

---

## 2910109 Introduction to Java and object-oriented programming

### Examination paper: Zone B

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) Explain the term *indentation* and why it is good to indent your programs properly.  
 (ii) What is the purpose of comments in a program and how are comments written in Java?  
 (iii) Briefly explain why the following program has a compilation error:

```
class f
{
    boolean x=5;
}
```

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

```
class f
{
    public static void main(String [ ] args)
    {
        System.out.println(1+2*3);
    }
}
```

[ 9 Marks ]

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

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

- (ii) Rewrite program *G* above using a *while* loop.

[ 8 Marks ]

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

[ 8 Marks ]

**QUESTION 2**

- (s) (i) Given that the ASCII code for the character **a** is 97, what is the ASCII code for the character **c**?

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

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

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

```
class ascii
{
    public static void main(String[] args)
    {
        System.out.print((char) 97);
    }
}
```

- (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();
        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<103 && x!=-1) System.out.print((char) x);
        }
    }
}

```

[ 8 Marks ]

- (c) Write a complete Java program that prints out the number of occurrences of each upper 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
{
    String first;
    String second;
    pair (String x, String y)
    {
        first=x;
        second=y;
    }
    public String toString()
    {
        return "<<" + first + "," + second + ">>";
    }
    public static void main(String [ ] args)
    {
        pair a = new pair("hello","world");
        System.out.println(a);
    }
}

```

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

```

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

```

- (b) Write a new class `quadruple` which consists of two pairs. You should include a constructor which has four parameters all of type `String` and a `toString()` method, which calls the `toString()` of the class `pair`. Your `toString()` method should be such that the following program prints `<<what,is>>,<<the,time>>`.

```
public class a
{
    public static void main(String[] args)
    {
        System.out.println(new quadruple("what","is","the","time"));
    }
}
```

[ 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) (i) What is the output of the following program?

```

class a
{
    public static void main(String [] args)
    {
        int[] a=new int[5];
        for(int i=0;i<5;i++)a[i]=i+1;
        for(int i=0;i<5;i++)System.out.println(a[i]);
    }
}

```

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

```

class b
{
    public static void main(String [] args)
    {
        int[] a=new int[5];
        for(int i=0;i<5;i++)a[i]=i+1;
        for(int i=0;i<5;i++)System.out.println(a[i]%2);
    }
}

```

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

```

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

```

[ 9 Marks ]

- (b) (i) Give a boolean expression which evaluates to true if the variable `x` has the value 1 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 2 and which evaluates to false otherwise.
- (iii) Give a boolean expression which evaluates to true if the variable `x` has the value 1 and the variable `y` has the value 2 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 same value 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("cat")` should return `"tac"`.

[ 8 Marks ]



## QUESTION 5

- (a) (i) Explain briefly the purpose of packages in Java.  
 (ii) Explain briefly the purpose of the import statement in Java.  
 (iii) Rewrite the following java class so it doesn't have any import statements.

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

[ 9 Marks ]

- (b) (i) Briefly describe the differences between arrays and Vectors.  
 (ii) Write Java code to produce a Vector *v* with two elements. The zeroth element of *v* is the String, "hello" and the next element of *v* is the Vector with only one element, the String "hello".

[ 8 Marks ]

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

`java check catapult`

should check whether the word `catapult` occurs in the dictionary. It should print `yes` if it finds the word and `no` if it doesn't.

[ 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("apple");
        }
        catch(Exception e)
        {
            System.out.println("orange");
        }
    }

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

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

```
public class A
{
    public static void main(String[] args)
    {
        int a=3;
        int b=4;
        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=3;
        int b=4;
        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
{
    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(4));
    }
}

```

- (ii) Write a recursive method static int power(int n,int m) which returns n to the power of m.

[ 8 Marks ]

- (c) (i) Define a class Date consisting of a Day, Month and Year. Write an instance method for the Date class which returns true if *this* date comes before the other Date which is supplied as a parameter to the method.
- (ii) Writing an expression which evaluates whether the 3rd February 1983 comes before a date d.

[ 8 Marks ]