

Printing with for Loops

- To print a character multiple times, use a `for` loop.

```
for (int j = 1; j <= 4; j++) {  
    System.out.print(".");    // 4 dots  
}
```

- `int i = ... ; // i is some positive int`
 `for (int j = 1; j <= i; j++)`
 `System.out.print("*"); //output?`

Nested Loops

- **nested loop:** A loop placed inside another loop.

```
for (int i = 1; i <= 4; i++) {  
    for (int j = 1; j <= 5; j++) {  
        System.out.print((i * j) + "\t");  
    }  
    System.out.println(); // to end the line  
}
```

- **Output:**

1	2	3	4	5
2	4	6	8	10
3	6	9	12	15
4	8	12	16	20

- Statements in the outer loop's body are executed 4 times.
 - The inner loop prints 5 numbers each time it is run.

Nested for Loops Example

- What is the output of the following nested for loops?

```
for (int i = 1; i <= 6; i++) {  
    for (int j = 1; j <= 10; j++) {  
        System.out.print("*");  
    }  
    System.out.println();  
}
```

Nested Loops Example

- What is the output of the following nested for loops?

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

- Write nested loops that display:

```
1  
22  
333  
4444  
55555  
666666
```

Another Nested Loops Example

- What nested for loops produce the following output?

```
inner loop - prints one line
....1
...2
..3
.4
5
```

} outer loop - loops 5 times since there are 5 lines

- We must build multiple complex lines of output using:
 - an *outer "vertical" loop* for each of the lines
 - *inner "horizontal" loop(s)* for the patterns within each line

Outer and Inner Loops

- First write the outer loop, from 1 to the number of lines.

```
for (int line = 1; line <= 5; line++) {  
    ...  
}
```

- Now look at the line contents. Each line has a **pattern**:
 - some dots - how many? How does number of dots relate to the line number?
 - a number - how does it depend on line number?

```
....1  
...2  
..3  
.4  
5
```

Nested for Loops Exercise

- What is the output of the following nested for loops?

```
for (int line = 1; line <= 5; line++) {  
    for (int j = 1; j <= 5 - line; j++)  
    {  
        System.out.print(".");  
    }  
    for (int k = 1; k <= line; k++) {  
        System.out.print(line);  
    }  
    System.out.println(); // new line  
}
```

Solution

- Answer:

. . . . 1
. . . 22
. . 333
. 4444
55555

Exercise

- Modify the previous code to produce this output:

. . . . 1

. . . 2 .

. . 3 . .

. 4 . . .

5

Solution

```
for (int line = 1; line <= 5; line++) {  
    for (int j = 1; j <= (5 - line); j++) {  
        System.out.print(".");  
    }  
    System.out.print(line);  
    for (int j = 1; j <= (line - 1); j++) {  
        System.out.print(".");  
    }  
    System.out.println();  
}
```

Common Mistakes

- Both of the following sets of code produce *infinite loops*:

```
for (int i = 1; i <= 10; i++) {  
    for (int j = 1; i <= 5; j++) {  
        System.out.print(j);  
    }  
    System.out.println();  
}
```

```
for (int i = 1; i <= 10; i++) {  
    for (int j = 1; j <= 5; i++) {  
        System.out.print(j);  
    }  
    System.out.println();  
}
```