COP 3330: Object-Oriented Programming Summer 2011

EXAM #1 Review

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Material Covered

- Introductory Notes (2 sets of notes).
  - Basic OO concepts.
  - Criteria for elegant software.
  - Advantages of OO.
  - Introduction to variables, classes, and methods.
  - Introduction to UML.
  - Inheritance – Specialization and Generalization
  - Subtypes and Polymorphism

Material Covered

- Classes in Java (3 sections of notes).
  - Inheritance and polymorphism.
  - Constructor chaining.
  - Overriding and overloading methods – the differences.
  - Casting objects and dynamic binding.
  - Abstract classes and interfaces.
  - The protected accessibility modifier.

Material Covered

- Basic Java (1 set of notes)
  - Structure of a Java application program.
    - Comments
    - Reserved Words
    - Modifiers
    - Statements
    - Blocks
    - Classes
    - Methods
    - The `main` method
- The notes on the Java Environment are not covered on the exam.

Test Format

- Some True/False questions
- Some fill-in-the-blanks questions.
- Some tracing through code and producing the output.
- Some writing of Java console application programs.

Sample Test Questions

1. Assume the following class declarations are given:

```
class A { ... }
class B extends A { ... }
class C extends B { ... }
```

Answer the following questions.

(a) Which class is the superclass of class B?

(b) Which class is the superclass of class A?

(c) Which types are the sub-types of type A?

(d) Which types are the super-types of type B?

Sample Test Questions (cont.)

2. Answer the following True/False questions.

   a) Java supports multiple-inheritance.

   b) If the data type of a reference variable is `Object`, that variable can store references to the objects of all classes.

Sample Test Questions (cont.)

3. Fill in the blank with the correct term.

(a) In the declaration of a class, the _____ keyword specifies the super-class of that class.

(b) The conversion of a sub-type to one of its super-types is called _____

(c) The conversion of a super-type to one of its sub-types is called _____

(d) A constructor of a sub-class can invoke one of its parent's constructors using _____

Sample Test Questions (cont.)

4. What is the output from the following program?

Question3.java | Example1.java | ParameterPassingExam | ParamTest.java | »6

```
//Exam 1 Review - Problem 4 - Summer 2011
public class ParamTest {
  static void f(int[] a, int[] b, int[][] c) {
    int x;
    x = a[0];
    a[0] = a[1];
    a[1] = x;
    c[0] = c[1];
    c[1] = b;
    b[0] = 7;
    b = new int[2];
    b[0] = 8;
    b[1] = 9;
    c[0][0] = a[0];
  }//end method f

  public static void main(String[] args) {
    int[] x1 = {0,1};
    int[][] x2 = {{2,3},{4,5}};
    f(x1, x2[0], x2);
    System.out.println("  x1[0]: " + x1[0] + "  x1[1]: " + x1[1] );
    System.out.println("  x2[0][0]: " + x2[0][0] + "    x2[0][1]: " + x2[0][1] +
                       "   x2[1][0]: " + x2[1][0] +"   x2[1][1]: " + x2[1][1] );
  }//end main method
}//end class paramTest
```


Sample Test Questions (cont.)

5. What is the output when F.java is executed?

ParamTest.java | Sample5.java | *F1.java

```
//Exam 1 Review - Problem 5 - Summer 2010

class D1 {
  //D1 instance variable
  protected int d;

  //D1(): default constructor
  public D1(){
     d = 0;
  }//end default no-arg constructor
  //D1(): specific constructor
  public D1(int v){
     d = v;
  }//end overloaded constructor
  //printD1(): facilitator
  public void printD1(){
     System.out.println("Value of d in D1: " + d);
     System.out.println();
  }//end printD1 method
}//end class D1
```

ParamTest.java | Sample5.java | *F1.java

```
public class F1 extends D1 {
  //F instance variable
  int d;  //note default status of d
  //F(): specific constructor
  public F1(int v){
     d = v;
     super.d = v*100;
  }//end default constructor
  //printF(): facilitator
  public void printF1(){
     System.out.println("Value of d in D1: " + super.d);
     System.out.println("Value of d in F1: " + this.d);
     System.out.println();
  }//end printF1 method

  //main(): application entry point
  public static void main(String[] args){
     F1 f = new F1(2);
     D1 d = f;
     d.printD1();
     f.printF1();
    }//end main method
}//end class F1
```


Answer Sample Question #1

1. Assume the following class declarations are given:

```
class A { ... }
class B extends A { ... }
class C extends B { ... }
```

Answer the following questions.

