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BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY
ICS 2201 OBJECT-ORIENTED PROGRAMMING II

APRIL 2010

TIME: 2 HOURS

Answer **question one** and **any other two** questions

1)

a) Explain each of the following terms:

i) Encapsulation

- *Wrapping inside an object all the data and the methods used to manipulate the data*

ii) Object

- *Instance of a class*

iii) Inheritance

- *Ability to create a new class by acquiring properties from an existing class*

iv) Polymorphism

- *Ability of objects related by inheritance to behave differently to the same message*

v) Message passing

[5 Marks]

- *Using an object reference to invoke a method (optionally passing to it actual parameters)*

Award 1 Mark for each

b) Outline any two benefits of multithreading in computer programs.

[2 Marks]

- *Multitasking*

- *Parallel processing*

- *Multi access in operating systems*

Any 2 @ 1 Mark

c) Distinguish between constructors and destructors and explain how Java implements destructors.

[4 Marks]

- *Constructor-special method used to instantiate objects*

- *Destructor- special method used to release memory for an object*

- *Java uses finalize method to implement destructors*

d) Assume a class hierarchy is to be created containing the following classes:

- *An Employee having a first name, last name and social security number.*

- *A Salaried Employee having a monthly salary*

- *A Commission employee having monthly total sales and commission rate.*

- *An hourly employee having an hourly wage and the number of hours worked in a month and overtime paid at 1.5 times hourly wage if hours exceeds 40.*

- *A Commission-Salaried employee who earns a monthly basic salary plus a commission on monthly sales.*

Based on the above information, devise a suitable class hierarchy to model the presented employees. You should also clearly identify which data items each object will store and the likely methods. Finally, you should also justify your design decisions. No program is required.

[9 Marks]

- *Class hierarchy diagram- 3 Marks*
- *Identifying methods- 2 Marks*
- *Identifying data elements- 2 Marks*
- *Justification of design decisions- 2 Marks*

e) Write a simple Java program that can be used to compute the area of a circle given the radius. The program should have a class Rectangle with instance variable radius, method computeArea and two constructors. One constructor accepts one parameter representing the radius and the other accepts no parameter but initializes radius to 0.0. The class should have a main method that is used to create two object references. Use the object references to call computeArea and to print the results appropriately in a dialog box. [10 Marks]

2)

a) Describe any three types of Java programs [6 Marks]

- *Applets-explain*
- *Applications-explain*
- *Java Beans-explain*
- *Servlets-explain*

Any 3 @ 2 Marks

b) Using sample code fragments, explain how to implement and reference a single dimensional array in Java. [5 Marks]

double [] d=new double[5];//defining 2 Marks

for(int x=0;x<d.length;x++) 1 Mark

*d[x]=x*x;//referencing and populating* 2 Mark

c)

i) Explain the term exception and state the benefit of exception handling in computer programs. [3 Marks]

- *Unexpected error condition* 1 Mark
- *Benefit of exception handling- creation of robust and fault tolerant programs* 2 Marks

ii) Explain the uses of each of the following clauses used in handling exceptions in Java:

(1) Try

- *Attempts to execute a statements or set of statements if there is no problem and throws an exception otherwise* 1 Mark

(2) Catch

- *catches and handles exception generated from try* 1 Mark

d) Write an application that accepts a person's weight and displays the number of calories the person needs in one day. A person needs 42 calories per kilogram of body weight, so the formula expressed in Java would be: calories=bodyWeigh*42. [4 Marks]

3)

a) Explain the role played by each of the following objects:

i) Event object

- *This refers to the particular GUI component with which the user interacts*

ii) Source object

- *This is an object notified by the event source when an event occurs i.e. it listens to an event and executes in response to the event.*

iii) Listener object

[6 Marks]

- *This encapsulates information about the event that occurred e.g. a reference to the event source and any event-specific information required by the event listener.*

b)

i) What are abstract methods?

[2 Marks]

- *Methods that do not have a method body in a class, in which they are declared, but are defined in a sub-class*

ii) How does polymorphism promote extensibility?

[2 Marks]

- *A class can be defined that uses methods of predefined classes through overriding. The working (logic) of a predefined class can be changed to suit programmer needs without changing the structure of the method*

iii) Distinguish between interface and implementation inheritance.

[2 Marks]

- *Interface inheritance- inheriting from an interface using implements keyword*
- *Implementation inheritance- inheriting from a class through extends keyword*

c) Write a program that displays a dialog box that has a title login window. It should have two labels named username and password and two text fields. It should also have three buttons labeled ok, cancel and help

[8 Marks]

4)

a)

i) Define the term abstract data type (ADT)

[2 Marks]

- *Data structures that use the concept of abstraction and encapsulation i.e. bundling in certain entities all the data elements and operations*

ii) Discuss how Java implements ADTs

[2 Marks]

- *Implemented through interfaces and classes*

b) The Shape class below cannot be instantiated – why not? What type of class is it, and why do we use this type of class?

[4 Marks]

```
public abstract class Shape {  
    protected float area;  
    protected float perimeter;  
    public void display(){System.out.println("I am a shape"); }  
}
```

```
public abstract String getShapeName();  
}
```

- *It is an abstract class* 2 Marks
 - *Used to create more general classes of common features* 2 Marks
- c) What is a Java Interface? Why is it used? Give an application example of how you might use an Interface. [4 Marks]
- *Like a contract between two classes* 1 Mark
 - *Used when you need something more abstract than an abstract class* 1 Mark
 - *Use when no single method need to be implemented and there are no instance variables* 1 Mark
 - *Give suitable example-* 1 Mark
- d) Write an applet that converts Celsius temperatures in the range 0-100, with a step size of 20 (i.e. 0, 20, 40, e.t.c.) to the equivalent Fahrenheit temperatures and displays the results in a text area box. The formula for conversion is:
- e) $fahrenheit=(9.0/5.0)* celsius+32.0;$ [8 Marks]

5)

- a) Explain each of the following. Use sample code to show how each is implemented in Java.
- i) Class methods
- *Called using class name and defined using static keyword* 2 Marks
- ii) Class variables [4 Marks]
- *Have same values for all instances of a class* 2 Marks
- b) Explain why it is important to use access controls in Object Oriented Programs.
- *Information hiding* 2 Marks
- c) Explain the effect of the java modifier protected on variables and methods in terms of access and inheritance. [4 Marks]
- *Variables and methods can be inherited* 2 Marks
 - *have package access* 2 Marks

d)

i) Write an applet program that provides the following interface:

Grading system	
Registration	<input type="text"/>
Mark:	<input type="text"/>
Grade:	<input type="text"/>
<input type="button" value="Find Grade"/>	

Award 4 Marks

[4 Marks]

ii) Write a Java program that makes use of the Interface above to calculate the grade of a student

Award 7 Marks

[8 Marks]