FOR LOOP

zyBook 5.5, zyBook 5.6, zyBook 5.7

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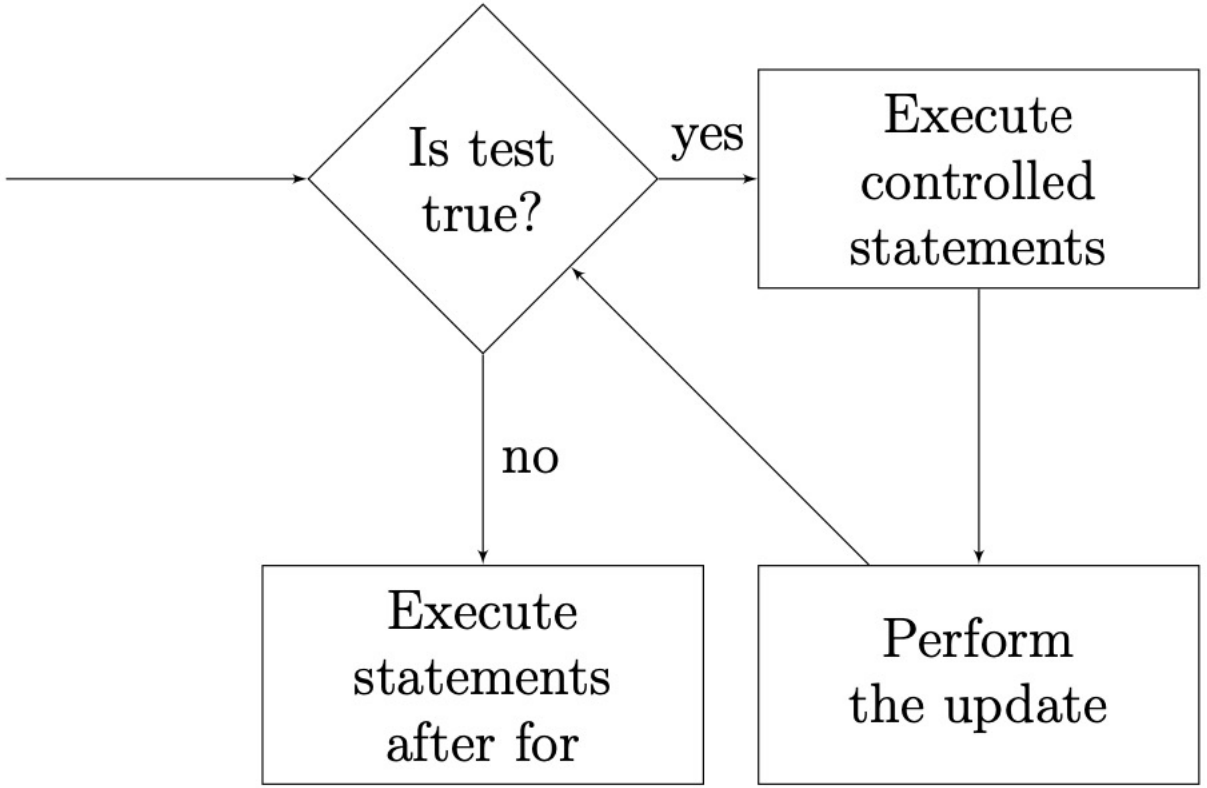
FOR LOOP

- What?
  - A for loop is a control structure (a syntactic structure that controls other statements)
  - Definite Loop → know how many times the loop will run
- What is the purpose?
  - Reduce redundancy
- How is it helpful?
  - Reduces the amount of code we need

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



- Initialization
  - Tells Java what variable to use in the loop
  - Performed once as the loop begins
  - The variable is called a loop counter.
    - can use any name, not just i
    - can start at any value, not just 0

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

- Continuation Test
  - Tests the loop counter variable against a limit
  - Uses relational operators
- Update
  - Updates the loop counter variable
  - Increment and decrement by 1
  - Increment and Decrement Operators

