Java Control: Repetition

CPSC 219: Introduction to Computer Science for Multidisciplinary Studies II
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Loop types

Post-test loops

- Checking the looping condition *after* executing the body of the loop.
- The loop body executes at least *one* time.

Pre-test loops

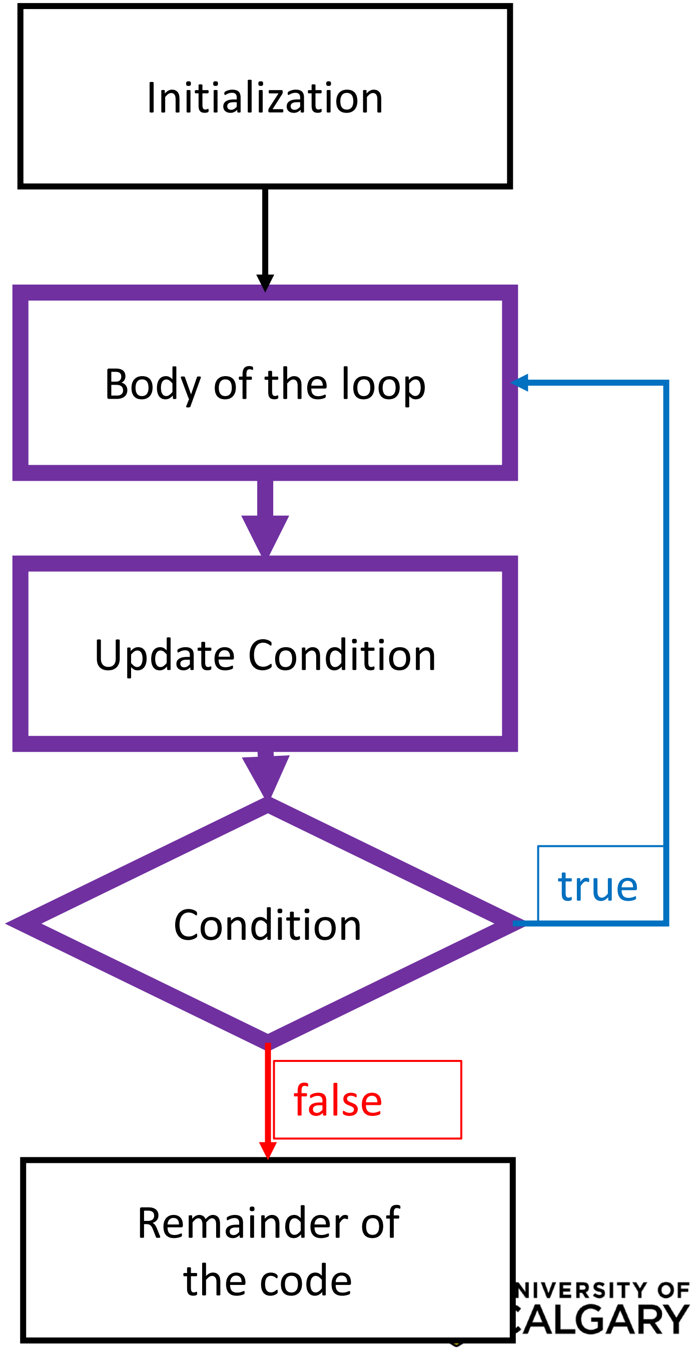
- Checking the looping condition *before* executing the body of the loop.
- The loop body executes *zero or more* times.

Post-Test Loop (do-while)

In Java! (not in Python)

Post-test loops

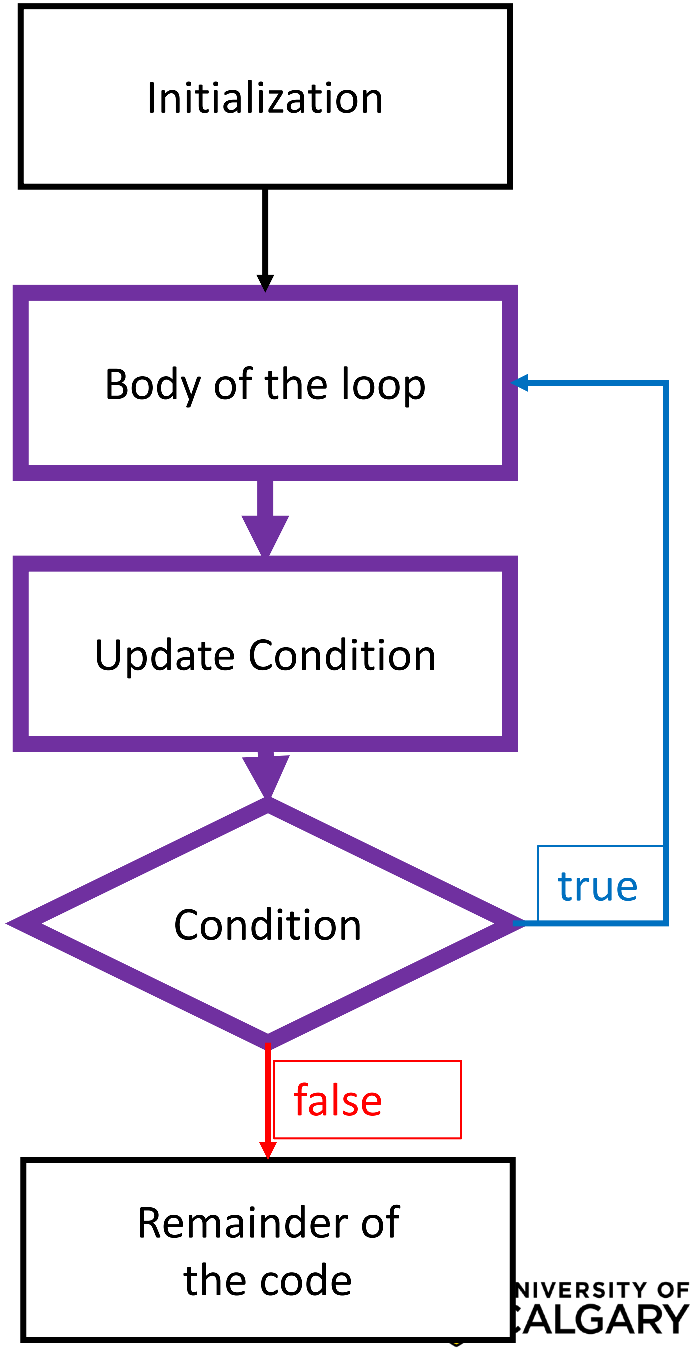
1. Initialize the loop control
2. Execute the body of the loop
   (the part to be repeated)
3. Update the loop control
4. Check the condition
   - **False** → stop the loop and go to the rest of program
   - **True** → repeat from step 2



do-while loops – (simple)

