Programming 1

Lecture 5 – Switch, String Operations & Static Methods

Faculty of Information Technology
Hanoi University

Contents

- Common loop mistakes
- The **switch** statement
- **String** operations
- Static methods (functions)

Common mistakes with Loops

```
for (int i = 1; i < 10; i++);
{
    System.out.println(i);
}
```

- **Do not** put a semicolon (`;`) at the end of a `for` loop's header

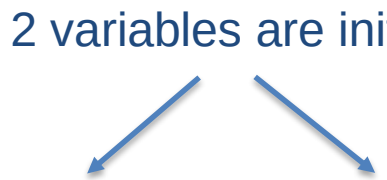
Common mistakes with Loops

```
int n = 1;
while (n < 10);
{
    System.out.println(n);
    n++;
}
```

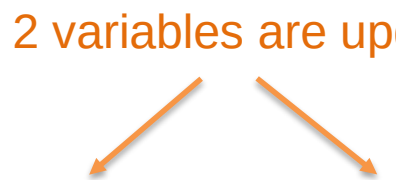
- Also, **do not** put a semicolon (`;`) at the end of a `while` loop's header

for loop initialization & update

- A for loop can perform more than one initialization and update
  - Simply separate the actions with commas (,)
- Examples:




```
for (n = 1, product = 1; n <= 10; n++)
    product = product * n;
```




```
for (i = 1, n = 1; i < 10; n = n * i, i++) {
    // ...
}
```

The `switch` statement

- The `switch` statement is often used to replace an `if…else` chain. Here is an example:

```
int n = sc.nextInt(); // read from keyboard
if (n == 1) {
    System.out.println("1st");
} else if (n == 2) {
    System.out.println("2nd");
} else if (n == 3) {
    System.out.println("3rd");
} else {
    System.out.println(n + "th");
}
```

The `switch` statement

- This `if…else` chain is used to specify the program's behavior for many cases of `n`.
- The first block whose condition returns a true value gets executed.

```
int n = sc.nextInt(); // read from keyboard
if (n == 1) {
    System.out.println("1st");
} else if (n == 2) {
    System.out.println("2nd");
} else if (n == 3) {
    System.out.println("3rd");
} else {
    System.out.println(n + "th");
}
```

The `switch` statement

- If no boolean expression evaluates to true, the `else` block will get executed.

```
int n = sc.nextInt(); // read from keyboard
if (n == 1) {
    System.out.println("1st");
} else if (n == 2) {
    System.out.println("2nd");
} else if (n == 3) {
    System.out.println("3rd");
} else {
    System.out.println(n + "th");
}
```

The `switch` statement

- The equivalent `switch` statement of that `if…else` chain.

```
int n = sc.nextInt(); // read from keyboard
switch (n) {
     case 1:
          System.out.println("1st");
          break;
     case 2:
          System.out.println("2nd");
          break;
     case 3:
          System.out.println("3rd");
          break;
     default:
          System.out.println(n + "th");
}
```

The `switch` statement

- However, the `switch` statement does not work the same way as an `if…else` chain.
- To see the difference, let's remove all `break` statements.

```
int n = 2;
switch (n) {
     case 1:
          System.out.println("1st");
     case 2:
          System.out.println("2nd");
     case 3:
          System.out.println("3rd");
     default:
          System.out.println(n + "th");
}
```

The `switch` statement

```
int n = 2;
switch (n) {
     case 1:
          System.out.println("1st");
     case 2:
          System.out.println("2nd");
     case 3:
          System.out.println("3rd");
     default:
          System.out.println(n + "th");
}
```

Output:

```
2nd
3rd
2th
```

But why?

`n` is `2` so shouldn't it print out only `"2nd"`?

The `switch` statement

```
int n = 2;
switch (n) {
     case 1:
          System.out.println("1st");
     case 2:
          System.out.println("2nd");
     case 3:
          System.out.println("3rd");
     default:
          System.out.println(n + "th");
}
```

Output:

```
2nd
3rd
2th
```

It turns out that it is called a switch for this reason.

The `switch` statement

```
int n = 2;
switch (n) {
     case 1:
          System.out.println("1st");
     case 2:
          System.out.println("2nd");
     case 3:
          System.out.println("3rd");
     default:
          System.out.println(n + "th");
}
```

Output:

```
2nd
3rd
2th
```

The first case that is equal to n turns the switch on.
From that point, every statement is executed regardless of case.

The `switch` statement

```
int n = 2; // a hard-coded value
switch (n) {
     case 1:
          System.out.println("1st");
          break;
     case 2:
          System.out.println("2nd");
          break;
     case 3:
          System.out.println("3rd");
          break;
     default:
          System.out.println(n + "th");
}
```

A break statement can prevent other cases to be executed.

The break statement breaks out of switch, just like what is does to a loop.

