Java Programming (COMP217009)

Spring, 2020

Instructor: Sangtae Ahn

Programming Assignment

- The first line in all your codes should type your student ID and name as a comment.

  ex) // 20201234 Sangtae Ahn

- Your code should satisfy all the given conditions. If you have made any assumptions, specify them in your codes as comments.

Q1. (20 points) Write a Java program that displays the following diamond-shaped asterisks.

1) Use the Scanner class to get an input for the number of lines.
2) Use loops to display asterisks.
3) File Name: “Q1_Diamond.java”

```
How many lines? 5
  *
 ***
*****
 ***
  *
```

```
How many lines? 8
   *
  ***
 *****
*******
*******
 *****
  ***
   *
```

```
How many lines? 11
    *
   ***
  *****
 *******
*********
***********
*********
 *******
  *****
   ***
    *
```

```
How many lines? 14
     *
    ***
   *****
  *******
 *********
 ***********
**************
**************
 ***********
 *********
  *******
   *****
    ***
     *
```

Q2. (20 points) Write a Java program that prompts the user to enter the year and first day of the year and displays the calendar table for the year (January to December). For example, if the user entered the year *2020*, and *3* for Wednesday, January 1st, 2020 (Monday: 1, Tuesday: 2, Wednesday: 3, Thursday: 4, Friday: 5, Saturday: 6, Sunday: 7), your program should display the calendar for each month in the year, as follows.

```
Enter a year: 2020
Enter the first day of the year: 3
          January 2020                          Feburary 2020
-----------------------------          -----------------------------
 Sun Mon Tue Wed Thu Fri Sat            Sun Mon Tue Wed Thu Fri Sat
                   1   2   3   4                                  1
   5   6   7   8   9  10  11              2   3   4   5   6   7   8
  12  13  14  15  16  17  18              9  10  11  12  13  14  15
  19  20  21  22  23  24  25             16  17  18  19  20  21  22
  26  27  28  29  30  31                 23  24  25  26  27  28  29

                                  …

          November 2020                         December 2020
-----------------------------          -----------------------------
 Sun Mon Tue Wed Thu Fri Sat            Sun Mon Tue Wed Thu Fri Sat
   1   2   3   4   5   6   7                      1   2   3   4   5
   8   9  10  11  12  13  14              6   7   8   9  10  11  12
  15  16  17  18  19  20  21             13  14  15  16  17  18  19
  22  23  24  25  26  27  28             20  21  22  23  24  25  26
  29  30                                 27  28  29  30  31
```

1) Use the Scanner class to get a year and the first day of the year.
2) Use *switch-case* statements.
3) Display calendars of the year from January to December
4) File Name: “Q2_Calendar.java”

Q3. (20 points) Write a Java program that computes the mean and standard deviation using the following equations.

$$\text{mean} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

$$\text{standard deviation} = \sqrt{\frac{\sum_i^n (x_i - mean)^2}{n-1}}$$

1) Use a single array to store numbers (array size: 10).
2) Use the Scanner class to get numbers in a single array.
3) Use methods. Your program should contain the following methods:

   public static double deviation(double[] x)
   public static double mean(double[] x)

   Tip: use Math.sqrt and Math.pow

4) Here is a sample run.

```
Enter ten numbers: 1 0.5 2.1 3.4 2.8 5.5 7.5 0.4 3.5 4.2
The mean is 3.09
The standard deviation is 2.263944443762798
```

5) File Name: "Q3_MeanSTD.java"

Q4. (20 points) Nine coins are placed in a *3-by-3* matrix with some face up and some face down. You can represent the state of the coins using a *3-by-3* matrix with values 0 (heads) and 1 (tails). Here are some examples:

```
0 0 0    1 0 1    1 1 0    1 0 1    1 0 0
0 1 0    0 0 1    1 0 0    1 1 0    1 1 1
0 0 0    1 0 0    0 0 1    1 0 0    1 1 0
```

There are a total of 512 possibilities, so you can use decimal numbers 0, 1, 2, 3,…, and 511 to represent all states of the matrix.

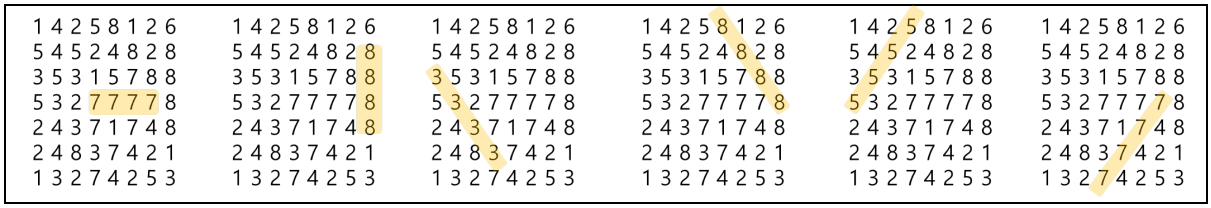
Write a Java program that prompts the user to enter a number between 0 and 511 and displays the corresponding matrix with the characters **H** and **T**. Here is a sample run:

```
Enter a number between 0 and 511: 0
H H H
H H H
H H H

Enter a number between 0 and 511: 1
H H H
H H H
H H T

Enter a number between 0 and 511: 2
H H H
H H H
H T H

Enter a number between 0 and 511: 15
H H H
H H T
T T T

Enter a number between 0 and 511: 250
H T T
T T T
H T H

Enter a number between 0 and 511: 400
T T H
H T H
H H H

Enter a number between 0 and 511: 510
T T T
T T T
T T H

Enter a number between 0 and 511: 511
T T T
T T T
T T T
```

1) Use the Scanner class to get an input number between 0 and 511.

2) File Name: “Q4_Coins.java”

Q5. (20 points) Write a program that finds how many four consecutive numbers of the same value, either horizontally, vertically, or diagonally the given matrix contains. For example, the following matrix has 1 horizontal line, 1 vertical line, and 4 diagonal lines for four same numbers consecutively.



1) Use the following matrix (8-by-7).

2	1	1	6	1	0	0
2	1	1	7	6	0	1
1	1	7	1	6	1	1
9	7	6	0	1	1	6
7	9	1	1	6	9	0
7	5	9	2	2	2	0
7	5	9	9	9	9	0
7	1	1	1	1	0	0

2) Use loops and methods.

3) Display:
the given matrix
# of horizontal lines
# of vertical lines
# of diagonal lines

4) Here is a sample run with a different matrix

```
1 1 1 7 5 5 2
5 1 1 7 7 0 2
1 1 7 1 6 7 2
9 5 6 2 1 2 7
2 9 1 1 6 9 7
1 5 9 9 9 9 7
7 5 9 9 2 1 7
3 1 0 2 9 0 6

# of horizontal lines : 1
# of vertical lines : 1
# of diagonal lines: 4
```

5) File Name: “Q5_Numbers.java”