

**1.00 Introduction to Computers and Engineering Problem Solving
Quiz 1 – March 4, 2005**

Name:	
E-mail Address:	
TA:	
Section:	

You have 80 minutes to complete this exam. For coding questions, you do not need to include comments, and you should assume that all necessary files have already been imported.

Question	Points
1	12
2	23
3	10
4	20
5	35
Total	100

Question 1. True/False (12 Points)

Answer the following questions about Java by circling TRUE or FALSE as appropriate.

- 1) Two classes in the same package can access each other's *private* variables as `object.variableName`, where `object` is an instance of the other class, and `variableName` is a private variable of that object

TRUE

FALSE

- 2) The following piece of code will compile

```
double a = 5.5;
```

```
double b = 6.9;
```

```
int sum = a+b;
```

TRUE

FALSE

- 3) Consider the following lines of code

```
int i=6;
```

```
int j=5;
```

```
double result = i/j + i%j;
```

The value stored in variable `result` is 2.2

TRUE

FALSE

- 4) A class constructor may have an `int` return value.

TRUE

FALSE

Question 2: Methods (23 Points)

In the code provided below, `MyInt` is a class with a single private variable `value`. Another class `Tools` has a static method `addIt()` which adds two integers, stores the value as an object of type `MyInt` and returns the `MyInt` object.

- Complete the method `addIt()` of the class `Tools`. **(15 Points)**
- Write a `main()` method in class `Tools` that initializes two integers to the values 5 and 77, calls `addIt()` appropriately, and prints the `MyInt` that is returned. **(8 Points)**

```
public class MyInt{
    private int value;

    public MyInt(int x){
        value = x;
    }

    public void printIt() {
        System.out.println("MyInt: "+value);
    }
}

public class Tools{

    // Adds two integers x and y, stores the result as an object of type MyInt
    // and returns that object

    public static MyInt addIt(int x, int y)
    {
        int z;
        z = x +y;
        MyInt mi = new MyInt(z);
        return mi;
    }
}
```

```
// Initializes two integers 5 and 77, calls addIt and prints MyInt result
```

```
public static void main(String[] args){
```

```
    int a = 5;  
    int b = 77;  
    MyInt c = Tools.addIt(a, b);  
    c.printIt();
```

```
}
```

```
}
```

Question 3: Control Structures (10 Points)

What is the output of this code? Write your answer below.

```
public class MyCode {  
    public static void main(String[] args) {  
        boolean b = true;  
        int k = -2;  
        int m = 1;  
        while (b) {  
            k += k + m++;  
            if (k > 10 || m >= 5)  
                break;  
        }  
        System.out.println(" k = " + k);  
        System.out.println(" m = " + m);  
    }  
}
```

The output is:

```
k = -6  
m = 5
```

Question 4. Constructors (20 Points)

Consider the following Window class and answer the following questions.

```
public class Window {  
  
    private String title;                // caption of the window  
    private static int OpenedWindows;    // number of opened windows  
    private static int RemainingMemory; // bytes  
    private static int DEFAULT_MEMORY = 256000; // bytes  
  
    // Memory used per window (bytes)  
    private static int MEMORY_CONSUMPTION = 50000;  
  
    public Window(String name) {  
        title= name;  
    }  
}
```

Add code to the constructor so that

1. Every time a new Window object is instantiated, the number of opened windows, OpenedWindows is incremented by one.
2. The current system memory RemainingMemory is updated so that
 - i. When there are no instances of Window, system memory equals DEFAULT_MEMORY
 - ii. Each Window instance consumes MEMORY_CONSUMPTION bytes. If RemainingMemory would become less than zero, increment it by DEFAULT_MEMORY so that it is greater than zero

```
public Window(String name)  
{  
  
    title= name;  
    // initialize RemainingMemory when there are no instance of  
    windows  
    if (Window.OpenedWindows == 0)  
        Window.RemainingMemory = DEFAULT_MEMORY;  
  
    // 1. increase number of total window  
    Window.OpenedWindows++;  
  
    // 2. update memory accordingly  
    Window.RemainingMemory -= MEMORY_CONSUMPTION;  
    if(Window.RemainingMemory < 0)  
        Window.RemainingMemory += DEFAULT_MEMORY;  
}
```

Question 5: Classes and Methods (35 Points)

The Quest for Phi, the Golden Ratio

You have been hired as the computer consultant for the new Indiana Jones movie which is secretly under production. Your job is to write the code that the young Dr. Jones will run on screen in a seemingly intelligent fashion. The purpose of the code is to discover the Golden Ratio, 1.618..., which also happens to be the rate at which the numbers in the Fibonacci sequence increase.

0 1 1 2 3 5 8 13 ..

The 0th term in the Fibonacci sequence is 0, the 1st term is 1. The nth term of the sequence is the sum of the two preceding, or (n-1) and (n-2) terms. For example, the 6th term, 8, is the sum of the 5th and 4th terms: $8 = 5 + 3$

The Golden Ratio phi is the value that the nth term divided by the (n-1) term converges to i.e., the limit of the series,

$2/1, 3/2, 5/3, 8/5, 13/8, 21/13, \dots$

We have written a skeleton class called Fibonacci for you. You will write methods to calculate the Fibonacci numbers and the Golden Ratio.

a. Write a public static method called `fibonacci`. This method takes an integer `n` as its argument and returns the `n`th Fibonacci number **(25 Points)**

```
public static int fibonacci (int n)
{
    // Declare any variables you need here
    int i;
    int fibnum;
    int pfibnum = 1;
    int ppfibnum = 0;

    if(n == 0)
        return 0; //If the argument n is 0, return the 0th Fibonacci number

    else if(n == 1)
        return 1; //If the argument n is 1, return the 1st Fibonacci number

    // For n greater than 1, calculate the nth Fibonacci number using a loop and return it
    else {
        for(i=2;i<=n;i++){
            fibnum = pfibnum + ppfibnum;
            ppfibnum = pfibnum;
            pfibnum = fibnum;
        }
        return pfibnum;
    }
}
```


- d. Write a public static method `goldenRatio()` which takes in as its argument a number `n`, and prints the ratio of the `n+1` st Fibonacci number to the `n`th Fibonacci number. This method should not return anything. **Your code should deal with the special case of when `n = 0` by printing that the ratio cannot be computed in that case. (10 Points)**

```
public static void goldenRatio(int n)
{
    if (n!=0)
        System.out.println("The Golden Ratio is " +
            (double) fibonacci(n+1)/fibonacci(n));
    else
        System.out.println("The Golden Ratio cannot be
            computed when n is 0");
}
```