(a) Which class is the superclass of class B? A

(b) Which class is the superclass of class A? Object

(c) Which types are the sub-types of type A? B and C

(d) Which types are the super-types of type B? A, & Object

Answer Sample Question #2

2. Answer the following True/False questions.

   a) Java supports multiple-inheritance. F

   b) If the data type of a reference variable is `Object`, that variable can store references to the objects of all classes. T

Answer Sample Question #3

3. Fill in the blank with the correct term.

(a) In the declaration of a class, the extends keyword specifies the super-class of that class.

(b) The conversion of a sub-type to one of its super-types is called a widening conversion (or upcasting)

(c) The conversion of a super-type to one of its sub-types is called narrowing conversion (or downcasting)

(d) A constructor of a sub-class can invoke one of its parent's constructors using super(...)

Answer Sample Question #4

Question3.java | Example1.java | ParameterPassingExam | ParamTest.java | »6

```
//Exam 1 Review - Problem 4 - Summer 2011
public class ParamTest {
  static void f(int[] a, int[] b, int[][] c) {
    int x;
    x = a[0];
    a[0] = a[1];
    a[1] = x;
    c[0] = c[1];
    c[1] = b;
    b[0] = 7;
    b = new int[2];
    b[0] = 8;
    b[1] = 9;
    c[0][0] = a[0];
  }//end method f

  public static void main(String[] args) {
    int[] x1 = {0,1};
    int[][] x2 = {{2,3},{4,5}};
    f(x1, x2[0], x2);
    System.out.println("  x1[0]: " + x1[0] + "  x1[1]: " + x1[1] );
    System.out.println("  x2[0][0]: " + x2[0][0] + "    x2[0][1]: " + x2[0][1] +
                       "   x2[1][0]: " + x2[1][0] +"   x2[1][1]: " + x2[1][1] );
  }//end main method
}//end class paramTest
```