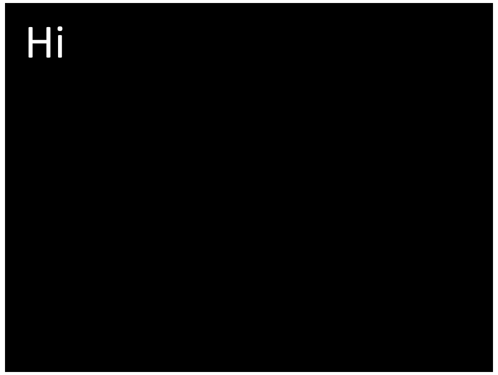
```
int x = 1;
do {
        System.out.println(“Hi”);
        x = x + 1;
} while (x <= 5);
```

```
Hi
Hi
Hi
Hi
Hi
```

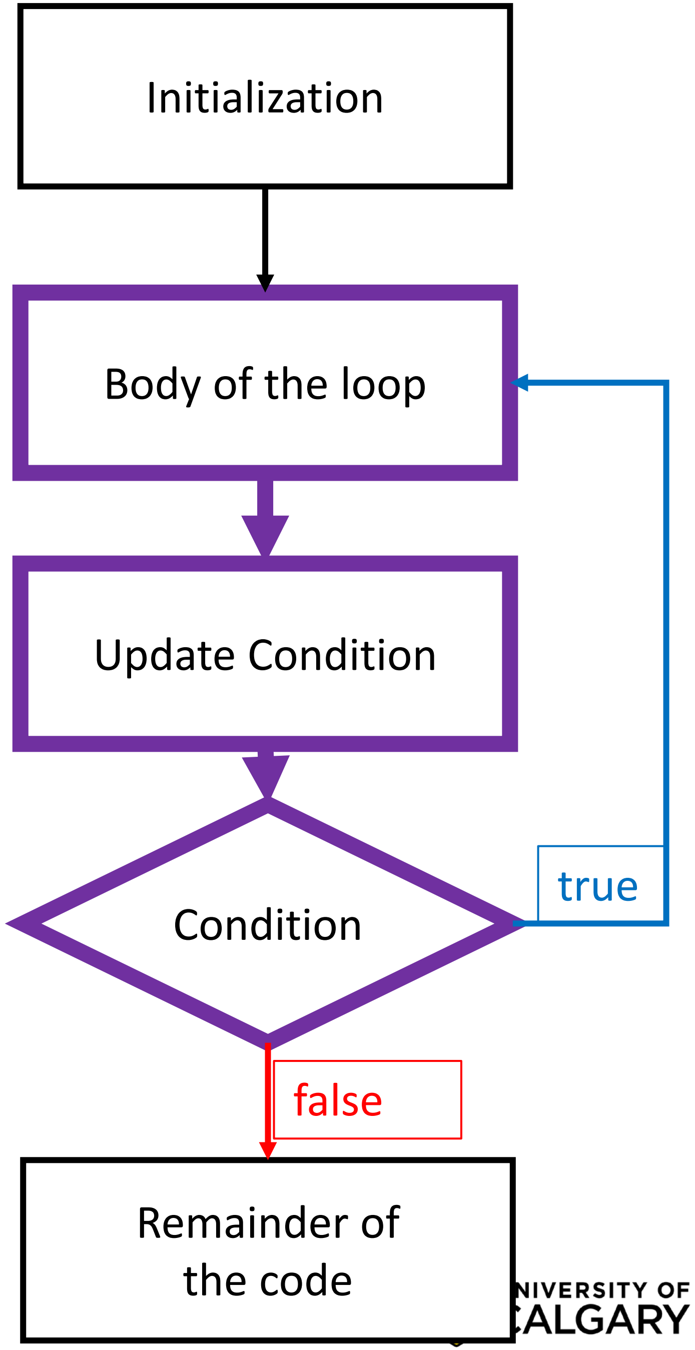


do-while loops – (always loops once)

```
int x = 1;
do {
        System.out.println("Hi");
        x = x + 1;
} while (x <= -999);
```



```
Hi
```



Pre-Test Loop (for/while)

In Java!

