The for Loop

• Another loop statement, for, is best for when you can determine in advance how many times you need to execute the loop (counting loop).

• The for statement includes the three parts needed for loops: initialize, test, and update.
  • All this information is conveniently placed at the beginning of the loop.

• All three loop statements (while, do, and for) are functionally equivalent.

The for statement

• The form of the for statement is
  \[
  \text{for } (<\text{initialize}>; <\text{boolean_expression}>; <\text{update}>)
  \text{<statement>}
  \]

• First, the initialize statement is executed.

• If boolean_expression evaluates to true, then statement (body of loop) is executed, followed by the update statement.

• The loop repeats until the boolean_expression evaluates to false.
The for Flowchart

```
initialize

boolean_expression
false

update
true

statement (body of loop)
```

A for Loop Example

```
int sum = 0;
for (int i = 1; i <= n; i++) {
    sum += i*i;
}
System.out.println(sum);
```

Which variable is the loop control variable?

Another for Loop Example

```
int sum = 0;
for (int i = 1; i <= n; i+=3) {
    sum += i;
}
System.out.println(sum);
```

Scope

- The scope of a variable is the area within a program that can reference the variable.
- The scope depends on where the variable is declared.

```
int sum = 0;
for (int i = 1; i <= n; i++) {
    sum += i*i;
}
System.out.println(sum);
```
Scope

```java
int sum = 0;
int i;
for (i = 1; i <= n; i++) {
    sum += i * i;
}
System.out.println("Sum of first " + (i-1) + " integers squared is " + sum);
```

Nested Loops

- A loop can have another loop inside of it.
- For each iteration of the outside loop, the inside loop runs completely.
- Often it is easiest to read from the inside out.
- Example:
  
  How many lines are printed?
  ```java
  for (int i = 1; i <= 5; i++) {
      for (int j = 1; j <= 3; j++) {
          System.out.println(i + " " + j);
      }
  }
  ```

  What happens if we write `println(i + j)`?

Palindromes

- A palindrome is word, phrase, or sequence that reads the same backwards as forwards.
- Example: Bob by Weird Al Yankovic
  (A parody of Bob Dylan's Subterranean Homesick Blues)
  
  http://www.youtube.com/watch?v=Nej4xJe4Tdg

How would you test whether a string is a palindrome?

Which Loops?

- for loops are more natural when we know how many iterations we need (definite or counting loops).
  Examples:
  - Print "" 10 times
  - Print the even numbers between 10 and the value of n
- while and do loops are more natural when we want to keep looping until some outcome (indefinite or result controlled loops).
  Examples:
  - Prompt the user until the user inputs the data in the correct form.
  - Continue looping until we reached a million dollars.