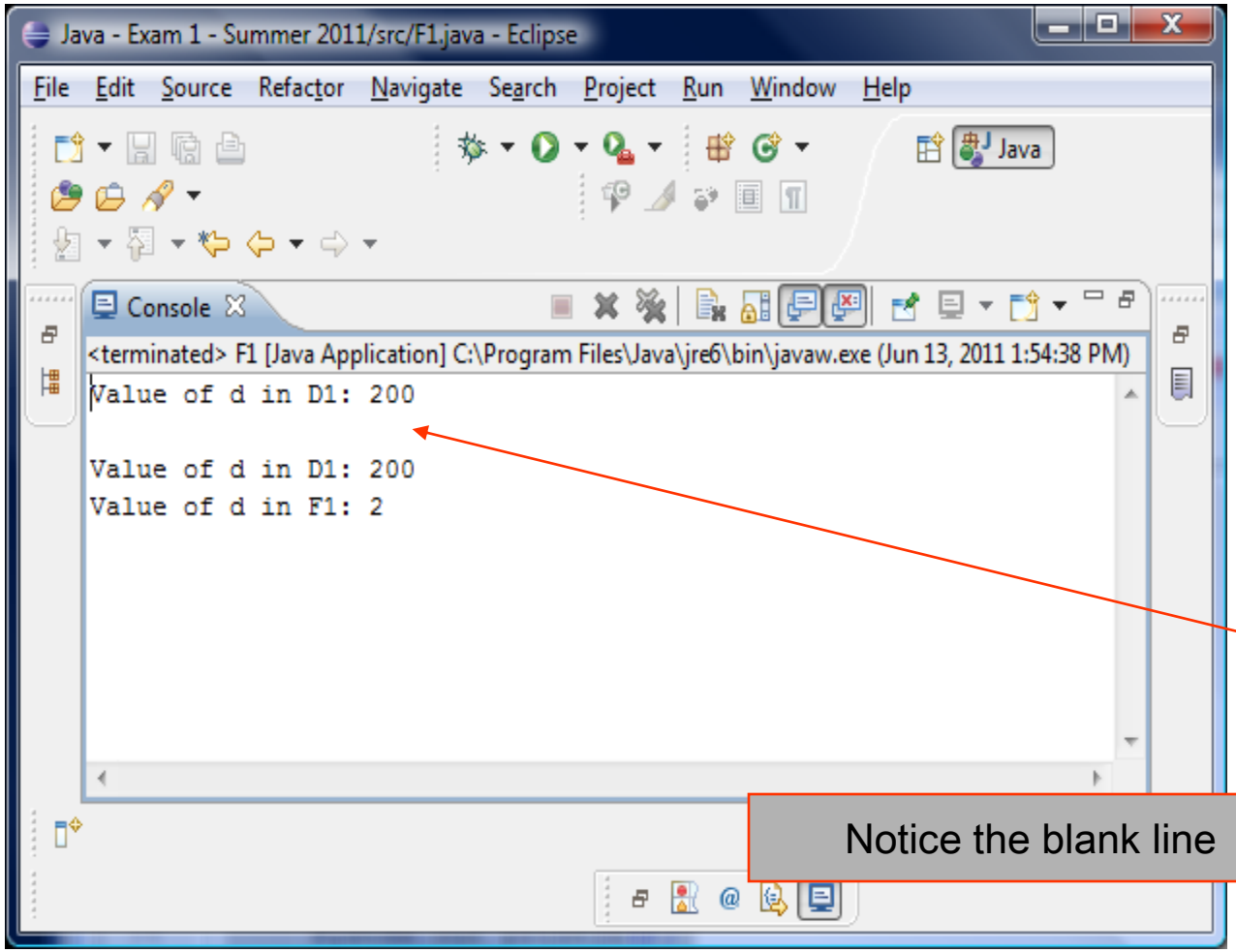
Console

<terminated> ParamTest [Java Application] C:\Program Files\Java\jre6\bin\javaw.exe (Jun 13, 20

```
x1[0]: 1  x1[1]: 0
x2[0][0]: 1    x2[0][1]: 5   x2[1][0]: 7   x2[1][1]: 3
```


Answer Sample Question #5

5. What is the output when F.java is executed?



More Sample Test Questions

1. Write a Java console application program that will ask the user for two distinct integer values and then print out (a) the smaller of the two numbers, (b) the sum of the two numbers, and (c) the product of the two numbers. Assume the two numbers to be input are small enough so that their product will fit in an integer variable. You can do everything inside the main method in this problem.

2. Write a public method that will accept a single integer parameter `n` that will print out only the odd numbers from `1` to `n`. Assume that `n > 1`. The value `n` may be either odd or even.

Sample Test Questions (cont.)

3. Given the code segments below and on the next page, illustrate graphically (draw a picture) the exact effect produced by executing the code.

```
class QuestionThree {
    public static void main(String args[]){
        Q3 obj1 = new Q3(4, 5.5); //line 1
        System.out.format("Result of line 1: obj1.x = %d obj1.y = %.2f \n", obj1.getX(), obj1.getY());
        Q3 obj2 = new Q3(6, 7.7); //line 2
        System.out.format("Result of line 2: obj2.x = %d obj2.y = %.2f \n", obj2.getX(), obj2.getY());
        obj1.m1(9); //line 3
        System.out.format("Result of line 3: obj1.x = %d obj1.y = %.2f \n", obj1.getX(), obj1.getY());
        obj2.m1(7); //line 4
        System.out.format("Result of line 4: obj2.x = %d obj2.y = %.2f \n", obj2.getX(), obj2.getY());
        obj2 = obj1; //line 5
        System.out.format("Result of line 5: obj1.x = %d obj1.y = %.2f \n", obj1.getX(), obj1.getY());
        System.out.format("Result of line 5: obj2.x = %d obj2.y = %.2f \n", obj2.getX(), obj2.getY());
    }//end main method
}//end class QuestionThree
```


Sample Test Questions (cont.)

