

Java Programming Exercise

Terms related to Programming

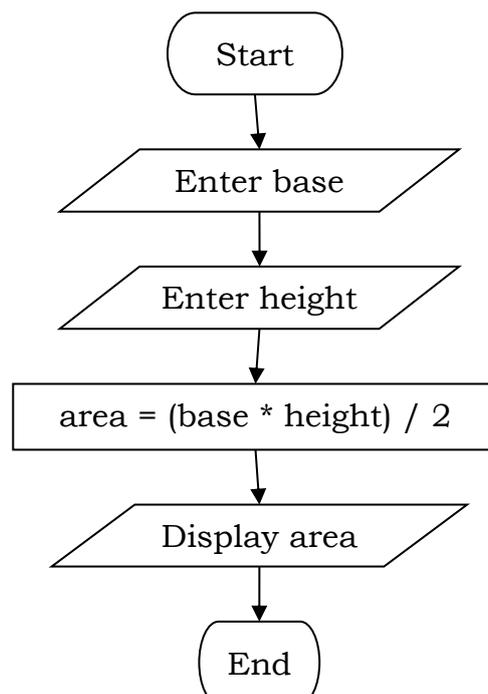
- 1) Define the terms: program, low-level language, high-level language, source code, machine code, compiler, and interpreter.
- 2) Describe and give one example of the following terms: keyword, operator, operand, identifier, syntax, semantics, and statement.

Terms related to Java

- 3) What is an applet and why is a Java applet secure?
- 4) What do we mean when we say that Java is portable?
- 5) A Java program is partly compiled and partly interpreted. Explain.
- 6) Describe the following: (a) IDE, (b) JDK.
- 7) Name two IDEs used for Java programming.

Flowcharts and Pseudocode

- 8) Explain the terms: algorithm, flowchart, and pseudocode.
- 9) Look at the flowchart below and answer the questions:
 - a) Explain what the algorithm represented by the flowchart is doing.
 - b) Express the flowchart in pseudocode.



- 10) Express the following program by means of (i) a flowchart and (ii) in pseudocode:

A program is given a value for the temperature in Centigrade. The program calculates its Fahrenheit equivalent and displays it on the monitor. The formula for the conversion from Centigrade to Fahrenheit is $F = C \times \frac{9}{5} + 32$.

- 11) Express the following program by means of (i) a flowchart and (ii) in pseudocode:

A program is given in input the value of a radius. It first calculates the area of circle with that radius ($A = \pi r^2$) and then calculates the volume of a sphere with the same radius ($V = \frac{4}{3} \pi r^3$). It then displays the results on the monitor.

About Java Programming

- 12) What is a comment and how is it performed in Java?
- 13)
- a) What is a Statement?
 - b) What do we write to tell Java to display “Hi There!” on the screen?
- 14) To input a value we are using the Keyboard class. On what is the condition can the Keyboard class be used.
- 15) What is the difference between print and println?
- 16) What is an escape sequence? Give two examples.
- 17) What is a variable?
- 18) What is a constant?
- 19) (a) What is a data type? (b) Give three examples of data types.
- 20) What is a variable declaration?
- 21) What do we mean when we say that a variable is initialized?
- 22) What is an assignment statement?

Starting to Program

- 23) Write the following two programs in Java.
- a) A program is given a value for the temperature in Centigrade. The program calculates its Fahrenheit equivalent and displays it on the

monitor. The formula for the conversion from Centigrade to Fahrenheit is $F = C * 9 / 5 + 32$.

- b) A program is given in input the value of a radius. It first calculates the area of circle with that radius ($A = \pi r^2$) and then calculates the volume of a sphere with the same radius ($V = \frac{4}{3} \pi r^3$). It then displays the results on the monitor.

Some more Definitions

- 24) Describe the terms (i) identifier, and (ii) keyword. Give two examples of keywords.
- 25) Java is case sensitive. What do we mean by this?

