

---

## 2910109 Introduction to Java and object-oriented programming

### Examination paper: Zone A

Time allowed: three hours

There are six questions on this paper. You should answer no more than **four** questions. Full marks will be awarded for complete answers to **four** questions. Each question carries 25 marks. The marks for each part of a question are indicated at the end of the part in brackets.

There are 100 marks available on this paper.

No calculators should be used.

---

**QUESTION 1**

- (a) (i) Describe the two ways of writing comments in Java.  
 (ii) Briefly explain why the following program will not compile:

```
class h
{
    int x=(1==1);
}
```

- (iii) What is the output of the following Java program?

```
class f
{
    public static void main(String [ ] args)
    {
        System.out.println(3+(2+2)*3);
    }
}
```

[ 9 Marks ]

- (b) (i) What is the output of the following program?

```
class H
{
    public static void main(String [ ] args)
    {
        int j=0;
        while(j<5)
        {
            System.out.println(2*j);
            j=j+1;
        }
    }
}
```

- (ii) Rewrite program *H* above using a *for* loop.

[ 8 Marks ]

- (c) Write a method which sorts a Vector of ints into descending order and briefly discuss the time complexity of your method.

[ 8 Marks ]

**QUESTION 2**

- (a) (i) Given that the ASCII code for the character *c* is 99, what is the ASCII code for the character *ø*?

- (ii) What is the output of the following Java program?

```
class ascii
{
    public static void main(String[] args)
    {
        System.out.print((int) 'b');
    }
}
```

- (iii) What is the output of the following Java program?

```
class ascii
{
    public static void main(String[] args)
    {
        System.out.print((char) 101);
    }
}
```

- (iv) Assuming the file *letters* is a file containing all 26 letters, 'a' to 'z', of the alphabet in order, with no other characters or white space, what is the output of the following Java program?

```
import java.io.*;
class one
{
    public static void main(String args[]) throws Exception
    {
        FileReader f = new FileReader("letters");
        int x;
        x=f.read();
        x=f.read();
        x=f.read();
        System.out.print((char)x);
    }
}
```

[ 9 Marks ]

- (b) (i) What is the output of the following program?

```

import java.io.*;
class two
{
    public static void main(String args[]) throws Exception
    {
        FileReader f = new FileReader("letters");
        int x=1,n=0;
        while (x!=-1)
        {
            x=f.read();
            if (x!=-1) n=n+1;
        }
        System.out.println(n);
    }
}

```

- (ii) What is the output of the following program?

```

import java.io.*;
class three
{
    public static void main(String args[]) throws Exception
    {
        FileReader f = new FileReader("letters");
        int x=1;
        while (x!=-1)
        {
            x=f.read();
            if (x<101 && x!=-1)System.out.print((char) x);
        }
    }
}

```

[ 8 Marks ]

- (c) Write a complete Java program that prints out the number of occurrences of each lower case letter in a file called apple.

[ 8 Marks ]

**QUESTION 3**

- (a) (i) What is the output of the following Java program?

```

public class pair
{
    int first;
    int second;
    pair (int x, int y)
    {
        first=x;
        second=y;
    }
    public String toString()
    {
        return "[" + first + "," + second + "]";
    }
    public static void main(String [ ] args)
    {
        pair a = new pair(12,17);
        System.out.println(a);
    }
}

```

- (ii) What is the output of the following Java program?

```

public class triple extends pair
{
    int third;
    public triple (int x,int y, int z)
    {
        super(x,y);
        third=z;
    }
    public String toString()
    {
        return super.toString()+"(" + third + ")";
    }
    public static void main(String [ ] args)
    {
        triple z = new triple(1,2,3);
        System.out.println(z);
    }
}

```

[ 9 Marks ]

- (b) Write a new class `quadruple` which consists of two pairs. You should include a constructor which has four parameters all of type `int` and a `toString()` method, which calls the `toString()` of the class `pair`. Your `toString()` method should be such that the following program prints `[[1,2]], [[3,4]]`.

```
public class a
{
    public static void main(String[] args)
    {
        System.out.println(new quadruple(1,2,3,4));
    }
}
```

[ 8 Marks ]

- (c) Write three equality instance methods for pairs, triples, and quadruples respectively. Two such objects are equal if and only if all their components are equal.

