Problem 1: Who wants to be a Java developer? (with apologies to Regis)

Fill in your answer in the space provided.

Question 1: Which is these word-pairs represents the IS-A relationship (in English)?
A. duck/bird B. bird/fly
C. beak/bird D. bird/nest

Final Answer:

Question 2: Which is these pairs represents the HAS-A relationship?
A. bird/duck B. bird/fly
C. bird/beak D. bird/flying,animal

Final Answer:

Question 3: Which is these pairs represents the BEHAVES-LIKE relationship?
A. bird/duck B. bird/fly
C. bird/beak D. bird/flying,animal

Final Answer:

Question 4: Which phrase below best describes the relationship between Country and Capital?
A. IS-A B. HAS-A
C. USES D. BEHAVES-LIKE

Final Answer:

Question 5: Which Java technology best supports the IS-A relationship?
A. Inheritance B. Access Restriction
C. Strong Typing D. Garbage Collection

Final Answer:

Question 6: Which Java keyword is used to specify inheritance?
A. extends B. implements
C. public D. static

Final Answer:
**Question** 7: Which Java keyword is used to specify compliance with an interface?

A. extends  
B. implements  
C. public  
D. static

Final Answer:

**Question** 8: Which Java keywords can not appear in a class declaration?

A. extends  
B. private  
C. void  
D. abstract

Final Answer:

**Question** 9: Is it possible to use the techniques of object oriented programming in a language that does not specifically support OOP?

A. Yes  
B. No  
C.  
D.  

Final Answer:

**Question** 10: Are private classes only for malicious corporations closely guarding their proprietary code?

A. Yes  
B. No  
C.  
D.  

Final Answer:

**Question** 11: Which Java keywords can not appear in instance variable definitions?

A. extends  
B. protected  
C. int  
D. private

Final Answer:

**Question** 12: Which Java keywords can not appear in method definitions?

A. implements  
B. void  
C. static  
D. private

Final Answer:

**Question** 13: Which of these fragments represents the HAS-A relationship between Foo and Bar?

A. class Foo extends Bar{}  
B. class Foo implements Bar{}  
C. class Foo { private Bar mybar; }  
D. abstract class Bar extends Foo{}

Final Answer:
**Question 14:** Which line of code in the following can be inserted in place of the comments, to perform the initialization described by the comments?

```java
public class T {
    int r;
    int s;

    T(int x, int y) {
        r = x;
        s = y;
    }
}

class S extends T {
    int t;

    public S(int x, int y, int z) {
        // insert here the code
        // that would do the correct initialization
        // r = x and s = y
        t = z;
    }
}
```

A. T(x, y); B. this(x, y); C. super(x, y); D. super(x, y, z);

Final Answer:

**Question 15:** What do the ‘public’ and ‘private’ keywords relate to?

A. Typing B. Garbage Collection C. Polymorphism D. Access Restriction

Final Answer:

**Question 16:** Which Java technologies most powerfully supports the programming concept of “encapsulation”?

A. Container Classes B. Access Restriction C. Garbage Collection D. Typing

Final Answer:

**Question 17:** Which Java technologies most powerfully support the programming concept of “abstraction”?

A. Inheritance and Polymorphism B. Heap Allocation C. Garbage Collection D. Applets

Final Answer:
Problem 2: Program Analysis: Short Answer

**Question 1:** What are the values of \(i, a, \text{ and } b\) after the following code fragment runs?

```java
int i;
int a=1;
int b=0;
for(i=0;i<10;i++){
    a = a * 2;
    b++;
}

i = a = b =
```

**Question 2:** What is the value of \(a\) after the following code fragment runs?

```java
int a=0;
while(true){
    if(a > 20) break;
    a = a+1;
}

a =
```

**Question 3:** What three lines will the following code print out when compiled and run?

```java
public class Spindle{
    public static void main(String[] args){
        int[] a = new int[] {1,2,3,4};
        int b = 5;
        int c =6;

        Fold.mutilate(a, b, c);
        System.out.println(a[0]);
        System.out.println(b);
        System.out.println(c);
    }
}

class Fold{
    static void mutilate( int[] a, int b, int c) {
        a[0] = 7;
        b = 8;
        c = 9;
    }
}
```

line1:
line2:
line3:
**Question 4:** What does the class Test below print out if it is compiled and run?

```java
public class Test {
    int x;

    Test(String s) {
        this();
        System.out.println(s);
        System.out.println("This");
    }

    Test(int x) {
        this("is");
    }

    Test() {
        System.out.println("a test.");
    }

    public static void main(String[] args) {
        int val = 2;
        Test t = new Test(val);
    }
}
```

Test prints out:
The next three short answer question use the following group of classes.

```java
/**
 * An interface with one method
 */
interface Face1{
    public void bar();
}

/**
 * A class with an accessor and method foo()
 */
class Class1{
    private int size = 0;
    private String name;

    Class1(String name){
        this.name = name;
    }

    public String getName(){
        return(name);
    }

    public void foo(){
        System.out.println(''Class1.foo()'');
    }
}

/**
 * A class inheriting from Class1
 */
class Class2 extends Class1 implements Face1{
    int size = 0;
    int x;

    Class2(String name){
        super(name);
    }

    public void foo(){
        System.out.println(''Class2.foo()'');
    }

    public void bar(){
        System.out.println(''Class2.bar()'');
    }
}
```
Question 5: What does the following print out?

```java
public class TestClass{
    public static void main(String[] args){
        Class1 c = new Class2('me');
        c.foo();
    }
}
```

Ans:

Question 6: What does the following print out?

```java
public class TestClass{
    public static void main(String[] args){
        Class1 c = new Class1('me');
        c.foo();
    }
}
```

Ans:

Question 7: What does the following print out?

```java
public class TestClass{
    public static void main(String[] args){
        Class2 c = new Class2('me');
        System.out.println(c.getName());
    }
}
```

Ans:

Question 8: What does the following print out?

```java
public class TestClass{
    public static void main(String[] args){
        Face1 c = new Class2('me');
        c.bar();
    }
}
```

Ans:
Problem 3: Class Implementation

In this problem we ask you to implement part of a class `Fraction`, which represents fractions of the form $a/b$ where $a$ and $b$ are integers, ($1/2, 4/6, 101/432$, etc.). In the space below, complete the class `Fraction`. Use `int` to store the numerator and denominator.

Include a constructor that initializes from a numerator and denominator.

Write an instance method for addition. [Hint: $a/b + c/d = (ad + bc)/bd$.]

Write a static method for multiplication. [Hint: $a/b * c/d = ac/bd$.]

Write a static `main()` that allocates two Fractions, $1/2$ and $3/4$ and stores their sum in a third variable.

(Be merciful to graders: please write clearly).

```java
/**
 * Class Fraction. Represent the fraction X/Y where X and Y are integers
 */
public class Fraction{
    /**
     * Your instance vars here
     */

    /**
     * Your constructor here
     */

    // Continued on next page
```
/**
 * Your add method here
 */

/**
 * Your static mult method here
 */

/**
 * Your static main  here
 */

}


Problem 4: OOP Design

You are designing an OO program to help people plan an evening out. It is proposed that the following classes be used. Add inheritance (extends phrases) and instance variables to show the IS-A and HAS-A relationships between these classes. Do not introduce any additional classes or and instance variables of any basic type. [Note: By Business, we mean anything that would appear in the Yellow Pages].

class Address
{

}

class Business
{

}

class City
{

}

class Restaurant
{

}

class Theater
{

}