Types

- 26) Given the following declarations and say which assignment statements are correct and which are not.

```
int i;
double num;
boolean b;
char c;
String s;

i = 65;
i = 8.0;
num = 37.9;
i = 9.7;
b = false;
b = 7;
c = 't';
c = false;
s = "Mdina";
s = "Mdina!!!!";
i = 8 + 15;
num = 6 + 5.4 / 8.6;
c = '8';
s = "wind" + "mill";
```

Other Terms and some Expressions

- 27) What is the meaning of the following terms (i) Unicode, (ii) casting, (iii) arithmetic operators, (iv) increment and decrement operators, (v) operator precedence.
- 28) When we write a program we try to make it as readable as possible.
a) What do we mean by readability?

b) Name three things that you do so that your program is more readable.

29) Evaluate the following expressions:

- a) (int) 3.6
- b) 20 % 7
- c) 42.0 / 5.0
- d) 42 / 5

Shorthand Assignments

30) What is the meaning of the following (shorthand) assignment statement:

`x += 3`

The Math Class

31) What do we mean by the Math class?

32) Consider the following expressions and say what output you expect:

```
System.out.println ( Math.pow (2, 4) );
System.out.println ( (int) Math.pow (2, 4) );
System.out.println ( Math.random() );
System.out.println ( Math.random()*6 );
System.out.println ( Math.random()*6 + 1);
System.out.println ( (int) Math.random()*6 + 1);
System.out.println ( Math.ceil (7.3) );
System.out.println ( Math.ceil ( -7.3) );
System.out.println ( Math.floor (7.3) );
System.out.println ( Math.floor ( -7.3) );
System.out.println ( Math.round (7.3) );
System.out.println ( Math.round ( -7.3) );
```

Formatting Numbers

33) Write down what you expect the following program to display.

```
public class FormatNumbers
{
    public static void main ( String args[] )
    {
        double x = 58.68401;
        double y = -478.25694;
        int z = 8;

        System.out.println ( x );
        System.out.println ( y );
        System.out.printf ( "%.2f %n" , x );
        System.out.printf ( "%.3f %n" , y );
        System.out.printf ( "The value of z is %5d %n", z );
    }
}
```

```
System.out.printf ( "%10.2f %n" , x );
System.out.printf ( "%10.2f %5d %n" , x, z );
}
}
```

Conditional Statements

- 34) What is a conditional statement?
- 35) The following algorithm is expressed in pseudocode. Write it as a Java program.

```
begin
  display "Enter your age"
  enter A
  if A<18
    then display "You cannot drive"
    else display "You can drive"
end
```

- 36) A program receives in input a mark. If the mark is less than 50 the program displays the word "fail". Otherwise it displays the word "pass". Write this program in Java.

Nested Conditional Statements

- 37) A program receives in input a mark. If the mark is less than 45 it displays the word "fail". Otherwise if the mark is greater or equal to 80 it displays "distinction", if it is between 60 and 79 (inclusive) it displays "credit" or else it displays the word "pass".
 - a) Express this algorithm as a flowchart.
 - b) Write the program in Java.

Logical Operators

- 38) Which are the three logical operators? How are they written in Java?
- 39) Express the following program as a flowchart.

```
public class LogicalOperators
{
  public static void main (String args[])
  {
    int m;

    System.out.println ("Enter mark");
    m = Keyboard.readInt();
```

```

        if (m >= 80) System.out.println ("A");
        if (m < 80 && m >= 60) System.out.println ("B");
        if (m < 60 && m >= 45) System.out.println ("C");
        if (m <45) System.out.println ("F");
    }
}

```

Some if .. then .. else Problems

- 40) A program that is given three numbers and it displays the largest one. Write this program in Java.
- 41) A program receives three numbers and it decides whether they were entered in ascending order or not. Write this program.