Pre-test loops

1. Initialize loop control

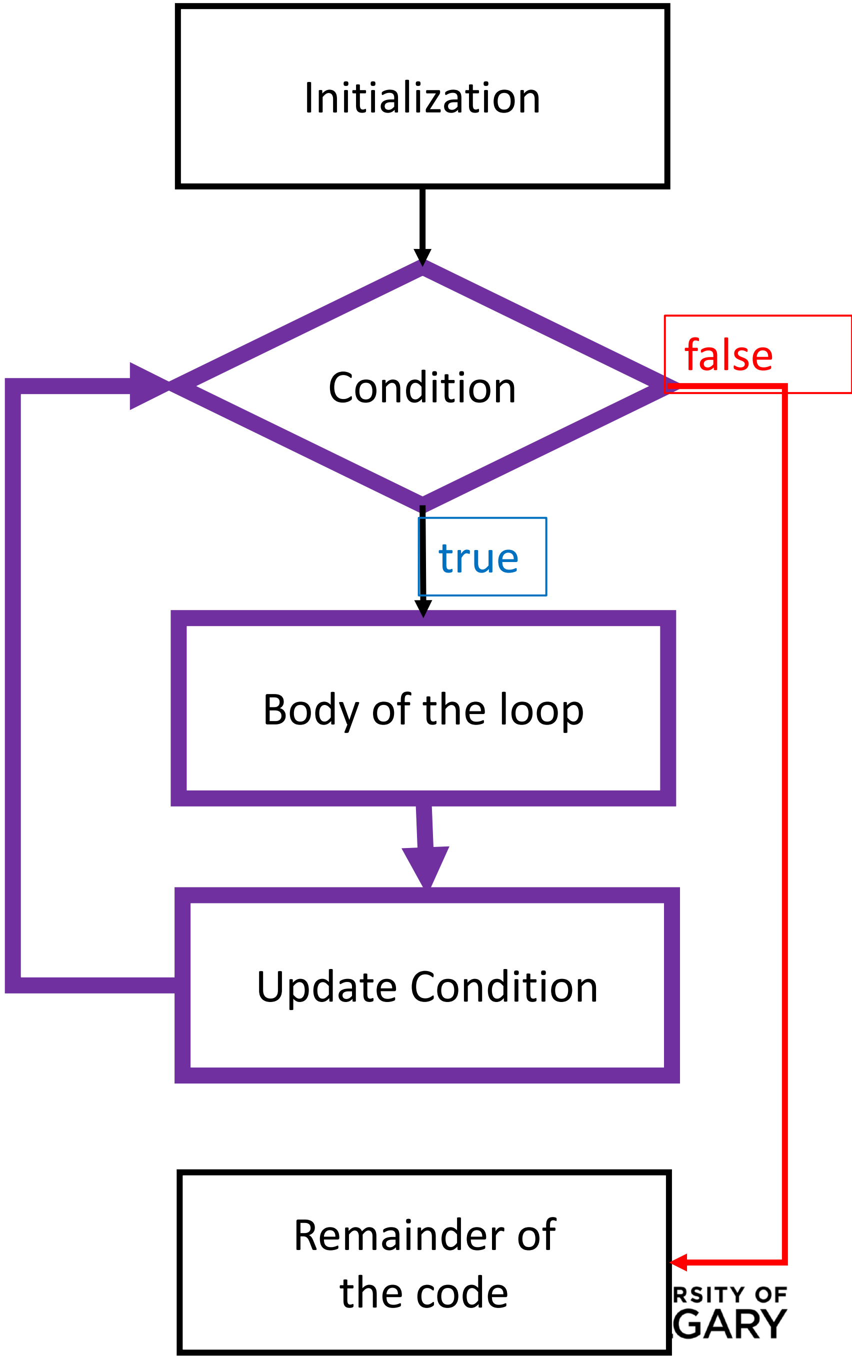
2. Check the condition

   False→ stop the loop, skip the body,
   go to the rest of program

   True → Execute the body of the loop

4. Update the loop control

5. Repeat from step 2



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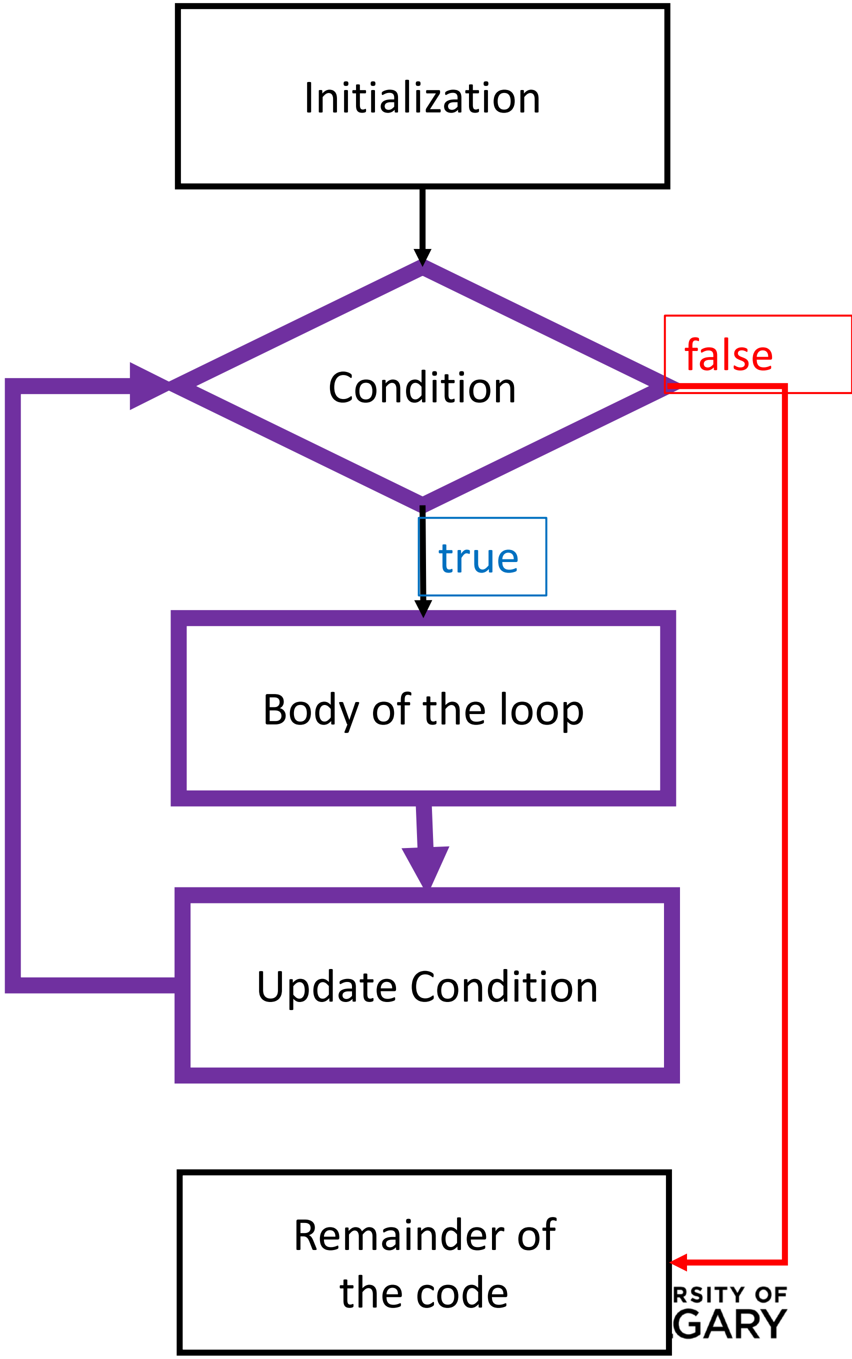
while loop (simple)