F1.java | Fraction.java | Q3.java | 11

```
/* Object class used in QuestionThree class
 * Exam Review 1 - Summer 2011
 *
 */
public class Q3 {
    private int x;
    private double y;
    public Q3(int p1, double p2) { x = p1; y = p2; }
    public int getX(){ return this.x; }
    public double getY(){ return this.y; }
    public void m1 (int val) { x = val; }
}
```


Sample Test Questions (cont.)

4. Instance variables and instance methods that belong to a particular kind of object are grouped together into a

   _____

5. The keyword _____ is used in Java to distinguish a class method from an instance method.

6. The job of a _____ is to initialize instance variables at the time an object is created.

7. Objects have a state and _____

Sample Test Questions (cont.)

8. Show the output produced by executing the program shown below.

Q3.java | QuestionThree.java | QuestionEight.java | 13

```
//QuestionEight - COP 3330 Exam Review 1 - Summer 2011
public class QuestionEight {
   public static void main(String[] args) {
      int m = 2;
      int n = 5;
      for (int i = 0; i < n; ++i) {
           System.out.println("i is: " + i);
           for (int j = 0; j < m; ++j) {
               System.out.println("     j is: " + j);
           }//end for loop
      }//end for loop
   }//end main method
}//end class QuestionEight
```


Sample Test Questions (cont.)

9. What is the output produced by executing the following program?

QuestionEight.java | QuestionNine.java | QuestionTen.java | 15

```
//QuestionTen - COP 3330 - Exam 1 Review - Summer 2011
public class QuestionTen {
   public static void main(String[] args) {
      int n = 3;
      while (n > 0) {
         System.out.println("n is: " + n);
         --n;
      }
      int m = 3;
      do {
        System.out.println("m is: " + m);
        --m;
      }while (m > 0);
   }
}
```


Answer to Sample Question #1

QuestionEight.java | QuestionNine.java | QuestionTen.java | QuestionOne.java | 15

```
//Question 1 - Exam 1 Review - Summer 2011

import java.util.Scanner;

public class QuestionOne{
  public static void main(String[] args){
    int   num1, num2;
    Scanner stdin = new Scanner(System.in);
    System.out.println("Enter first integer: ");
    num1 = stdin.nextInt();
    System.out.println("Enter second integer: ");
    num2 = stdin.nextInt();
    if (num1 < num2)
      {System.out.println("The smaller number is: " + num1);}
    else
      {System.out.println("The smaller number is: " + num2);}
    System.out.println("The sum of the numbers is: "    +(num1+num2));
    System.out.println("The product of the numbers is: " + num1*num2);
  }//end main method
}//end class QuestionOne
```


