CS1101 Programming and Problem Solving

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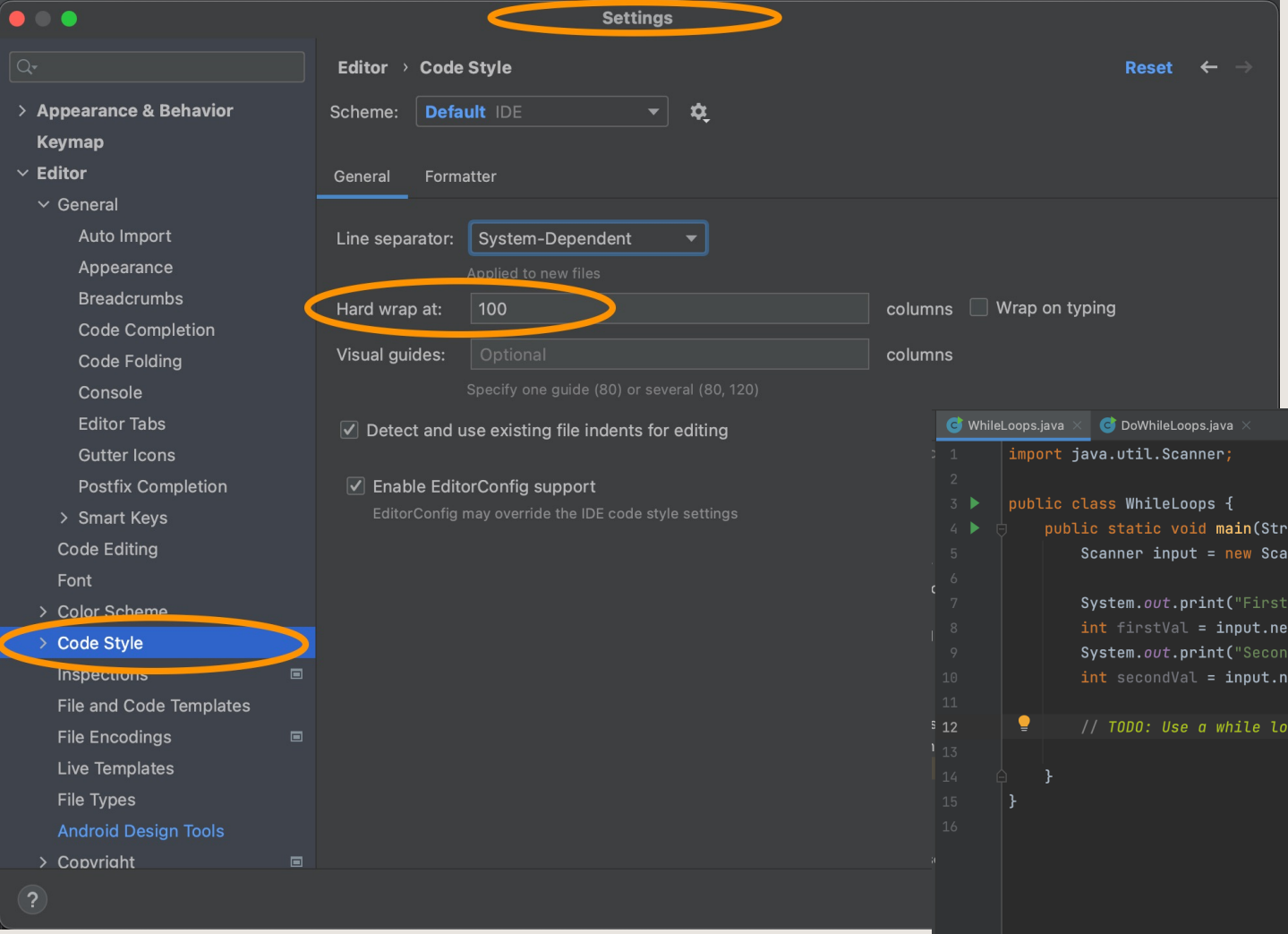
Spring 2023