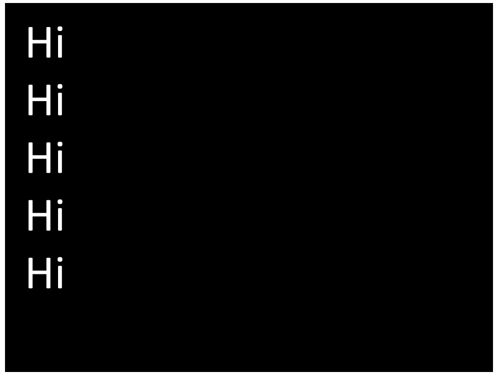
```
int x = 1;
while (x <= 5){
        System.out.println("Hi");
        x = x + 1;
}
```

```
Hi
Hi
Hi
Hi
Hi
```

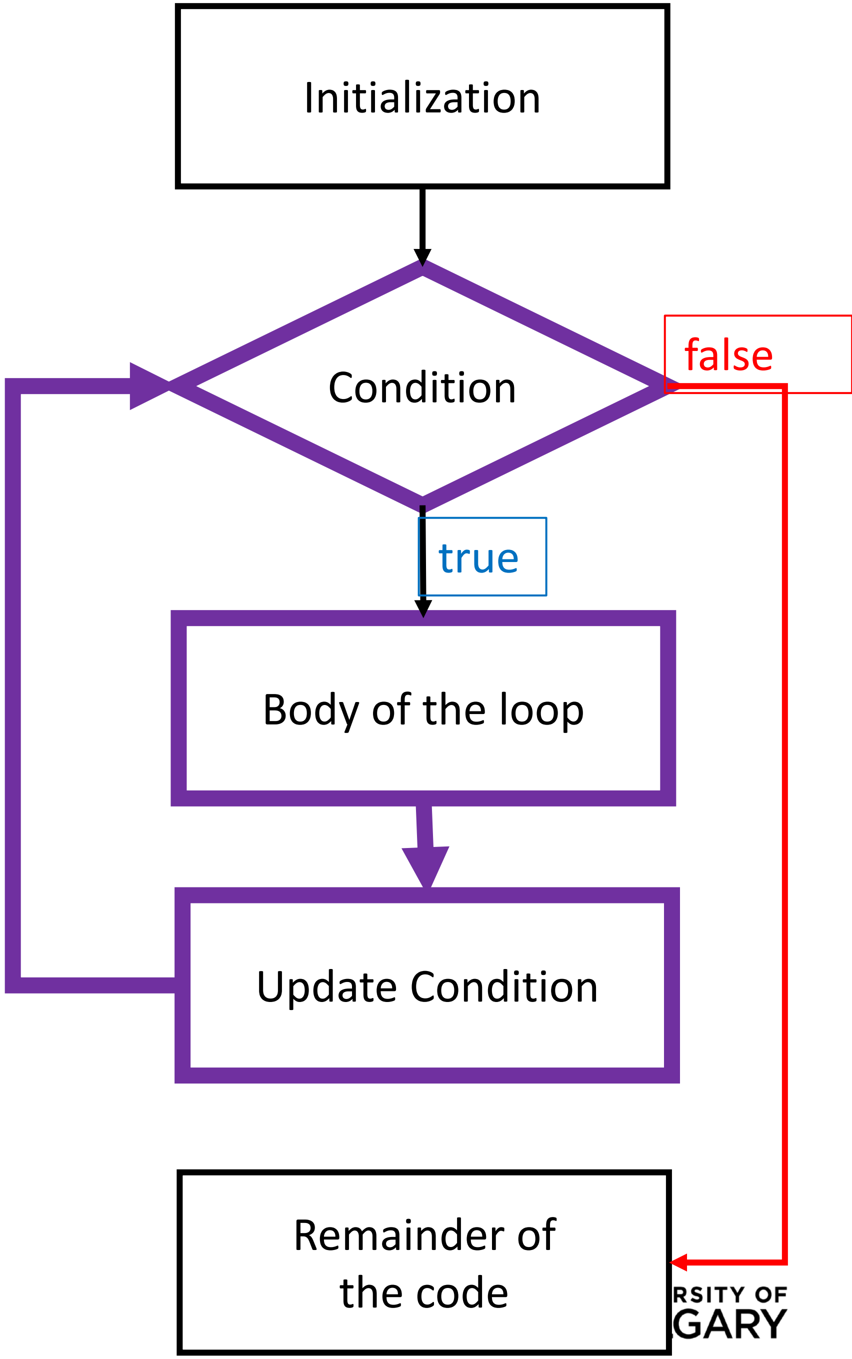


for loop (simple)

```
for (int x = 1; x <= 5; x = x +1){
        System.out.println(“Hi”);
}
```



```
Hi
Hi
Hi
Hi
Hi
```



Compare

For vs While

all for loops are while loops
all while loops are for loops*

```
int x = 1;
while (x <= 5){
        System.out.println(“Hi”);
        x = x + 1;
}

for (int x = 1; x <= 5; x = x +1){
        System.out.println(“Hi”);
}
```