Answer to Sample Question #2

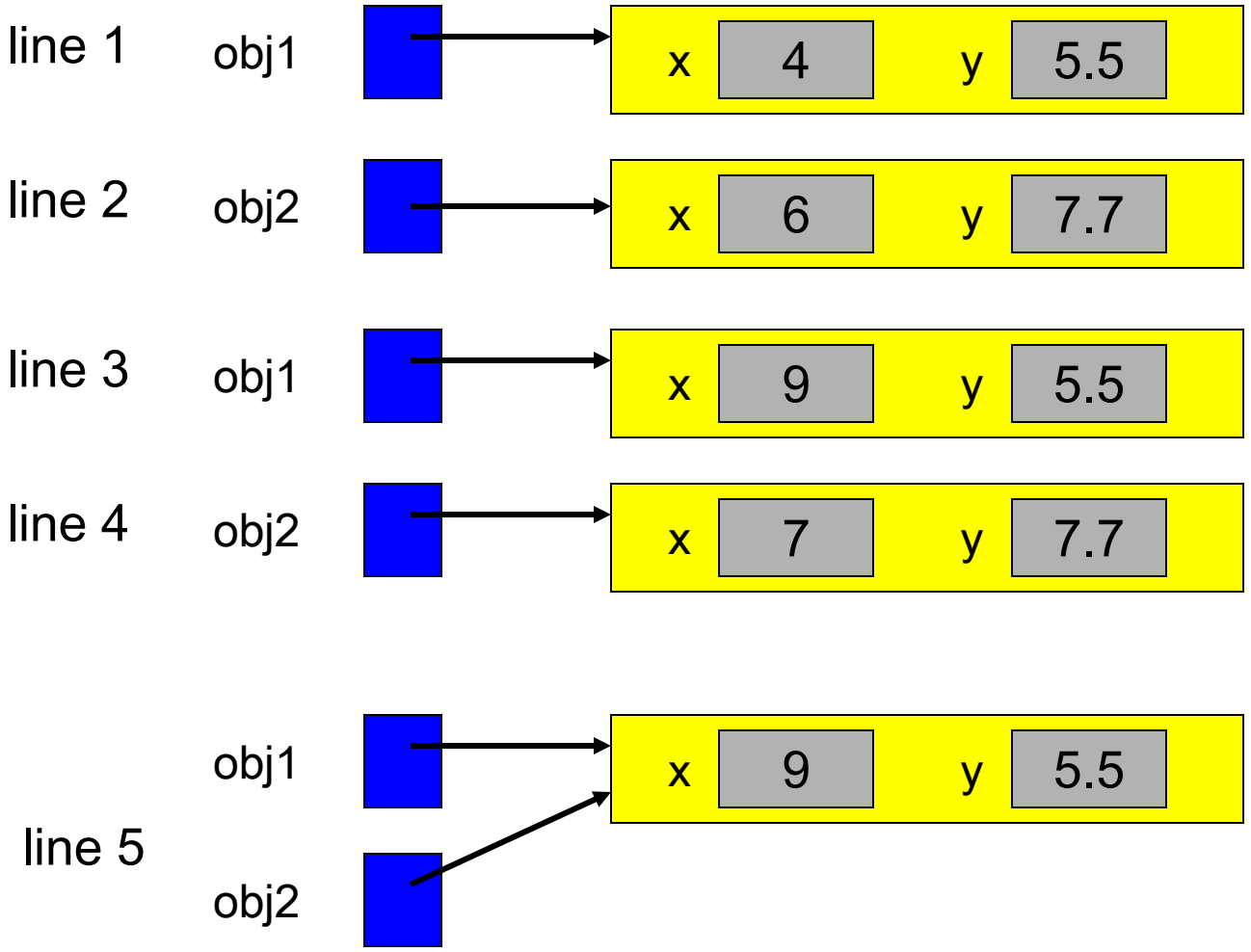
QuestionNine.java | QuestionTen.java | QuestionOne.java | QuestionT

```
//QuestionTwo - COP 3330 - Exam 1 Review - Summer 2010
import java.util.Scanner;

public class QuestionTwo {
   public static void main (String args[]) {
     Scanner stdin = new Scanner(System.in);
     System.out.print("Enter the upper end: ");
     int max = stdin.nextInt();
     printOdd(max);
   }//end main method

   public static void printOdd (int n){
    for (int i = 1; i <= n; ++i){
       if (i % 2 != 0) //odd number
            System.out.println(i + " ");
    }//end for loop
   }//end method printOdd
}//end class QuestionTwo
```