The switch Construct

- 42) Write a program that asks the user to input a number from 1 to 12. The program then displays the month corresponding to the number for example if 3 is entered the program will display “March”. The program must also display “No corresponding month” if the number entered is not between 1 and 12.
- 43) Look at the program shown below.

```

class SwitchDemo2 {
    public static void main(String[] args)
    {

        int month;
        int year;

        System.out.println ("Enter month (integer)");
        month = Keyboard.readInt();

        switch (month)
        {
            case 1: case 3: case 5:
            case 7: case 8: case 10:
            case 12:
                System.out.println ("31");
                break;
            case 4: case 6:
            case 9: case 11:
                System.out.println ("30");
                break;
            case 2:
                System.out.println ("Enter year");
                year = Keyboard.readInt();

```

```

        if (((year % 4 == 0) && !(year % 100 == 0)) || (year % 400 == 0))
            System.out.println ("29");
        else
            System.out.println ("28");
        break;
    default:
        System.out.println("Invalid month.");
        break;
    }
}
}

```

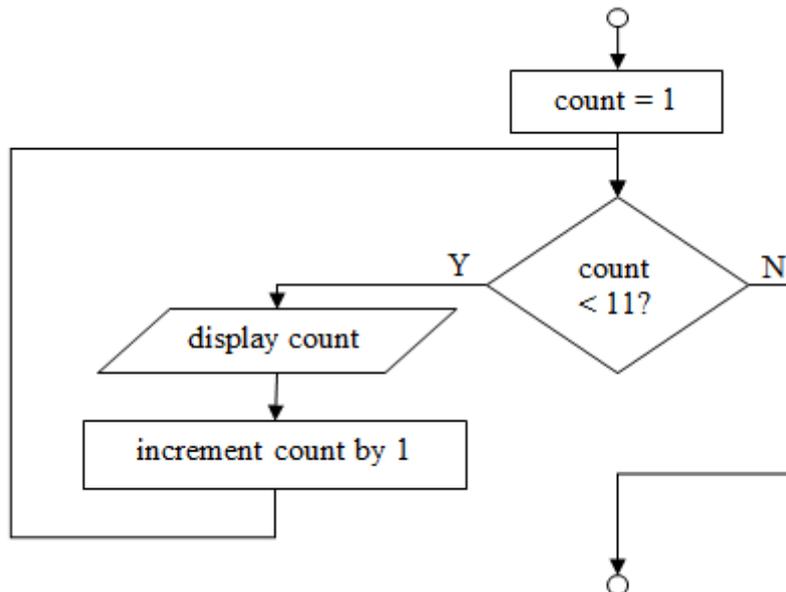
- a) Explain what the program is doing.
- b) Draw a flowchart for the program.

- 44) Can the value following the switch keyword be:
- a) an integer
 - b) a real
 - c) a character
 - d) a string?

Loops

- 45)
- a) In how many ways can you write a loop in Java?
 - b) What is the difference between these loops?

- 46) Refer to the diagram below.



- a) What is the algorithm performing?
- b) Implement the above algorithm as a Java program.

- 47) Write a program that displays the values 3, 6, 9 ... 36. Use the for-loop.

- 48) Write a program that displays the values 6, 11, 16 ... 66. Use the while-loop.
- 49) Write a program that is given a whole number n in input and then displays the first n multiples of 10 e.g. if it is given 3 it displays 10, 20, 30. Use the do-while loop.
- 50) Write a program that receives in input a sequence of numbers. When 0 is entered it means that there are no more numbers to input. The program finds the sum of the inputted numbers.
- 51) Write a program that generates a random number from 1 to 100. It asks the user to guess the number. The program outputs the message "Your number is greater than my number", "Your number is less than my number" or "You guessed the number. The program stops when the user finally guesses the number.
- 52) Write a program that receives in input a sequence of numbers. When 0 is entered it means that there are no more numbers to input. The program counts how many numbers have been entered. For example if the numbers 2, 5, 7 and 98 are entered the program outputs 4. The 0 is obviously not counted.
- 53) Write a program that asks the user to enter a number between 0 and 100. The program loops and keeps on asking the user for a number between 0 and 100 if the user keeps entering a number out of this range. The program stops when a valid number is entered.
- 54) Write a program that receives in input a sequence of numbers. When 0 is entered it means that there are no more numbers to input. The program finds the average of the inputted numbers. 0 is not counted as one of the numbers.
- 55) Find a program that receives in input a sequence of numbers. When 0 is entered it means that there are no more numbers to input. The program finds the total of the positive numbers and it ignores the negative numbers.