*For-each loops are different

all for loops are while loops
all while loops are for loops*

```
int x = 1; int y = 2;
while (x <= 5){
        System.out.println(“Hi”);
        x = x + 1; y = y + 10;
}

for (int x = 1, int y = 2; x <= 5; x = x + 1, y = y + 10){
        System.out.println(“Hi”);
}
```

*For-each loops are different

Loops in Java – Developing for/while

The following are equivalent loops:

```
int sum = 0;

for (int i = 0; i < 10; i++){
     sum = sum  + i;
}
System.out.println(sum);
```

```
int sum = 0;
int i = 0;
while ( i < 10 ){
    sum = sum + i;
    i++;}
System.out.println(sum);
```

Loops in Java – Developing for/while

The following are equivalent loops:

```
int sum = 0;

for (int i = 0; i < 10; i++){
     sum = sum  + i;
}
System.out.println(sum);
```

```
int sum = 0;
int i = 0;
while ( i < 10){
    sum = sum + i;
    i++; }
System.out.println(sum);
```

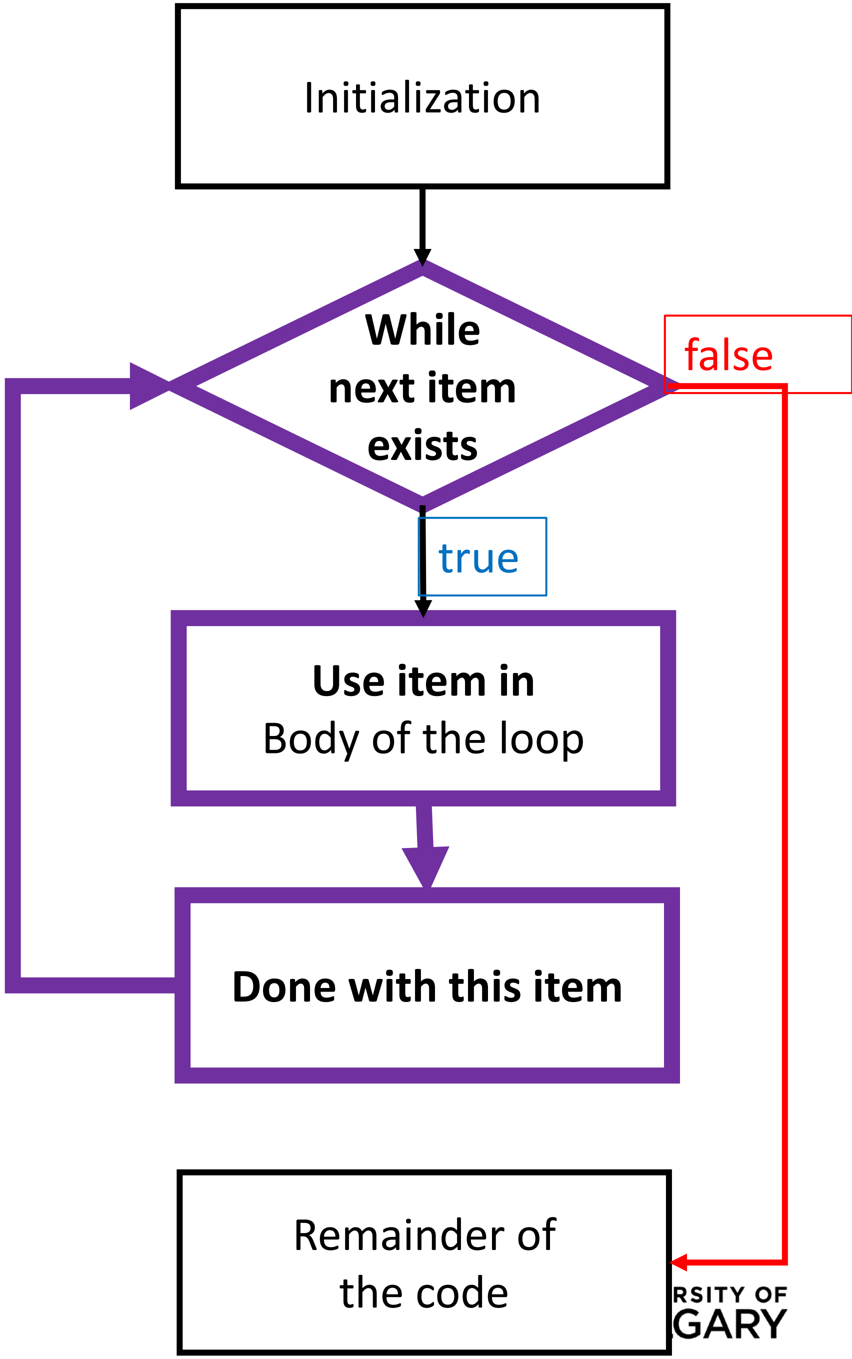
For-each Loop

for-each loops - invalid

```
String hello = "Hello, World!";
for (char x: hello){
    System.out.println(x);
}
```

