CS102A Introduction to Computer Programming
Fall 2020
Lab 4

Objectives

1. Learn how to use the `do`…`while` loop to repeatedly execute code blocks in a program.
2. Learn how to use the `switch` selection statement to choose one of multiple code blocks to be executed.
3. Learn how to use the `break` and `continue` statements in a program.

1 Exercises

1.1 Exercise 1

Just like Exercise 5 in Lab 3, you are asked to write a program that approximates the value of π using the infinite series $\pi = 4 - 4/3 + 4/5 - 4/7 + 4/9 - 4/11 + \ldots$. This time, use `for` loops to estimate the value of π according to the specified number of iterations and precision threshold.

Think

When is it more suitable to use `for` rather than `while` loops? Similarly, when would the latter be better?

The user will input:

- An integer `n` representing the number of terms in the above formula. The estimated value of π is more precise when `n` is bigger.

- A double value representing a precision threshold. Your program should terminate when the difference between two successive iterations is smaller than the precision threshold. Print the value of π and the number of iterations.

1.2 Exercise 2

Recall Exercise 2 in Lab 3. You are asked to write a program that calculates a student's GPA according to the method used by SUSTech:

Grade	GPA
100–90	4.0
89–80	3.0
79–70	2.0
69–60	1.0
59–0	0

Concretely, the user will input the number of credits and score for each course. The data entry process should continue until the user inputs `-1`. Based on the input data, the program will output the student's final GPA; use `switch` to compute the GPA.

Sample output:

```
3 95
2 89
3 77
3 67
1 95
-1
The final GPA is 2.6
```

Think

When could `if`…`else` be replaced by `switch`?

1.3 Exercise 3

There are 30 or 31 days in a month, except February. There are 28 days in February in a common year, and 29 days in a leap year. Write a program where the user will input the year and month via the command line, and the program will print how many days this month has using `switch`.

Recall that a year is a leap year if it is:

1. Divisible by 4, but not divisible by 100; or
2. Divisible by 400.

You are asked to use `DaysofYearMonth` as the class name and `DaysofYearMonth.java` as the file name. The following code template is provided to you:

```
public class DaysOfYearMonth {
    public static void main(String[] args) {
        int year = Integer.parseInt(args[0]);
        int month = Integer.parseInt(args[1]);
        String monthName = "";
        int days = 0;
        boolean isLeapYear = false;
        if ( /*fill in the control statement here */   ) {
            isLeapYear = true;
        } else {
            isLeapYear = false;
        }
        switch (month) {
            /* fill in the cases below */
            case 1:
                days = 31;
                monthName = "January";
                break;
            case 2:
            case 3:
            case 4:
```

```
            case 5:
            case 6:
            case 7:
            case 8:
            case 9:
            case 10:
            case 11:
            case 12:
            default:
                System.out.println("Error!");
                break;
        }
        System.out.printf("%s of %d has %d days.\n", monthName,
           year, days);
    }
}
```

Sample inputs and outputs:

```
> java DaysOfYearMonth 2019 3
March of 2019 has 31 days.

> java DaysOfYearMonth 2019 2
February of 2019 has 28 days.

> java DaysOfYearMonth 1900 2
February of 2019 has 28 days.

> java DaysOfYearMonth 2000 2
February of 2019 has 28 days.
```

1.4 Exercise 4

Recall the 9×9 multiplication table in Exercise 3 from Lab 3. Modify the program so that it:

1. Can display a multiplication table of any given size in $\{1, \ldots, 9\}$;
2. Keeps running until the user inputs `0`; and
3. Warns the user in case of invalid input.

You are asked to use `break` and `continue` statements to complete this exercise.

Sample output:

```
Please input a number to print the Multiplication Table [0 to
terminate]:
-4
Please input a number between [1,9]
Please input a number to print the Multiplication Table [0 to
terminate]:
1
1 * 1 =  1
Please input a number to print the Multiplication Table [0 to
terminate]:
3
1 * 1 =  1
1 * 2 =  2  2 * 2 =  4
1 * 3 =  3  2 * 3 =  6  3 * 3 =  9
Please input a number to print the Multiplication Table [0 to
terminate]:
9
1 * 1 =  1
1 * 2 =  2  2 * 2 =  4
1 * 3 =  3  2 * 3 =  6  3 * 3 =  9
1 * 4 =  4  2 * 4 =  8  3 * 4 = 12  4 * 4 = 16
1 * 5 =  5  2 * 5 = 10  3 * 5 = 15  4 * 5 = 20  5 * 5 = 25
1 * 6 =  6  2 * 6 = 12  3 * 6 = 18  4 * 6 = 24  5 * 6 = 30  6 * 6
 = 36
```

```
1 * 7 =  7  2 * 7 = 14  3 * 7 = 21  4 * 7 = 28  5 * 7 = 35  6 * 7
 = 42  7 * 7 = 49
1 * 8 =  8  2 * 8 = 16  3 * 8 = 24  4 * 8 = 32  5 * 8 = 40  6 * 8
 = 48  7 * 8 = 56  8 * 8 = 64
1 * 9 =  9  2 * 9 = 18  3 * 9 = 27  4 * 9 = 36  5 * 9 = 45  6 * 9
 = 54  7 * 9 = 63  8 * 9 = 72  9 * 9 = 81
Please input a number to print the Multiplication Table [0 to
terminate]:
0
```