Logistics

- **ZY-4B** on **zyBook > Assignments**
  - Due: **Wednesday, Feb 22**, at 11:59pm
- **PA05 – W, A, B** on **zyBook > Chap 11**
  - Due: **Thursday, Feb 23**, at 11:59pm
- Midterm Exam 1 regrade requests due Tuesday, Feb 28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Reset
Scheme: Default IDE
General
Formatter
Line separator: System-Dependent
Applied to new files
Hard wrap at: 100 columns
Wrap on typing
Visual guides: Optional columns
Specify one guide (80) or several (80, 120)
Detect and use existing file indents for editing
Enable EditorConfig support
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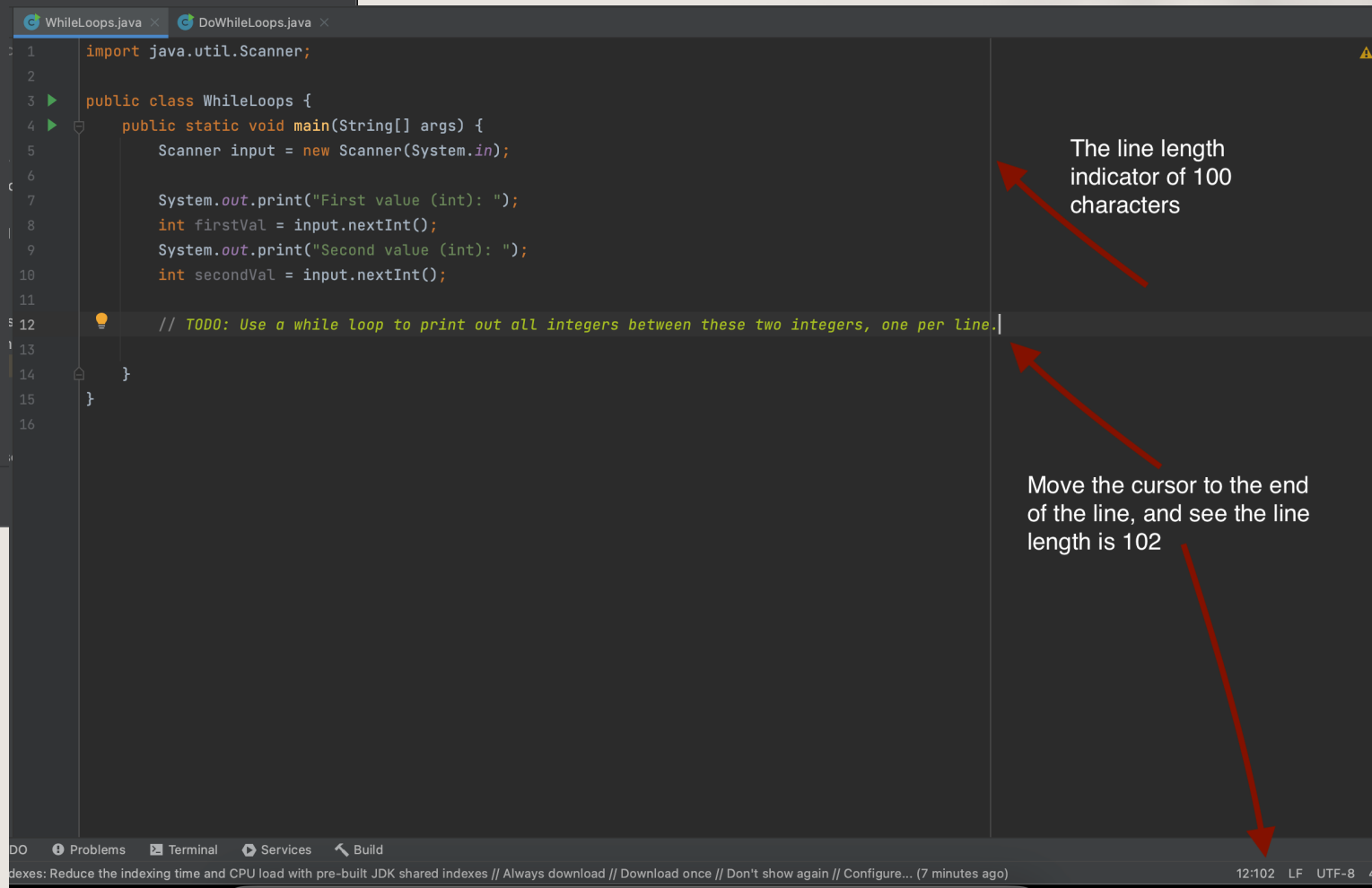
WhileLoops.java
DoWhileLoops.java
import java.util.Scanner;
public class WhileLoops {
public static void main(String[] args) {
Scanner input = new Scanner(System.in);
System.out.print("First value (int): ");
int firstVal = input.nextInt();
System.out.print("Second value (int): ");
int secondVal = input.nextInt();
// TODO: Use a while loop to print out all integers between these two integers, one per line.
}
}
The line length indicator of 100 characters
Move the cursor to the end of the line, and see the line length is 102
Problems
Terminal
Services
Build
12:102
LF
UTF-8

