

Please fill in your Student Number and Name.

Student Number : _____

Name:

Student Number:

University of Cape Town ~ Department of Computer Science
Computer Science 1015F ~ 2009
Test 2

Question	Max	Mark	Internal	External
1	10			
2	10			
3	10			
TOTAL	30			

Marks : 30
Time : 40 minutes
Instructions:

- a) Answer all questions.
- b) Write your answers in pen, in the spaces provided.
- c) Show all calculations where applicable.

Question 1 [10]

Consider the following method and answer the questions that follow. Remember that **Math.abs** returns the absolute value of an integer.

```
public void drawShape ( int n )
{
    for ( int i=-n; i<=n; i++ )
    {
        for ( int j=0; j<n-Math.abs(i); j++ )
            System.out.print ( ' ' );
        if ( i!=0 )
            System.out.print ( '*' );
        for ( int k=0; k<(2*Math.abs(i)-1); k++ )
            System.out.print ( ' ' );
        System.out.println ( '*' );
    }
}
```

- a) What is the output if **n = 1**? Write one character in each block and assume the top-left corner is where the output starts. [2]

- b) What is the output if **n = 3**? Write one character in each block and assume the top-left corner is where the output starts. [2]

c) Rewrite the following 2 lines of the program in the form of a **while** loop. [2]

```
for ( int j=0; j<n-Math.abs(i); j++ )  
    System.out.print ( ' ' );
```

d) Under what circumstances would you choose to use a **do-while** loop instead of a **while** loop? What is the advantage? [2]

e) Suppose you wish to test the program using equivalence classes and boundary values. Provide a suitable set of test values and state whether each tests an equivalence class or a boundary value. [2]

Question 2 [10]

Consider the following class definition and answer the questions that follow.

```
class Student
{
    String name;
    int age;

    // methods
}
```

- a) What is the advantage of Object Oriented Programming over imperative/procedural programming that is not object-oriented? [1]

- b) What is a class? [1]

- c) How does an instance variable differ from a local variable? [2]

- d) Write a **Student** constructor that sets all instance variables based on values passed in as parameters. [2]

- e) Write a standard **equals** method to test for equality of a **Student** object with another passed in as a parameter. Remember that **equals** returns a **boolean** value, and assume that the parameter and instance variables of all objects are non-null. [2]

- f) We can write classes such that some objects contain only data while others contain only methods. This, however, violates a key principle of OOP. State the name of this principle and explain why we adhere to it. [2]

Question 3 [10]

Consider the code below then answer the questions that follow. It uses a **Person** class not shown here. The **Person** class has no print/output statements.

```
public class PersonDriver
{
    public static void main(String[ ] args)
    {
        // p is a male with name Joe aged 21. So is q
        Person p = new Person("Joe",21, 'M');
        Person q = new Person("Joe",21, 'M');
        if (p.getName( ) == q.getName( ) )
            System.out.println("same name");
        else System.out.println("different name");
        if ( p == q )
            System.out.println("same person");
        else System.out.println("NOT same person");
        p = q;
        if (p.getName( ) == q.getName( ) )
            System.out.println("now same name");
        else System.out.println("now different name");
        if ( p == q )
            System.out.println("now same person");
        else System.out.println("still NOT same");
        Person x = new Person( p );
        if ( p == x )
            System.out.println("x same person");
        else System.out.println("x NOT same person");
        Person.finalJob( );
    }
}
```

a) Give the program output i.e., the 5 lines of output produced by the **println** statements in **main**. [5]

b) Which method in this Java code is a static method: **getName()** or **finalJob()**? [1]

c) In which line is the copy constructor of class **Person** being called? [1]

d) You are asked to write the **getName** method of class **Person**.
Briefly explain why an **if** statement to check for null is necessary or unnecessary in the **getName** method. [1]

e) Suppose that **Person** has an instance variable declared as shown below:

```
char sex; // male or female
```

Give Java code for the method **sameSex** which returns **true** or **false** depending on whether two **Persons** have the same gender or not. An example call is shown below:

```
myBool = p.sameSex( q );
```

Ensure that your code works for all possible values in **Person** objects. [2]