REDUNDANCY

```java
public class MultiplesOfFive {
    public static void main(String[] args) {
        System.out.println(1 + " * " + 5 + " = " + (1 * 5));
        System.out.println(2 + " * " + 5 + " = " + (2 * 5));
        System.out.println(3 + " * " + 5 + " = " + (3 * 5));
        System.out.println(4 + " * " + 5 + " = " + (4 * 5));
        System.out.println(5 + " * " + 5 + " = " + (5 * 5));
        System.out.println(6 + " * " + 5 + " = " + (6 * 5));
        System.out.println("Done!");
    }
}
```

```
$ javac -d bin -cp bin src/MultiplesOfFive.java

$ java -cp bin MultiplesOfFive
1 * 5 = 5
2 * 5 = 10
3 * 5 = 15
4 * 5 = 20
5 * 5 = 25
6 * 5 = 30
Done!
```

```java
public class MultiplesOfFive {
    public static void main(String[] args) {
        // System.out.println(1 + " * " + 5 + " = " + (1 * 5));
        // System.out.println(2 + " * " + 5 + " = " + (2 * 5));
        // System.out.println(3 + " * " + 5 + " = " + (3 * 5));
        // System.out.println(4 + " * " + 5 + " = " + (4 * 5));
        // System.out.println(5 + " * " + 5 + " = " + (5 * 5));
        // System.out.println(6 + " * " + 5 + " = " + (6 * 5));

        int x = 1;
        System.out.println(x + " * " + 5 + " = " + (x * 5));
        x++;
        System.out.println(x + " * " + 5 + " = " + (x * 5));
        x++;
        System.out.println(x + " * " + 5 + " = " + (x * 5));
        x++;
        System.out.println(x + " * " + 5 + " = " + (x * 5));
        x++;
        System.out.println(x + " * " + 5 + " = " + (x * 5));
        x++;
        System.out.println(x + " * " + 5 + " = " + (x * 5));
        System.out.println("Done!");
    }
}
```

```
$ java -cp bin MultiplesOfFive
1 * 5 = 5
2 * 5 = 10
3 * 5 = 15
4 * 5 = 20
5 * 5 = 25
6 * 5 = 30
Done!
```

```java
public class MultiplesOfFive {
    public static void main(String[] args) {
        // System.out.println(1 + " * " + 5 + " = " + (1 * 5));
        // System.out.println(2 + " * " + 5 + " = " + (2 * 5));
        // System.out.println(3 + " * " + 5 + " = " + (3 * 5));
        // System.out.println(4 + " * " + 5 + " = " + (4 * 5));
        // System.out.println(5 + " * " + 5 + " = " + (5 * 5));
        // System.out.println(6 + " * " + 5 + " = " + (6 * 5));

        for (int i = 1; i <= 6; i++) {
            System.out.println(i + " * " + 5 + " = " + (i * 5));
        }
        System.out.println("Done!");
    }
}
```

```
$ javac -d bin -cp bin src/MultiplesOfFive.java

$ java -cp bin MultiplesOfFive
1 * 5 = 5
2 * 5 = 10
3 * 5 = 15
4 * 5 = 20
5 * 5 = 25
6 * 5 = 30
Done!
```

LOOP THAT ITERATES N TIMES

(Example with n = 5)

Forward: starting at 1

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

1
2
3
4
5

Forward: starting at 0

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

0
1
2
3
4

Backward

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

5
4
3
2
1

LOOPS AND STRINGS

```java
import java.util.Scanner;

public class StringLoop {
    public static void main(String[] args) {
        Scanner scan = new Scanner(System.in);
        System.out.print("Enter String: ");
        String input = scan.nextLine();

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

```
$ javac -d bin -cp bin src/StringLoop.java

$ java -cp bin StringLoop
Enter String: CSC 116
0: C
1: S
2: C
3:
4: 1
5: 1
6: 6
```

COMPARE LOOPS

- Syntax of while loop is like an if statement
  - Body of while loop is executed 0 or many times
  - Body of if executed 0 or 1 time
  - Must declare and initialize variable prior to loop
  - Must update variable inside loop
- A for loop can be rewritten as a while loop
  - Difference is scope of variable

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

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