for Loop

zyBook Chap 5.4, 5.5, 5.6

Indefinite vs. Definite Loops

- **Indefinite loop**
  - A loop that keeps looping **as long as a condition is true**, or until a condition becomes false
    - while loops, do-while loops

- **Definite loop**
  - A loop that executes a **known number** of times
    - for loops

while Loop

```
<initialization>;
while (<continuation test>) {
    <controlled statement(s)>;
    <update>;
}
<statement(s)>;
```

```
int i = 0;
while (i < 3){
    System.out.print(i + " ");
    ++i;
}
```

```
for (int i = 0; i < 3; ++i){
    System.out.print(i + " ");
}
```

```
int i;
for (i = 0; i < 3; ++i){
    System.out.print(i + " ");
}
```

```
0 1 2
```

for Loop

```
for (<initialization>; <continuation test>; <update>) {
    <controlled statement(s)>;
}
<statement(s)>;
```

Step 1: Initialize the loop counter

- Usually, **declare + initialize**
- **Performed once** as the loop begins
- Can start at any value
- Can use any name (e.g., i, j, k…)

Step 2: Check the continuation test

- Tests the loop counter variable against a limit
- Uses relational operators (<, >, <=, >=)

Step 3: If true, execute the controlled stmt(s)

Step 4: Update the loop counter

- E.g., +=, -=, *=, /=, ++, --

Looping: Check the continuation test again…

```
for (int i = 0; i < 3; ++i){
    System.out.print(i + " ");
}
```

i = 0;

i < 3 ?
True
Print out i // 0
++i // i = 1;

i < 3 ?
True
Print out i // 1
++i // i = 2;

i < 3 ?
True
Print out i // 2
++i // i = 3;

i < 3 ?
False

Q: What's the output of the following code?

```
int n = 5;
for (int i = 1; i <= n; ++i) {
    System.out.print(i + " ");
}
```

Ouput: 1 2 3 4 5

```
int n = 5;
for (int i = 0; i < n; ++i) {
    System.out.print(i + " ");
}
```

Ouput: 0 1 2 3 4

```
int n = 5;
for (int i = n; i >= 1; --i) {
    System.out.print(i + " ");
}
```

Ouput: 5 4 3 2 1

TopHat: What's the output of the following code?

```
int x = 3;
for (int i = 1; i <= 10; ++i) {
    System.out.println(x);
}
System.out.println(i);
```

Compile Error
Since the loop counter `i` is **declared** and **initialized** in the loop header, the scope of `i` is within the for loop

Loops and Strings

```java
import java.util.Scanner;

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

        Scanner console  = new Scanner(System.in);
        System.out.print("Enter String: ");
        String inputString = console.nextLine();

        // Loop through string, and
        // print out one index and character on each line
        // Reminder: String index starts at 0
        for (int i = 0; ____________________________; i++) {
            System.out.println(i + ": " + inputString.charAt(i));
        }
    }
}
```

```
$ javac StringLoop.java
$ java StringLoop
Enter String: CS 1101
0: C
1: S
2:
3: 1
4: 1
5: 0
6: 1
```