Part 3

More about String

Escaping special characters

- The backslash \ is the escape character.
  - Some special characters must be escaped in strings.

Sequence	Meaning
\t	Tab character
\b	Backspace character, will remove a previous character
\"	The double quote
\n	Newline character
\\	The backslash character itself

```
"She said \"Hello!\" to me."
```

She said "Hello" to me.

```
"I'm gonna take\b\b\b\bgive your\b money."
```

?

```
"C:\\Temp\\Secret.txt"
```

C:\Temp\Secret.txt

String comparison

- Use **String.equals()** method to compare 2 Strings (case-sensitive)

```
String s = "Hello";
boolean b1 = s.equals("Hello"); // true
boolean b2 = s.equals("hello"); // false
```

- Use **String.equalsIgnoreCase()** method to compare 2 Strings (case-insensitive)

```
String s = "Hello";
boolean b1 = s.equalsIgnoreCase("Hello"); // true
boolean b2 = s.equalsIgnoreCase("hello"); // true
```

Find a String within another String

- **s1.indexOf(s2)** returns the position of String s2 in String s1.

```
String s1 = "Welcome to FIT";
int pos = s1.indexOf("come");
System.out.println(pos);
System.out.println(s1.indexOf("greeting"));
System.out.println(s1.indexOf("fit"));
System.out.println(s1.indexOf("Wel"));
```

Output:

```
3
-1
-1
0
```

More String operations

Method name	Description
`startsWith(`**`prefix`**`)`	Tests if a string starts with the specified prefix.
`endsWith(`**`suffix`**`)`	Tests if a string ends with the specified suffix.

```
boolean b = "Hello".startsWith("He");
```

```
true
```

```
boolean b = "Hello".endsWith("abc");
```

```
false
```

More String operations

Method name	Description
`compareTo(`**`str`**`)`	Compares two strings alphabetically.

```
String s1 = "Apple";
String s2 = "Banana";
String s3 = "Cars";
int order = s1.compareTo(s2); // -1, s1 < s2 by 1
int order2 = s1.compareTo(s3); // -2, s1 < s3 by 2
int order3 = s3.compareTo(s1); // 2, s3 > s1 by 2
```

Here, the comparison is based on the first character that is different.
0 if two Strings are exactly the same.
1 or -1 of one String is the subset of the other String.

More String operations

Method name	Description
`trim()`	Returns a copy of the string, with leading and trailing whitespaces omitted.

```
String s = "    Hi, dad!    ";
System.out.println(s + " I'm back!");
System.out.println(s.trim() + " I'm back!");
```

Output:

```
    Hi, dad!    I'm back!
Hi, dad! I'm back!
```

Java methods

- **Definition:** A method is a block of code which only runs when it is called.

Methods in a Java program

```
public class MyApp {
    public static int getPositiveInt() {
        Scanner sc = new Scanner(System.in);
        int x = 0;
        do {
            try {
                x = sc.nextInt();
            } catch (Exception e) {
                sc.nextLine();
            }
        } while (x <= 0);
        return x;
    }
    public static void main(String[] args) {
        int a = getPositiveInt();
        System.out.println(a);
    }
}
```

About Java methods

- You can write your own methods!
- Writing a method is like inventing a new Java statement yourself!
- Methods in Java are similar to functions in other languages (similar, not the same).
- Divide a complex program into smaller modules
  - Much easier to debug each part than an entire big program.
  - Better organize your program, making development easier.
  - If a piece of code is used multiple times, putting it in a method results in shorter source code.

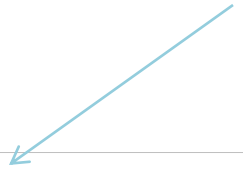
Method execution

- A method only runs when it is called.
  - Methods are called by their names.
  - A method can be called multiple times.

- The **`main`** method is an exception. It runs when the program starts.
  - Inside the **`main`** method, we can write statements to call other methods.

Using non-static methods

sc is an instance of class Scanner



Correct use:

```
Scanner sc = new Scanner(System.in);
int x = sc.nextInt();
```

Incorrect use:

```
int x = Scanner.nextInt();
```

Notes on the methods we use

- Some familiar static methods:
  - `Math.sqrt(), Math.pow(), Integer.parseInt()`
- A `static` method is called from the **name** of the class that contains it.
- Some familiar non-static methods:
  - Scanner.nextInt(), String.substring(), String.charAt()…
- A non-static method is called from an **instance** of the class that contains it.

Notes on the methods we use

- Within a class, methods can be called using only the method name (without class name or instance).
  - In a `static` method (or `static` context), we can only directly call other `static` methods.
  - In a non-static method, we can call both static and non-static methods by name.
- The `main` method is `static`, so it can only call other `static` methods within the same class.
  - That's why, for the time being, for simplicity, all methods that we create will be `static`.

