OBJECT ORIENTED PROGRAMMING WITH JAVA
(MCAP 1201)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) Double x = 0;
x = (check ( ).equals ("1")) ? getSales ( ) : nextStore ( );
What datatype could be returned by method check( ) as shown above?
(a) int   (b) boolean   (c) string   (d) byte.

(ii) Which of the below is not a memory leak solution?
(a) Code changes   (b) JVM parameter tuning
(c) Process restart   (d) GC parameter tuning.

(iii) class A {
    int i, j, k;
    public A(int ii) { i = ii; }
    public A( ) {
    k = 1;
    }
}
Referring to the above, which code instantiates an object of class A?
(a) new A(this)   (b) A a = new A(3)
(c) A(3) a   (d) A a = new A(4,8).

(iv) Objects can be cast to another class when one of the following is the case:
(a) both classes are direct subclasses of the same superclass
(b) the source class is not abstract or static
(c) the target class is a subclass of the source class
(d) both classes are subclasses of the same abstract superclass.

(v) What will be the output of the following code segment (assuming that the object 'ct' gets stored in the address location 2345)?
```
class ClassTest {
    public String toString ( ){
        return "ClassTest";
    }
    public static void main (String [ ] args){
        ClassTest ct = new ClassTest ( );
        System.out.println (ct);
    }
}
```
(a) ClassTest@2345   (b) Error   (c) ClassTest   (d) ct.

(vi) Which code declares class A to belong to the mypackage.financial package?
(a) package mypackage; package financial;
(b) import mypackage.*;
(c) package mypackage.financial.A; mypackage.financial;
(d) package.

(vii) Which statement about static inner classes is true?
(a) Static inner classes may access any of the enclosing classes members
(b) Static inner classes may not be instantiated outside of the enclosing class
(c) Static inner classes do not have a reference to the enclosing class
(d) Static inner classes are created when the enclosing class is loaded.

(viii) Consider the following code
```
package B;
    public class A {
        int getSquare (int i) {
            return i * i;
        }
    }
```
Referring to the above, what classes can access method getSquare ( ) in class A?
(a) Class A
(b) Class A and all other classes in package B only
(c) Class A, all subclasses of A in package B only
(d) Class A all non-subclasses of A in package B only.

(ix) How can you have a "try" block that invokes methods that throw two different exceptions?
(a) Catch one exception in a "catch" block and the other in a "finally" block
(b) Setup nested "catch" blocks for each exception
(c) Catch one exception in a "catch" block and the other via the return value
(d) Include a "catch" block for each exception.

(x) Which one of the following is a limitation of subclassing the Thread class?
(a) You must catch the ThreadDeath exception
(b) You must implement the Threadable interface
(c) You cannot have any static methods in the class
(d) You cannot subclass any other class.

Group – B

2. (a) What is the role of the Java interpreter? What purpose does the just-in-time-compiler serve?

(b) Is it necessary to save a Java program with a filename same as the name of the class containing the main method? Illustrate with an example.

(c) Write a program that takes a string from the user on the command-line and print it in reverse. "*This is a test*" must be printed as: "*test a is this*".

(1 + 2) + 3 + 6 = 12

3. (a) Given are two one-dimensional arrays A and B, which are sorted in ascending order. Write a program to find the UNION and INTERSECTION of the two arrays.

(b) What are byte codes? How are they different from machine codes?

(c) Describe the JVM heap structure.

6 + 3 + 3 = 12

Group – C

4. (a) "In Java, the variables are initialized before any method is called even constructor" – Explain with an example.

(b) "Java does not support destructors" – Discuss.

(c) What are constructors? What is meant by constructor overloading? Explain with an example.

4 + 3 + (2 + 3) = 12

5. (a) What is a singleton class? Write a program to define and use a singleton class.

(b) Write a program to:
- Set up an instance of a Person class. Prompt the user to type in the name, age and gender. Then set the attributes of a Person instance to these values and print them out.
- Make use of the getUpperAgeLimit ( ) method to test the age typed in by the user is a valid one. If it is not valid, output an error message and stop the program.
- Output the attributes of this instance in the following form – John Smith is a man. Or, Joan Smith is a woman. Or, Jim Smith is a boy. Or, Jane Smith is a girl. A boy or a girl is anyone aged 17 or less.
- Set up two instances of the Person class and give them suitable attributes. Output the information in the form – John Smith is younger than Dave Jones.

(1 + 4) + 7 = 12

Group – D

6. (a) What is the difference between method overloading and method overriding? Illustrate with an example.

(b) What is the difference between shadow and override?

(c) What is partial implementation of an interface? What is a marker interface?

4 + 3 + (4 + 1) = 12

7. (a) "Packages are used to keep the class name space compartmentalized" — Explain. What is the significance of compiling a Java program with the –d option?

(b) Write an inheritance hierarchy for classes Quadrilateral, Trapezoid, Parallelogram, Square. Use Quadrilateral as the super class of the hierarchy. Specify the instance variables and methods for each class. The private instance variables of Quadrilateral should be the x-y coordinate pairs for the four endpoints of the Quadrilateral. Write a program that instantiates objects of your classes and outputs each object's area (except Quadrilateral).

(3 + 1) + 8 = 12

Group – E

8. (a) What happens precisely when the code in the try block throws an exception?

    (b) What are the different ways of *synchronizing* threads. Illustrate with an example.

    (c) "Vector objects cannot store primitive type data directly." — How do you handle this with wrapper classes?

    (d) What is a finally block? When and how is it used? Give a suitable example.

    2 + 3 + 3 + (1 + 1 + 2) = 12

9. (a) Suppose you've defined an exception called NotANumberException( ). Now suppose that NotAPositiveNumberException extends NotANumberException. Will

    ```
        catch (NotANumberException) {
             System.out.println("Caught a NotANumberException");
        }
    ```
    catch a NotAPositiveNumberException?
    Now you have the following catch clause and throw a NotAPositiveNumberException. What happens?

    ```
        catch (NotANumberException) {
        System.out.println("Caught a NotANumberException");
        }
        catch (NotAPositiveNumberException) {
        System.out.println("Caught a NotAPositiveNumberException");
        }
    ```

    (b) Write a program that stores names of some countries and their capitals. The program prints the name of the capital when the name of a country is entered by the user and vice-versa. The program should throw a user defined exception called NoMatchFoundException if the country or the capital entered by the user is not found.

    4 + 8 = 12