Answer to Sample Question #3



Answers to Sample Questions 4-7

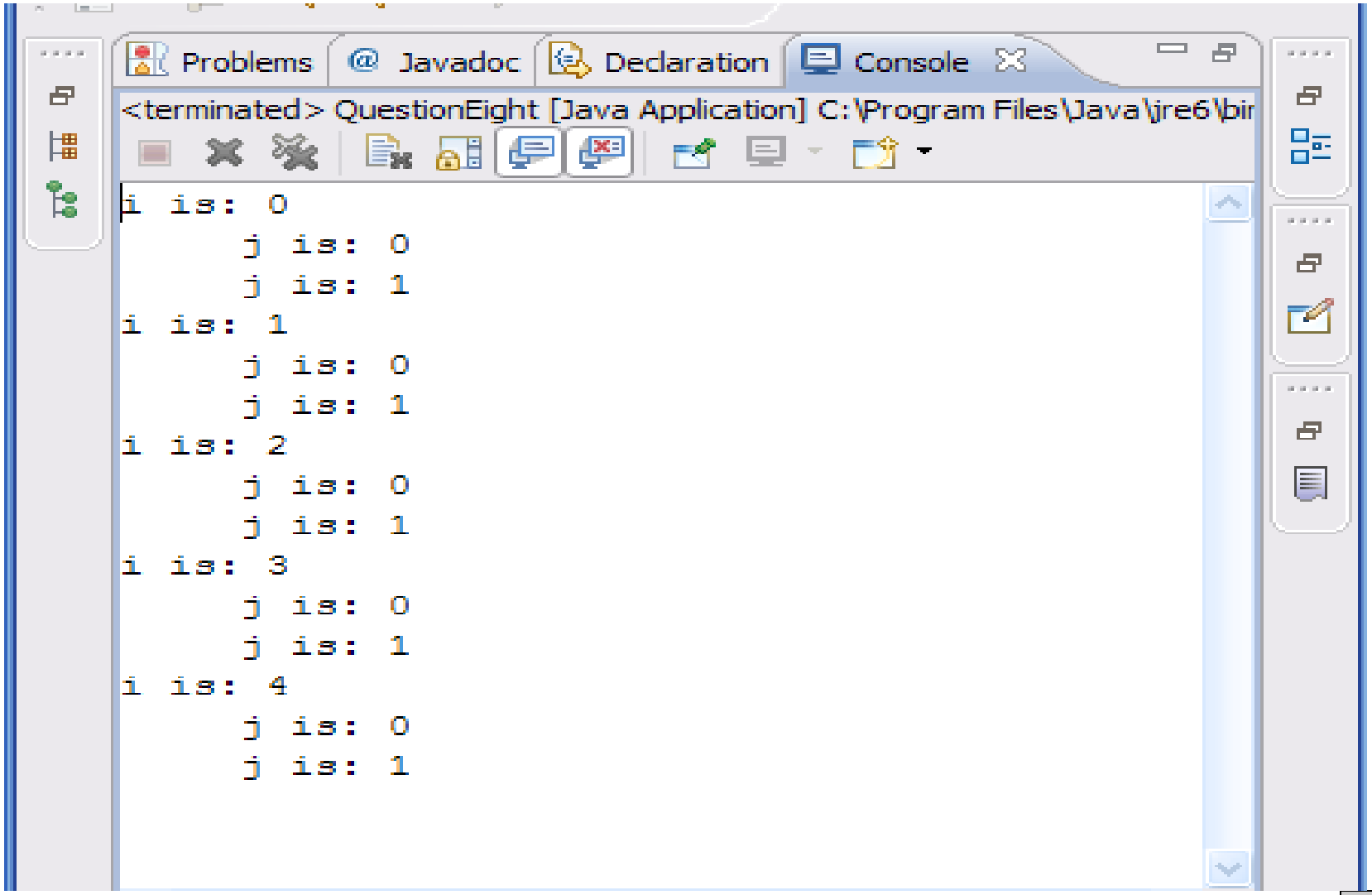
4. Instance variables and instance methods that belong to a particular kind of object are grouped together into a class

5. The keyword static is used in Java to distinguish a class method from an instance method.

6. The job of a constructor is to initialize instance variables at the time an object is created.

7. Objects have a state and behavior

Answer to Sample Question 8



Answer to Sample Question 9