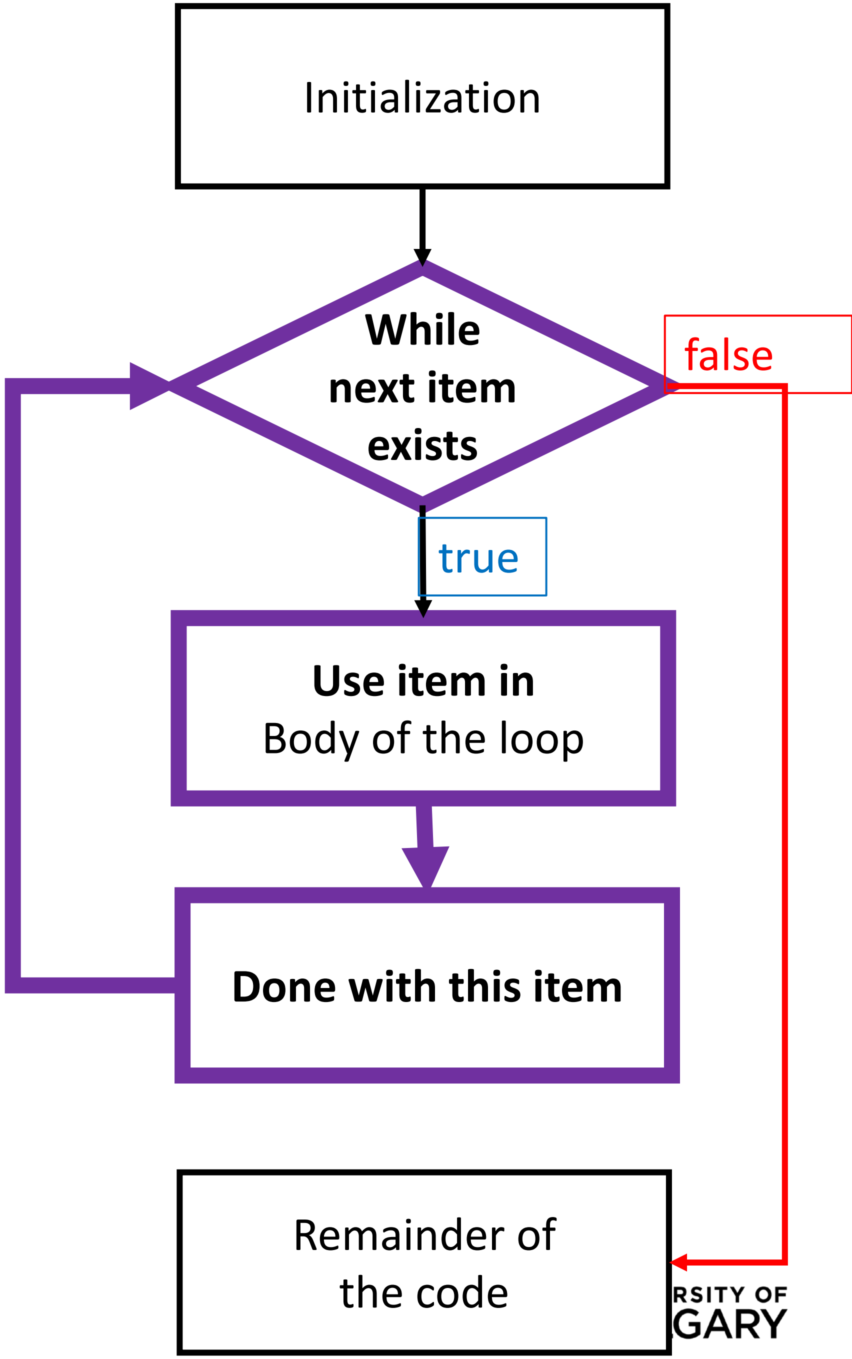
Not always as simple as Python (this is invalid syntax!)

- For-each on String requires more syntax
- For-each on other types will exist (like ArrayLists)



for-each loops - valid

```
String hello = "Hello, World!";
//Change String into for-each loop-able type
for (char x: hello.toCharArray()){
    System.out.println(x);
}
// By index
for (int i =0; i < hello.length(); i++){
    System.out.println(hello.charAt(i));
}
```

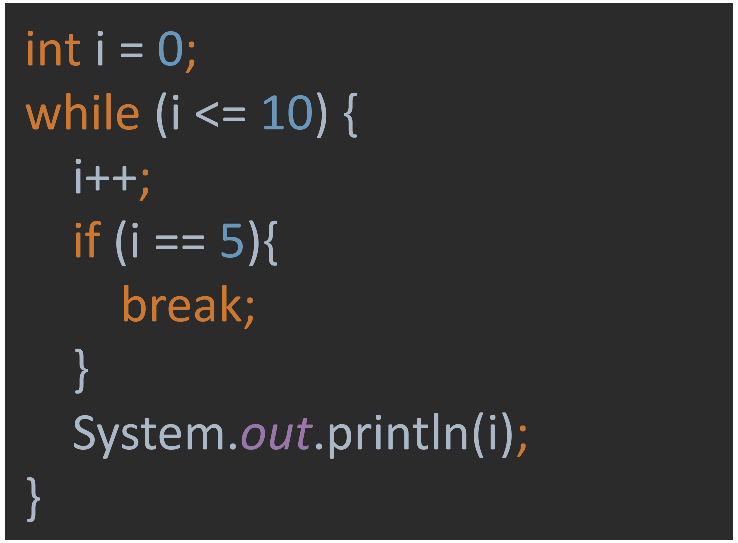


Break/Continue

Break and Continue

- Allow a loop iteration to end prematurely
- `break`
  - Entire loop ends immediately
  - Execution continues at the first statement after the loop body
- `continue`
  - Current iteration ends immediately
  - Execution returns to the top of the loop
    - In a for loop, the next item in the list is used

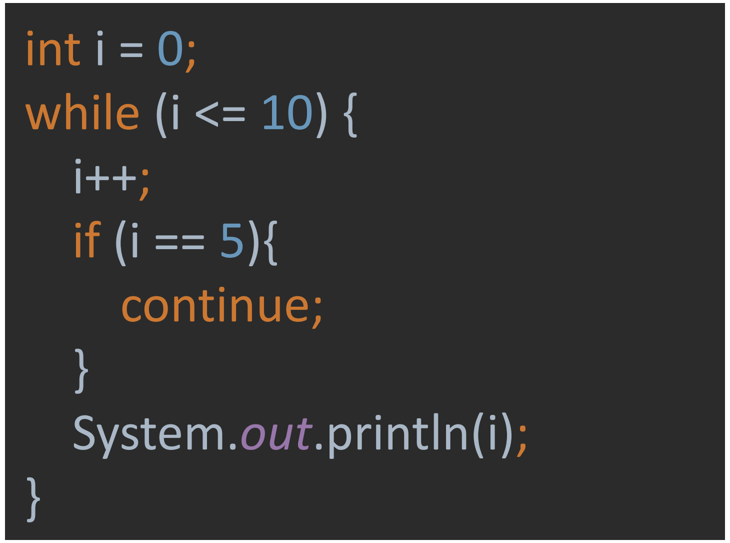
Break and Continue



```
int i = 0;
while (i <= 10) {
   i++;
   if (i == 5){
      break;
   }
   System.out.println(i);
}
```

