Printing with for Loops

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

```java
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?

based on slides at buildingjavaprograms.com
Nested Loops

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

  ```java
  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?

```java
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?
  ```java
  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.

```java
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?

```plaintext
......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 . . .
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:
  ```java
  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();
  }
  ```