Standing Assignments – 50 Questions, all do-able!

Attempt the "easy" questions first, i.e. the questions which can be worked out using your present level of knowledge. This sort of activity is also called "gathering the low-hanging fruit"! As you progress further, gain more experience, you will be able to work out the other questions as well.

1) Consider the polynomial:

$$Z = X^4 + X^3Y + X^2Y^2 + XY^3 + Y^4$$

Write a Java program that prints values of Z for X on the interval [-3, 4] and Y on the interval [-5, 6]. X and Y are incremented in steps of 0.1 and 0.2 respectively. Your program should output the maximum and minimum values of Z.

2) Write a Java program to find the number of terminal zeroes and the number of digits in the expansion of 1001! (1001 factorial).
3) Write a program which prints the number 9 nine times in the first row, the number 8 eight times in the second row, the number 7 seven times in the third row, and so on down to 1, which it prints once.
4) Write a program which reads a number with a decimal point, and prints the number of digits before and after the decimal point. Modify your program so that it reports the fractional part of the number as being greater than 0.5, equal to 0.5, or less than 0.5.
5) Write a program to read int numbers, one per line, until a negative number is entered. Your program should print the average of the even numbers and the average of the odd numbers.
6) Write a program which prints all the integers from 1 to 1001, except those which are multiples of 7 or 11.
7) Write a program which reads six ints a, b, c and d, e, f. Now consider the two straight lines with equations: ax + by = c and dx + ey = f. Your program should report whether the lines are parallel, co-incident or intersecting. If they intersect, print the intersection point.
8) Write a program which accepts three integers a, b and c which may be negative or positive. Your program should return the roots of the quadratic equation with coefficients a, b and c, stating clearly if the roots are real, distinct, or imaginary.
9) The marks of students in a College exam are listed in a file called marks.dat. One line contains one mark, ranging between 0 and 100.

Test scores are assigned as follows:

Marks >= 90	A
80 <= Marks < 90	B
65 <= Marks < 80	C
50 <= Marks < 65	D
Marks < 50	F

Write a Java program which reads the file marks.dat, and reports:

1) The number of students who received A, B, C, D and F grades, respectively.
2) The percentage of students receiving each letter grade.

Test your program by creating a 30-line test file containing 30 marks between 0 – 100.

10) Compound interest is calculated using the formula $A = P (1 + R / 100.0)^T$, where the symbols have their usual meanings. The interest at the end of T years is A – P. Suppose a fixed deposit is opened with a principal of Rs. 525000 @ 8.5% compound interest for 10 years. Print a table showing the interest accruing at the end of each year.
11) Write a program which reads int numbers entered from the keyboard, one number per line, until a negative number is entered. Your program should print the largest and smallest values entered, as well as the average of the even numbers, and the average of the odd numbers.
12) Two int arrays of dimension 20 are filled with non-zero integer numbers. Write a program which determines how many numbers are common to both arrays.
13) Two int arrays of dimension 20 are filled with non-zero integer numbers. Write a program which creates an array of dimension 40, and loads it alternately with numbers from each array.
14) Write a program to determine the second largest number in an array containing 20 ints.
15) Write a program to read a string of length "n" characters from the keyboard, where n is arbitrary but less than 50. The program then asks the user to input a number less than n, say "m". The program then prints the same string with the m^{th} character deleted.
16) Write a program to read a string consisting only of lowercase letters and spaces. The program then replaces each letter by the next letter in the alphabet, thus: a -> b, b -> c, c -> d … z -> a.
17) Write a program which asks the user for a positive int "n" to be read from the keyboard, allocates space for "n" ints, and fills this space with the first "n" odd numbers.
18) An arbitrary number of doubles is typed on the command line of an executing program. The program reports the average of the numbers passed, as well as the largest and the smallest of the numbers.
19) A string (for example a sentence such as "the quick brown fox jumps over the lazy dog") is passed in the command line of an executing program. The program prints the longest word (or words) in the sentence.
20) Write a program which accepts the x- and y- co-ordinates of three points, and determines the perimeter of the triangle formed by them.
21) Write a program which accepts three positive doubles from the keyboard, decides if they can form the sides of a triangle, and then returns the three angles of the triangle. [Use the cosine formula: $a^2 = b^2 + c^2 – 2bc\ CosA$.]
22) Write a program which calls a function with parameter pointer to int which accepts an array of 50 marks, and returns the array sorted in descending order.
23) Write a program in which a string consisting of an arbitrary sequence of 0's and 1's, for example:

"10111010111011101100011111"

is passed to a function by the main () program. The function returns an object which can be queried to report the number of 0's and 1's in the string.

24) Write a program in which the string "Now I know a spell unfailing" is given in the command line of an executing program. The program types the following digits when <Enter> is pressed "314159". Here each separate digit is the number of letters in consecutive words of the string.

25) Write a complete program which accepts three ints a, b and c from the keyboard, which are the coefficients of a quadratic equation such that $b^2 > 4ac$. (The program keeps looping until the condition is met.) Further, the program calls a function named quadratic () which uses these numbers and returns the two roots of the equation according to the formulas $(– b + \text{sqrt} (b^2 - 4ac)) / (2a)$ and $(–b - \text{sqrt} (b^2 - 4ac)) / (2a)$.