1, 2, 3, 4

ends loop at 5 before print



```
int i = 0;
while (i <= 10) {
   i++;
   if (i == 5){
      continue;
   }
   System.out.println(i);
}
```

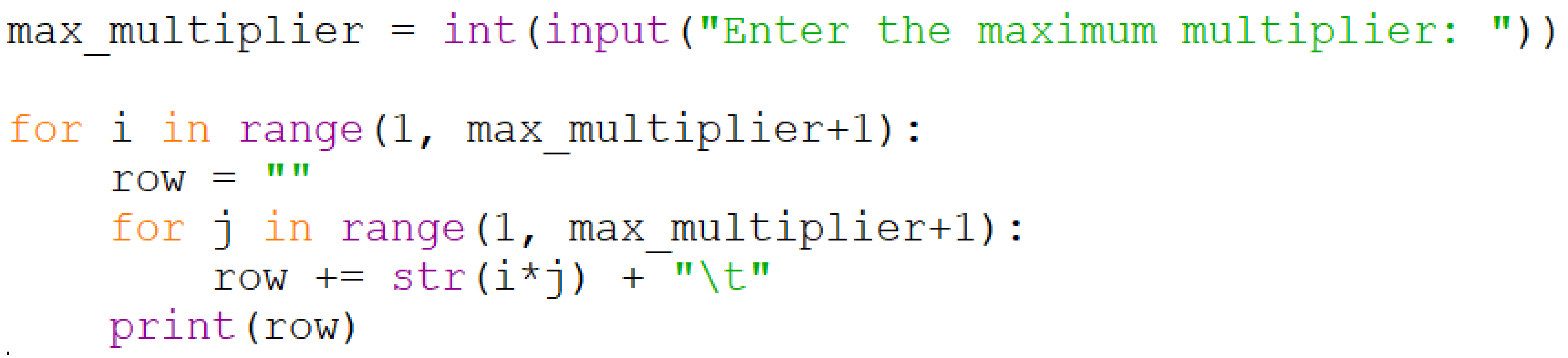
1, 2, 3, 4, 6, 7, 8, 9, 10, 11

skips rest of body before print at 5

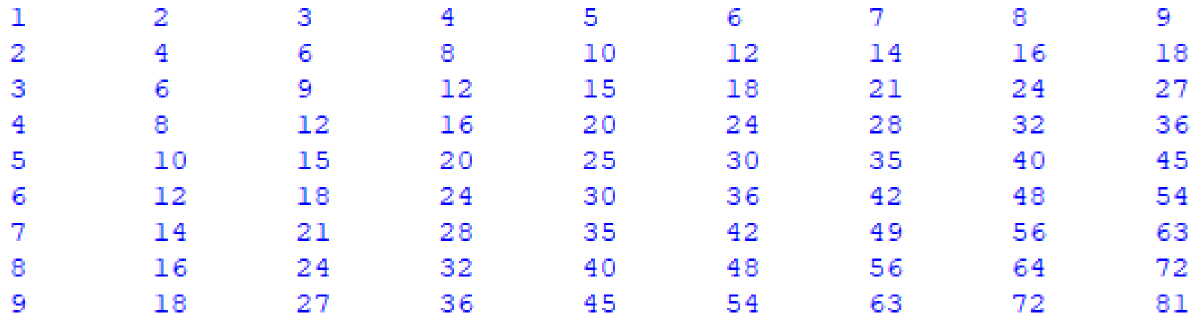
Loop Examples

Multiplication Table (Python)

Produce a multiplication table from **1** to some **value** inputted by user:



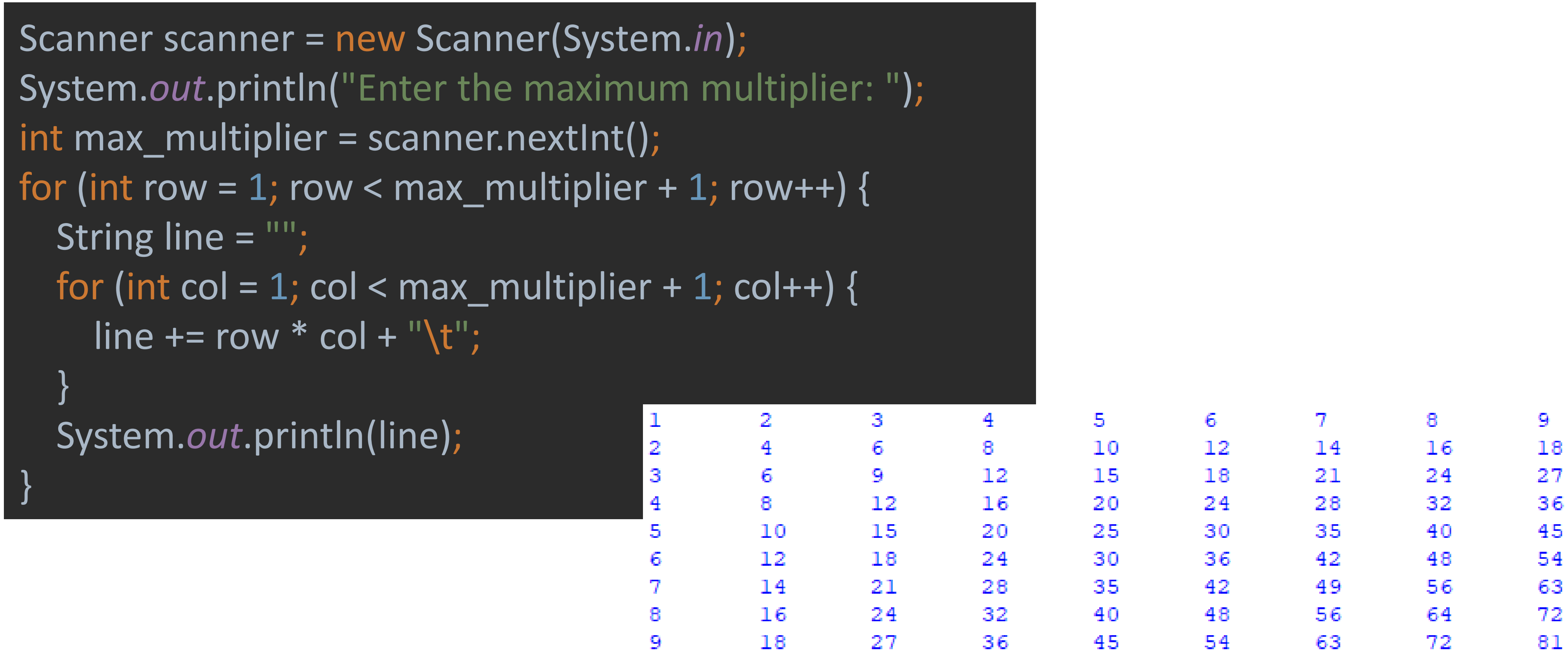
```
max_multiplier = int(input("Enter the maximum multiplier: "))

for i in range(1, max_multiplier+1):
    row = ""
    for j in range(1, max_multiplier+1):
        row += str(i*j) + "\t"
    print(row)
```



```
1       2       3       4       5       6       7       8       9
2       4       6       8       10      12      14      16      18
3       6       9       12      15      18      21      24      27
4       8       12      16      20      24      28      32      36
5       10      15      20      25      30      35      40      45
6       12      18      24      30      36      42      48      54
7       14      21      28      35      42      49      56      63
8       16      24      32      40      48      56      64      72
9       18      27      36      45      54      63      72      81
```