Arrays

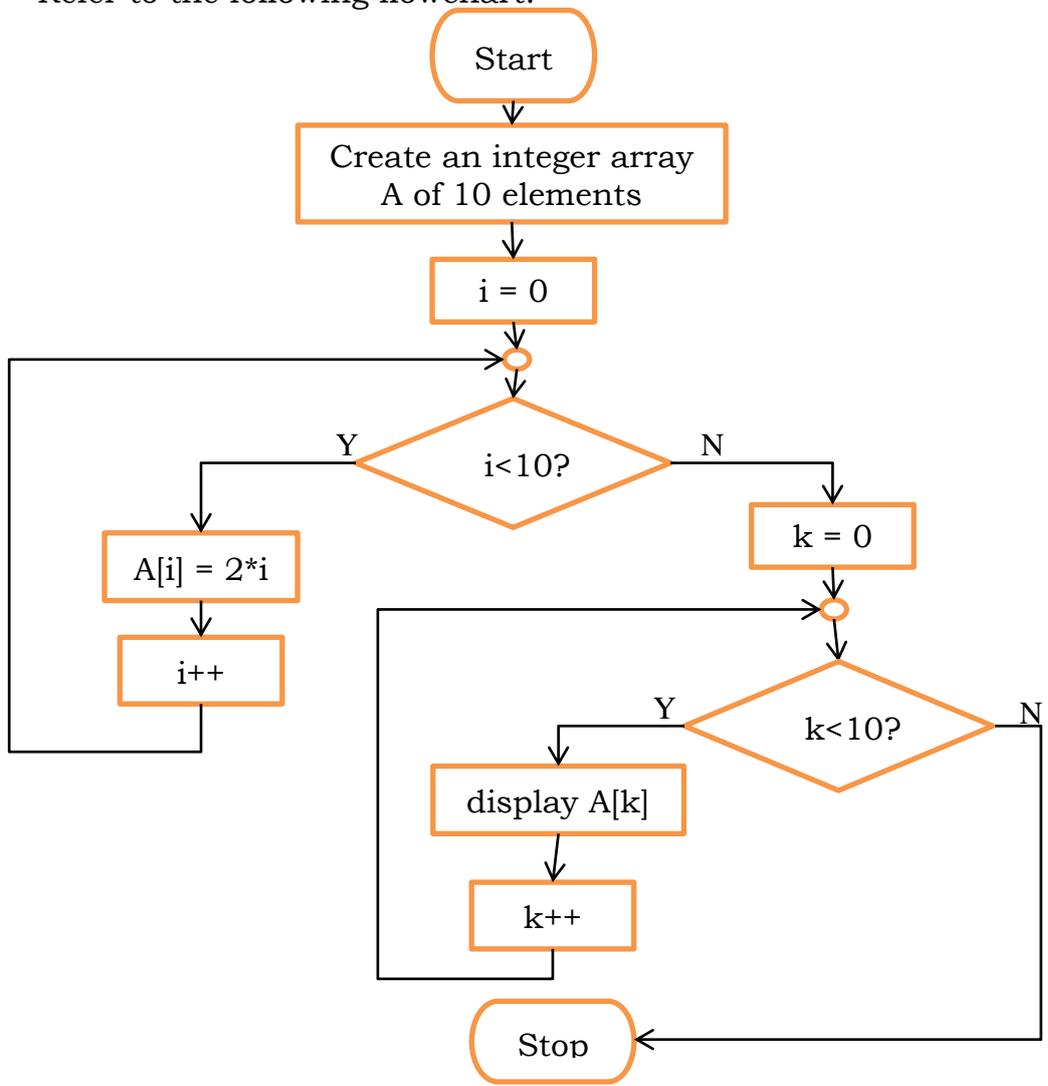
- 56) Describe what we mean by a:
 - a) one-dimensional array
 - b) multi-dimensional array
- 57) Suppose you want to declare a one-dimensional array named Numbers that contains 100 real numbers. How would you do this?
- 58) An array type is a reference type (not a primitive type). Why?
- 59) Consider the following array:

0	1	2	3	4	5	6	7	8	9
2	5	-4	7	8	0	-6	9	14	-8

array Num

- a) Evaluate the following expressions
- (i) Num[1] - 3
 - (ii) 2*Num[7] + Num[0]
 - (iii) Num [2+4]
- b) Show how the array will change after the following assignment statements are performed:
- (i) Num [7] = 3;
 - (ii) Num[4] = Num[2] + 9;
 - (iii) i = 6;
Num[i] = Num[i+1];
 - (iv) for (i=0; i<10; i++)
Num[i] = 2*Num[i]

60) Refer to the following flowchart.



- a) Explain what the algorithm is doing.
 - b) Write the program.
- 61) Write a program that fills an array of 10 integers with 10 random numbers in the range of 1 to 100. The program then displays these 10 random numbers.
- 62) Write a program that is given in input 10 numbers and the program first stores the numbers in an array and then calculates the total of the numbers in the array.
- 63) Study the following program and answer the questions.

```
public class Arrays
{
    static String names [ ] = new String [5];
    static int ages [ ] = new int [5];

    public static void main (String args[ ])
    {
        int aveAge;

        enterValues( );
        aveAge = averageAge( );
        System.out.println ("The average age is " + aveAge);
    }

    public static void enterValues ( )
    {
        for (int i=0; i<5; i++)
        {
            System.out.print ("Enter name: ");
            names[i] = Keyboard.readString( );
            System.out.print ("Enter age of " + names[i] + ": ");
            ages[i] = Keyboard.readInt( );
        }
    }

    public static int averageAge ( )
    {
        int ave;
        int tot = 0;

        for (int i = 0; i<5; i++)
            tot = tot + ages[i];

        ave = tot / 5;
    }
}
```

```
        return ave;
    }
}
```

- a) How many methods does the class Arrays have? Name these methods.
 - b) Add another method called `searchName()`. This method checks whether a given person is found in the array or not.
 - c) Add another method called `maximumAge()`.
 - d) Add another method called `nameOfOldestPerson()`.
 - e) Change the main method and make it show a menu with the options (1) Enter values, (2) Find average age, (3) Search a person (this option will say whether the given person is found in the array or not), (4) Find the maximum age, (5) Find who is the oldest person, (6) Exit program. This menu must be looped several times until the user decides to exit the program.
- 64) Mention two advantages and two disadvantages of arrays.
- 65) Write a program that implements a telephone directory. One array will hold names and another will hold the telephone numbers corresponding to the names. The following options will be offered by the program: (1) Insert a name (with its telephone number), (2) Delete a name, (3) List all names with their telephone numbers, (4) Search (for a telephone number given the name), (5) Exit.