26) A leap year is defined as a year which is divisible by 4 and not divisible by 100, or which is divisible by 400. Write a function int days (int dd, int mm, int yy) returns the number of days from January 1 up to the (and including) the date passed. (Your program should work for both leap and non-leap years.)

27) Write a program which prompts the user to enter a single digit from the keyboard, for example 7. main () passes this digit to a function void doIt (int sum). This function sets the string to "seven" and the value of sum to 28, being the sum of the first 7 numbers (1 + 2 + 3 + 4 + 5 + 6 + 7).

28) Write a program to determine if a string of digits (length <= 5) which is read in can comprise an octal number. If so, the program should return the decimal value of the number.

29) Write a program to determine if a string of letters and digits (length <= 5) which is read in can comprise a hexadecimal number. If so, the program should return the decimal value of the number.

30) An int array of dimension 20 contains only the ints 0 or 1 in its 20 elements. The array is passed by main () to a function int decimalValue (int [] array). The function returns the decimal value of the number formed by the ordered sequence of the binary digits in the array.

31) Write a function that accepts a sequence four bits and returns (via an appropriately constructed object) the octal, decimal and hexadecimal values encoded by the bits.

32) Write a function void splitter (String str) which accepts a string comprising an even number of characters, and returns on object built of two strings formed from the given string by splitting it in the middle.

33) Write a function void splitter (int x) which accepts an int comprising of an even number of eight or fewer digits, and returns an object comprised of two ints formed by splitting it in the middle.

34) A string of arbitrary length and consisting only of the lowercase alphabetical characters is given to you, for example:

"qwsdefwugvdcerihfawvbnehsttyuioplkjhgfdsazxugbcvblohnmnhtojhgdsvbfcde"

An int array numbersOfLetters [26] is also given. Write a program which populates the array with the number of a's b's, c's etc. present in the string. Thus numbersOfLetters [0] is 2, because 2 a's are present, and numbersOfLetters [25] is 1 because only 1 'z' is present.

35) A string of arbitrary length and consisting only of the digits 0, 1, 2, 3, …, 9 is given to you, for example:

"754397530927654891905478146929846385440098521367547098149 03"

An int array numbersOfDigits [10] is also given. Write a program which populates the array with the number of 0's 1's, 2's etc. present in the string. Thus numbersOfDigits [9] is 7, because 7 9's are present, and numbersOfDigits [7] is 6 because 6 7's are present.

Use your array to find the sum of the digits present in the string.

36) Write a Java program which does the following: A string is passed to a function. The function returns the string formed by removing its last character and placing it at the front of the string.

37) A string and two different ints i, j (>= 0) are passed to a function. The function returns the string formed by interchanging the characters at the ith and jth positions in the string.

38) Write a function which accepts a date String such as "2-05-1949" and returns a String which contains the month number instead of the month name: 2 May 1949.

39) Write a Boolean function which accepts a date String such as "2-05-1949" and returns true if the date is valid, false if otherwise. For a valid date use Zeller's congruence to return the day of the week which falls on the given date. (Look up Zeller's congruence in Wikipedia or elsewhere.)

40) Create a class Date which incorporates the methods specified in questions 38 and 39 above. Include in it a function int diffDate (Date d1, Date d2) which returns the difference of days between d1 and d2. [Hint: You will need to use the knowledge gained by solving (26) above.]

41) Write a Java Program to find the sum of digits in the expansion of 4444^{4444}.

The following are typical MidTerm or Final Exam questions. Make sure you can solve them.

42) Here are two versions of a simple program. Which one of these will compile without error? Remember, x is an int.

```
public class TestVersion1
    {

      public static void main (String [] args)
          {
            int x = 5.5;
            x += 3.7;
            System.out.println (x);
          }
    }
```

```
public class TestVersion2
    {

      public static void main (String [] args)
          {
            int x = 5;
            x += 3.7;
            System.out.println (x);
          }
    }
```

43) What is the value of x after each of the following statements is executed?
    int x = (int) 1.8;
    int x = Math.round (1.8);

44) Give the output when the following statements are executed:
    int n = 27; // 11011 in binary
    System.out.println ((n & (1 << 3)) >> 3);

45) Give the output when the following statements are executed:
    System.out.println (3 & 4);
    System.out.println (3 | 4);
    System.out.println (~ 3);
    System.out.println (3 ^ 4);

46) Will the following statement compile?
    float f = 1.2;

47) Which of the following statements is in error?
    A) Integer x = new Integer (5);
    B) Integer y = new Integer ("5");
    C) Integer z = 5;
    D) Integer w = new Integer ();
    E) More than one statement is in error.

48) Which of the following is incorrect? (Assume java.math has been imported.)
    A) BigInteger x = new BigInteger (1234);
    B) BigInteger y = new BigInteger ("5567");
    C) BigDecimal z = new BigDecimal (1234);
    D) BigDecimal w = new BigDecimal ("5.567");
    E) All are correct.

49) Consider the following statements:
    1) Integer x = 5;
    2) Integer y = 5;
    Then the expression x == y returns:
    A) true B) false

50) Which of the following declarations is correct:

[A] int numbers [] = (1, 2, 3, 4, 5);

[B] int [] numbers = (1, 2, 3, 4, 5);
[C] int numbers [] = {1, 2, 3, 4, 5};
[D] int numbers [] = 1, 2, 3, 4, 5;
[E] None of the above.