Answer any 5 questions (5 × 8 = 40).

1. (a) Consider the code of the following server called **OlympicServer** running in a computer with ip address of **34.34.34.34**. It sends the names of the leaders in the medal standing of Rio Olympic to a client. Write down the code of a class called **OlympicClient** that will read these names via a socket and print them in the console.   [5]

```java
import java.io.IOException;
import java.io.OutputStream;
import java.net.ServerSocket;
import java.net.Socket;
public class OlympicServer {
    public OlympicServer() throws IOException {
        ServerSocket serverSocket = new ServerSocket(9999);
        Socket client = serverSocket.accept();
        OutputStream out = client.getOutputStream();
        String leaders[] = {"USA","UK","China","Russia","Germany"};
        for (String x:leaders) {
            out.write(x.getBytes());
            out.write("\n".getBytes());
            out.flush();
        }
        out.close();
    }
    public static void main(String[] args) throws IOException {
        new OlympicServer();
    }
}
```

(b) Suppose, owner of the **OlympicServer** calls you and informs that this server can handle only one client and it has to be restarted after it is done. They want to hire you to modify their code of the class so that this program can handle multiple clients and need no restarts. Write the modified code of the server. [3]

2. What is wrong with the following codes? Fix them all.   [3+2+3=8]

(a)
```java
public class UnSafeClass {
    public static void unsafeMethod() throws Exception,RuntimeException {
        System.out.println("This is an unsafe method!");
    }
    public static void main(String[] args) {
        try {
            unsafeMethod();
        } catch (Exception e) {
            e.printStackTrace();
        }catch(RuntimeException e)
        {
            e.printStackTrace();
        }
    }
}
```

(b)
```
public class Nobody {
    public static void main(String[] args) {
        Somebody person = new Somebody() {
            String name = "nobody";
            public void printName() {
                System.out.println("I am " +name);
            }
            public void printName(String  name) {
                System.out.println("I am " +name);
            }
        };
        person.printName("nobody");
    }
}
interface Somebody{
    public void printName();
}
```

(c)
```
public class SafeClass {
    public static double sqrt(double number) throws Exception {
        if (number<0) throw new Exception("Negative number");
        else return Math.sqrt(number);
    }
    public static void main(String[] args) {
        System.out.println(sqrt(3));
    }
}
```

3. (a) A text file named **olympic.txt** contains information of all countries participating in the Rio Olympic 2016. Each line in the file starts with the name of the country followed by the number of gold, silver and bronze medals won by the country. Write a Java program that reads the file and writes the the content of this file into another file named **copy.txt**. A sample file looks as following. [3]

```
USA 46 37 38
UK 27 23 17
China 26 18 26
Russia 19 18 19
Germany 17 10 15
...
```

(b) Now, you have to write another Java program that reads the same file **olympic.txt** and writes into **processed.txt**, but this time it also calculates the total number of medals (summation of gold, silver and bronze medals) in each line in addition to the information read. [5]

4. Write a generic method named **countInRanage** that takes three input parameters: an array of generic type, an element of the same generic type called low and another element of the same generic type high. The method returns an integer that is the number of elements in the array that are greater than *low* and less than *high*. Also write a main method that calls this method (**countInRanage**) using three different types (Integer, Double etc.) of arrays and prints the output in the console. Reason the output of your program as well. [5+2+1=8]

5. (a) Consider the following class:

```
public class Pair<P,Q> {
    public P first;
    public Q second;
    public Pair(P first, Q second) {
        this.first = first;
        this.second = second;
    }
}
```

Now write a different Java class **App** containing main method that creates pairs using the information given in each line in the following table (country name and total medals) and add them to an **ArrayList** of **Pair**s. You do not need to take input from the console or read from file. [4]

USA 121
UK 67
China 70
Russia 56
Germany 42

(b) Consider the case of the Question 5a. Write a Java method within the **App** class that takes an **Arraylist** of **Pair**s as input parameter and sort it in the ascending order of the total number of medals. [4]

6. (a) Write Java code that creates the following GUI using Java. This window has a JFrame with three buttons and a JTextArea with scroll bars. Each time a button is pressed it adds a text to the JTextArea depending on which button is pressed. For example, if you click the button named **Circle**, it will add **You Clicked Circle** to the JTextArea followed by a new line. [6]
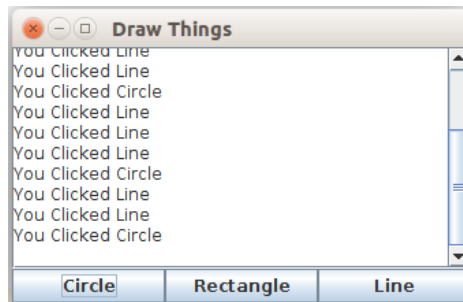
(b) What happens when you run the following code? Explain your answer. [2]

```
import java.io.*;
public class WriterClass {
    public static void main(String[] args) throws IOException {
        ObjectOutputStream out = new ObjectOutputStream(new FileOutputStream("out.txt"));
        out.writeObject(new P());
        out.close();
    }
}
class P{
    public Q q=new Q();
}
class Q{}
```

7. (a) Write a Thread based Java application that will create three threads. Each of them have a private integer called start and will print five consecutive integers beginning from start. Comment on the output of the program you wrote. [2]

(b) Please look at the following code snippet:

```java
public class Counter {
    // complete this class
}
public class CounterThread extends Thread{
    protected Counter counter = null;
    public CounterThread(Counter counter){
        this.counter = counter;
    }
    public void run() {
        for(int i=0; i<10; i++){
            counter.add(i);
        }
    }
}
public class Example {
    public static void main(String[] args){
      Counter counter = new Counter();
      Thread  threadA = new CounterThread(counter);
      Thread  threadB = new CounterThread(counter);

      threadA.start();
      threadB.start();
    }
}
```

Counter class is not complete. You need to complete this class in a way such that only one thread (**threadA** or **threadB**) from the main method can access the object counter. However, you cannot change the other classes. [3]

(c) The following program is expected to print the sum of the values written in the array by three threads. However, your friend who is running the code is reporting that this program always prints something else. What is probably wrong? Explain. Rewrite the code, so that the **System.out.println()** always print the correct sum in the console. [3]

```java
public class ThreadDread extends Thread {
    private int value;
    private int index;
    private int [] array;
    public ThreadDread(int value, int index, int[] array) {
        this.value = value;
        this.index = index;
        this.array = array;
        start();
    }
    public void run(){
        try {
            Thread.sleep((long) (Math.random()*1000));
        } catch (InterruptedException e) {
            e.printStackTrace();
        }
        array[index]=value;
    }

    public static void main(String[] args) {
        int [] array= new int[3];
        Thread t1=new ThreadDread(1,0,array);
        Thread t2=new ThreadDread(2,1,array);
        Thread t3=new ThreadDread(3,2,array);
        System.out.println(array[0]+array[1]+array[2]);
    }
}
```