Multiplication Table (Java)

Produce a multiplication table from **1** to some **value** inputted by user:



```
Scanner scanner = new Scanner(System.in);
System.out.println("Enter the maximum multiplier: ");
int max_multiplier = scanner.nextInt();
for (int row = 1; row < max_multiplier + 1; row++) {
    String line = "";
    for (int col = 1; col < max_multiplier + 1; col++) {
        line += row * col + "\t";
    }
    System.out.println(line);
}
```

```
1       2       3       4       5       6       7       8       9
2       4       6       8       10      12      14      16      18
3       6       9       12      15      18      21      24      27
4       8       12      16      20      24      28      32      36
5       10      15      20      25      30      35      40      45
6       12      18      24      30      36      42      48      54
7       14      21      28      35      42      49      56      63
8       16      24      32      40      48      56      64      72
9       18      27      36      45      54      63      72      81
```

Christmas tree

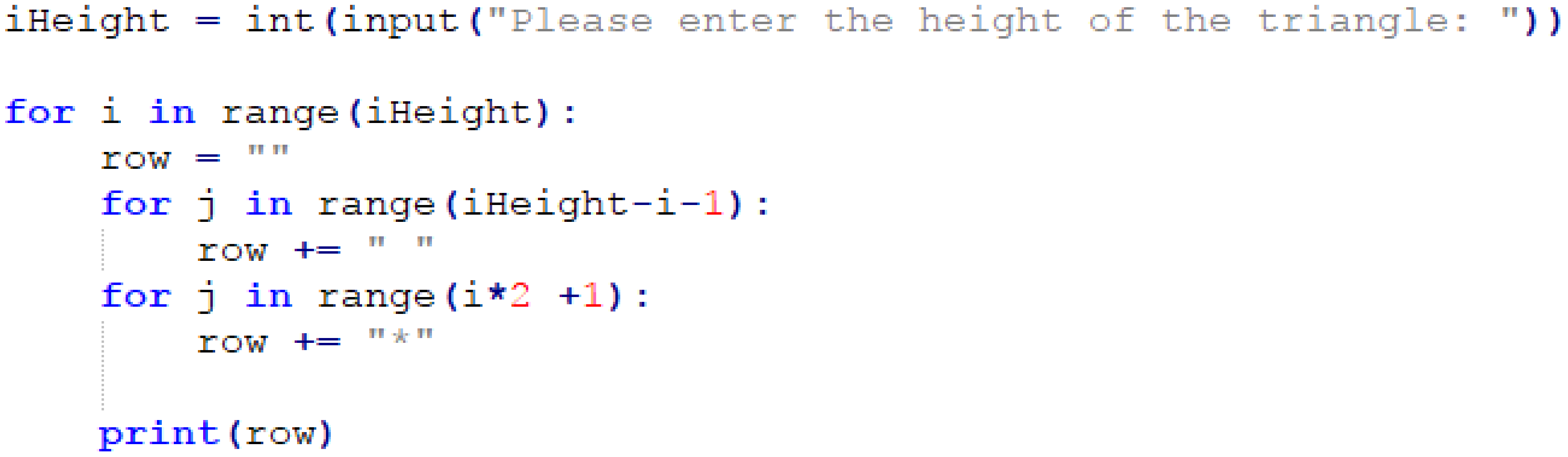
- Write a program that will print a triangle of a height provided by the user. For example:
  - If the height is 3, the triangle will look like:

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

  - If the height is 10, the triangle will look like:

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

Christmas Tree Solution (Python)



```
iHeight = int(input("Please enter the height of the triangle: "))

for i in range(iHeight):
    row = ""
    for j in range(iHeight-i-1):
        row += " "
    for j in range(i*2 +1):
        row += "*"

    print(row)
```

Christmas Tree Solution (Java)

```java
Scanner scanner = new Scanner(System.in);
System.out.println("Enter height of tree: ");
int height = scanner.nextInt();
for (int h = 0; h < height; h++) {
    int spaces = height - h - 1;
    int stars = 2 * h + 1;
    String line = "";
    for (int i = 0; i < spaces; i++) {
        line += " ";
    }
    for (int i = 0; i < stars; i++) {
        line += "*";
    }
    System.out.println(line);
}
```

Onward to … Functions.

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