Object-Oriented Programming

- 66) Explain the terms:
- a) class
 - b) object
 - c) method
 - d) method declaration (definition)
 - e) method call
 - f) parameters (formal and actual)
 - g) local variable
 - h) instance variable
 - i) class variable
- 67)
- a) Some methods return a value. Others do not. Explain.
 - b) Can a method return more than one value?
- 68) What is UML and why is it used?
- 69) Consider the following program and answer the questions below.

```

import java.util.Random;

public class Player
{
    String name;
    int pos = 0; //represents the position of the player on the board
    Random rand = new Random();

    private int throwDie( ) {
        int die;

        die = rand.nextInt(6) + 1;
        return die;
    }

    public void play () {
        int dieResult;

        dieResult = throwDie( );
        System.out.println ("The number on the die is " + dieResult);
        if (pos + dieResult <= 100)
            pos = pos + dieResult;
    }

    public void displayPosition () {
        System.out.println (name + " is on tile " + pos);
    }
}

public class Race
{
    public static void main (String args[ ]) {
        Player player1, player2, player3;
        String name1, name2;
        String pressEnter;
        boolean endOfGame = false;

        System.out.println ("RACE between two users and computer");
        System.out.println ("He or she or it that reaches 100 first is the winner!");
        System.out.println ();
        System.out.println ("Good Luck");
        System.out.println ();
        System.out.println ("Enter the name of the first player");
        name1 = Keyboard.readString();
        System.out.println ("Enter the name of the second player");
        name2 = Keyboard.readString();

        player1 = new Player( );
        player2 = new Player( );
        player3 = new Player( );

        player1.name = name1;
        player2.name = name2;
    }
}

```

```

player3.name = "Computer";

do {
    System.out.println ( );
    System.out.println (name1 + " press Enter to throw die");
    pressEnter = Keyboard.readString( );
    player1.play( );
    System.out.println ( );

    System.out.println (name2 + " press Enter to throw die");
    pressEnter = Keyboard.readString( );
    player2.play( );
    System.out.println ( );

    System.out.println (name1 + " or " + name2 + " press Enter to throw die");
    pressEnter = Keyboard.readString( );
    player3.play( );

    player1.displayPosition( );
    player2.displayPosition( );
    player3.displayPosition( );

    if ((player1.pos == 100) || (player2.pos == 100) || (player3.pos == 100))
        endOfGame = true;
}
while (endOfGame == false);
}
}

```

- a) In this program the programmer defined two classes. Which are they?
- b) Also, the programmer made use of other classes. Which are they?
- c) How many methods does the class Player have? Which are they?
- d) Which line in the class Race creates objects?
- e) Find a local variable in the program.
- f) Give an example of variable initialization.
- g) Show a conditional statement in the program.
- h) Explain what each of the following lines is doing:
 - (i) die = rand.nextInt(6) + 1;
 - (ii) player1.play();
- i) Explain what the program is doing.

70) Write a program following the steps shown below:

- a) Create a class called **bankAccount** that has the following data: **IDNumber**, **name**, **DOB**, and **amount** (meaning amount in bank by the particular customer). The class should have the following methods: **deposit (sum)**, **withdraw (sum)**, **addInterest**. The method addInterest works in this way: if the amount is positive then an interest of 4% is added to the amount. If the amount is negative

(meaning a debit) then an interest of 5% is added (meaning it increases the debit).

- b) Create a class called **bank** that performs the following:
 - (i) It creates three objects of type `bankAccount` (the data is entered by the user). Let us call these objects **cust1**, **cust1** and **cust3**.
 - (ii) Performs a withdrawal of 20€ from `cust1`, a deposit of 34€ by `cust2` and `addInterest` on the three customers.
 - (iii) Then it finds how much money in all there is in the bank.
 - (iv) It finally finds who has the largest sum of money in the bank.

71) Write a stock-control program as described here:

- a) A class called **item** is created. This class has to have the following data: **code**, **description**, **numberInStock**, **minimumNumber** and **price**. *minimumNumber* represents the minimum number that is allowed in stock before more items are ordered. The class has to have the following methods: **addItem**, **isMinReached**, and **modifyItem**. *addItem* can be used to add more items in stock and remove items from stock. *isMinReached* is a method that returns true if the minimum number of items is reached. *modifyItem* is used for example to change the price of the item.
- b) Another class called **stockControl** is created. This class makes use of an array that holds objects of type *item*. `stockControl` will hold the *main* method and this method offers the following options to the user:
 - (i) Add an item, (ii) Remove an item, (iii) List all items, (iv) List all items that need restocking, (v) Modify item and (vi) Quit program.