Loops and Strings

```java
import java.util.Scanner;

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

        Scanner console  = new Scanner(System.in);
        System.out.print("Enter String: ");
        String inputString = console.nextLine();

        // Loop through string, and
        // print out one index and character on each line
        // Reminder: String index starts at 0
        for (int i = 0; i < inputString.length(); i++) {
            System.out.println(i + ": " + inputString.charAt(i));
        }
    }
}
```

```
$ javac StringLoop.java
$ java StringLoop
Enter String: CS 1101
0: C
1: S
2:
3: 1
4: 1
5: 0
6: 1
```

Nested Loop

zyBook Chap 5.7

Nested Loops – A loop inside of another loop

```
while (<condition>) {
    <statements>;
    for (<initialization>; <continuation test>; <update>) {
        <statements>;
    }
}
<statement>;
```

```
for (<initialization>; <continuation test>; <update>) {
    <statements>;
    for (<initialization>; <continuation test>; <update>) {
        <controlled statements>;
    }
}
<statement>;
```

Example – 1

"Sentinel Loop"
Use a **while** loop since we do not know when the sentinel value would be entered by the user.

```
import java.util.Scanner;

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

        Scanner console  = new Scanner(System.in);
        System.out.print("Enter String (or QUIT to quit): ");
        String inputString = console.nextLine();

        while(!inputString.equals("QUIT")) {
            for (int i = 0; i < inputString.length(); i++) {
                System.out.println(i + ": " + inputString.charAt(i));
            }
            System.out.print("Enter String (or QUIT to quit): ");
            inputString = console.nextLine();
        }
    }
}
```

```
$ javac StringLoop.java
$ java StringLoop
Enter String (or QUIT to quit): Hello
0: H
1: e
2: l
3: l
4: o
Enter String (or QUIT to quit): World
0: W
1: o
2: r
3: l
4: d
Enter String (or QUIT to quit): Quit
0: Q
1: u
2: i
3: t
Enter String (or QUIT to quit): QUIT
```

Example – 2

```
public class NestedFor{
    public static void main(String[] args){
        int row = 4;
        int column = 10;

        // Outer for loop
        // 4 rows of the pattern
        for (int i = 0; i < row; ++i) {
            // Inner for loop
            // in each row, 10 repetitions of printing j
            for (int j = 0; j < column; ++j) {
                System.out.print(j);
            }
            System.out.println();
        }
    }
}
```

```
$ javac NestedFor.java
$ java NestedFor
0123456789
0123456789
0123456789
0123456789
```

i = 0
i < 4 ?
True

j = 0
j < 10 ?
True
Print out j
++j // **j = 1**

j < 10 ?
True
Print out j
++j // **j = 2**

…

j < 10 ?
True
Print out j
++j // **j = 10**

j < 10 ?
False

Move the cursor
to a new line
++i; // **i = 1**

i < 4 ?
True

j = 0
j < 10 ?
True
Print out j
++j // **j = 1**

…

j < 10 ?
False

Move the cursor
to a new line
++i; // **i = 2**

…
…

Coding Practice

Q: Reproduce the following patterns with nested for loops

```
*
**
***
****
*****
```

```
    1
   2
  3
 4
5
```

Hint: print out the spaces and then the number

Sample Solutions

```
*
**
***
****
*****
```

```
    1
   2
  3
 4
5
```

```
int row = 5;

for (int i = 0; i < row; ++i) {
    for (int j = 0; j <= i; ++j) {
        System.out.print("*");
    }
    System.out.println();
}
```

```
int row = 5;
int column = 5;

for (int i = 1; i <= row; ++i) {
   for (int j = 0; j < column - i; ++j) {
       System.out.print(" ");
   }
   System.out.println(i);
}
```