[ 8 Marks ]

**QUESTION 4**

- (a) What is the output of the following program?

```

class b
{
    public static void main(String [] args)
    {
        int n=5;
        int a[] = new int [n];
        for (int i=0;i<n;i++)a[i]=i;
        for (int i=0;i<n;i++)
        {
            if (a[i]<a[j])
            {
                int t=a[i];
                a[i]=a[j];
                a[j]=t;
            }
        }
        for (int i=0;i<n;i++) System.out.println(a[i]);
    }
}

```

[ 9 Marks ]

- (b) (i) Give a boolean expression which evaluates to true if the variable *x* has the value 5 and which evaluates to false otherwise.
- (ii) Give a boolean expression which evaluates to true if the variable *x* has the value 1 or the value 6 and which evaluates to false otherwise.
- (iii) Give a boolean expression which evaluates to true if the variable *x* has the value 2 and the variable *y* has the value 4 and which evaluates to false otherwise.
- (iv) Give a boolean expression which evaluates to true if the variables *x*, *y* and *z* all have the different values and which evaluates to false otherwise.

[ 8 Marks ]

- (c) Write a method whose heading is

```
static String reverse(String s)
```

which reverses a String.

For example, `reverse("Java")` should return "avaJ".

[ 8 Marks ]

**QUESTION 5**

- (a) Explain briefly the purpose of the `import` statement in Java.
- (b) (i) Explain briefly the purpose of packages in Java.  
 (ii) Simplify the following java class by using an `import` statement.

```
class EchoNoImport
{
    public static void main(String[] args) throws java.io.IOException
    {
        java.io.BufferedReader in =
        new java.io.BufferedReader(new java.io.InputStreamReader(System.in));
        String s =in.readLine();
        System.out.println(s);
    }
}
```

[ 9 Marks ]

- (c) (i) In Java, four bytes are used to store the contents of a variable of type `int`. How many different values can a variable of type `int` have?  
 (ii) What is the output of the following program?

```
class A
{
    static void G()
    {
        int x=2;
    }

    public static void main(String[] args)
    {
        int x=3;
        G();
        System.out.println(x);
    }
}
```



(iii) What is the output of the following program?

```
class A
{
    static int x;

    static void G()
    {
        x=2;
    }

    public static void main(String[] args)
    {
        x=3;
        G();
        System.out.println(x);
    }
}
```

(iv) What is the output of the following program?

```
class A
{
    public static void main(String[] args)
    {
        int [ ] x= new int[3];
        int [ ] y = new int [3];
        for (int j=0;j<3;j++) { y[j]=17;}
        y=x;
        for (int i=0;i<3;i++) {x[i]=i;}
        System.out.println(y[1]);
    }
}
```

[ 8 Marks ]

(d) Assuming there is large list of words in a file called words (one word per line). Write a complete Java Program checker that acts as a spell checker.

java checker cat

should print out all words in file words that start with cat.

[ 8 Marks ]

**QUESTION 6**

- (a) (i) What is the output of the following program?

```
public class A
{
    public static void f(String s)
    {
        try
        {
            Integer.parseInt(s);
            System.out.println("good");
        }
        catch(Exception e)
        {
            System.out.println("bad");
        }
    }

    public static void main(String[] args)
    {
        f("MCMXIII");
    }
}
```

- (ii) What is the output of the following program?

```
public class A
{
    public static void main(String[] args)
    {
        int a=5;
        int b=26;
        a=b;
        b=a;
        System.out.println(b);
    }
}
```

- (iii) What is the output of the following program?

```

public class A
{
    public static void main(String[] args)
    {
        int a=7;
        int b=8;
        int c=b;
        b=a;a=c;
        System.out.println(a+" "+b);
    }
}

```

[ 9 Marks ]

- (b) (i) What is the output of the following program?

```

public class A
{
    static int f(int n)
    {
        if (n==0) return 1;
        else return n+f(n-1);
    }

    public static void main(String[] args)
    {
        System.out.println(f(6));
    }
}

```

- (ii) Write a method
- `static int fib(int n)`
- which returns the
- n*
- th Fibonacci number. The zeroth and first Fibonacci numbers are both 1 and all other Fibonacci numbers are the sum of the previous two Fibonacci numbers.

[ 8 Marks ]

- (c) One word is an anagram of another if the letters of one can be re-arranged to form the other. For example,
- learn*
- and
- renal*
- are anagrams, as are
- moat*
- and
- atom*
- . Note: a word is not an anagram of itself.

Write a method that takes two strings and returns true if one string is an anagram of another and false otherwise. You may need to write more than one method in order to achieve your solution.

Describe the algorithm you have used and the assumptions you have made (if any).

[ 8 Marks ]