
    String  msg_2= "Hello World";
    static String  msg_3 = "Hello World";
    public static void main(String[] args) {
        String  msg_1 = "Hello World";
    }
}
```

i. msg_1 is a class variable.

ii. msg_2 is a local variable.

iii. msg_3 is an instance variable.

iv. xyz() can be declared as a private method.

v. Number variable can be access by the sub class and other classes.

vi. xyz class can be declared as a private class.