Return

- To run/trigger a method, write its name like so:

```
getPositiveInt(); // as a statement
int a = getPositiveInt(); // as an expression
System.out.println(getPositiveInt()); // expression
int b = 5 + getPositiveInt(); // expression
```

- Each time a method name appears is a method call.
- A method call makes two things happen:
  - All the statements inside the method are executed.
  - The method call itself is an expression. An expression is essentially a value. This value is specified inside the method with the return statement.

Return

- Consider an example:

```
public class MyApp {
    public static int getPositiveInt() {
        return 51;
    }
    public static void main(String[] args) {
        System.out.println(getPositiveInt());
    }
}
```

Output:

```
51
```

So, `getPositiveInt()` is an int with value 51

Producing method output

- A method usually produces a value.
  - With the exception of `void` methods which should not return a value.
- The output is produced with a **`return`** statement.

```
public class MyApp {
    public static int getPositiveInt() {
        return 51;
    }
    public static void main(String[] args) {
        System.out.println(getPositiveInt());
    }
}
```

Method return type

- The data type of the `getPositiveInt()` method is `int`

```
public class MyApp {
    public static int getPositiveInt() {
        return 51;
    }
    public static void main(String[] args) {
        System.out.println(getPositiveInt());
    }
}
```

- The value in the return statement must have the same data type as the method's. If you don't want a method to return a value, use the `void` type for your method.

Method return type

- A `void` method cannot contain a return statement with value, but can contain an empty return statement:

```
public static void printMenu() {
    System.out.println("1. Option A");
    System.out.println("2. Option B");
    System.out.println("3. Option C");
    return;
}
```

- A `return` statement stops (terminates) the method.
- Any statement after the `return` statement will never be executed. The compiler will notify you if it discovers unreachable statements after a `return` statement.

Dataflow into and out of a method

- From where? By whom? To where?
- If there is a sender, there must be a receiver.

Method call (sender)

```
int result = gcd(5, 15);
System.out.println(result);
```

Method (receiver)

```
public static int gcd(int a, int b) {
    int c;
    while (b != 0) {
        c = a;
        a = b;
        b = c % b;
    }
    return a;
}
```

Passing parameters to a method

- Parameters are specified after the method name, inside the parentheses.
  - Mutiple parameters are separated by commas.
- Parameters act as variables inside the method.

```
static void printMax(int x, int y) {
    if (x > y) {
        System.out.println(x);
    } else {
        System.out.println(y);
    }
}
```

Method I/O

- A Java method receives inputs and produces an output.
- Inputs are received through parameters.
  - The list of parameters is given within a pair of parentheses **(…)** in the method header.
  - The list of parameters can be empty.
- The output is produced with the `return` statement.
  - With the exception of `void` methods, which do not produce output.

Example: average()

- Input: `double[]`
- Output: `double`

```
public static double average(double[] a) {
    double sum = 0;
    for (int i = 0; i < a.length; i++) {
        sum += a[i];
    }
    return sum / a.length;
}
```

Usage:

```
double[] arr = {1, 1.5, 2, 2.5, 3, 3.5};
System.out.println(average(arr));
```

Example: isVowel()

- A vowel is one of a, e, i, o, u and y:

```
public static boolean isVowel(char c) {
    switch (c) {
        case 'a':
        case 'e':
        case 'i':
        case 'o':
        case 'u':
        case 'y':
            return true;
    }
    return false;
}
```

Example: isVowel()

```
public static boolean isVowel(char c) {
    return c == 'a' || c == 'e' ||
           c == 'i' || c == 'o' ||
           c == 'u' || c == 'y';
}
```

Example: sqrt()

```
public static double sqrt(double x) {
    if (x < 0) {
        System.out.println("Square root not defined!");
        return Double.NaN;
    }
    if (x == 0) return 0;
    double s = 1, prev_s;
    do {
        // save the previous guess
        prev_s = s;
        // update the guess
        System.out.println(prev_s);
        s = (s + x / s) / 2;
        // stop if 2 guesses are the same
    } while (prev_s != s);
    return s;
}
```

Example: code re-use

```
public static boolean isUppercase(char c) {
    return (c >= 65 && c <= 90);
}

public static boolean isLowercase(char c) {
    return (c >= 97 && c <= 122);
}

public static boolean isLetter(char c) {
    return isUppercase(c) || isLowercase(c);
}
```

- 65 and 90 are ASCII code of letter A and Z
- 97 and 122 are ASCII code of letter a and z

Example: code re-use

```
public static char toLowercase(char c) {
    if (isUppercase(c)) {
        return (char) (c + 32);
    } else {
        return c;
    }
}
```

- The distance between a lower case and upper case character is 32, such as between A (65) and a (97)