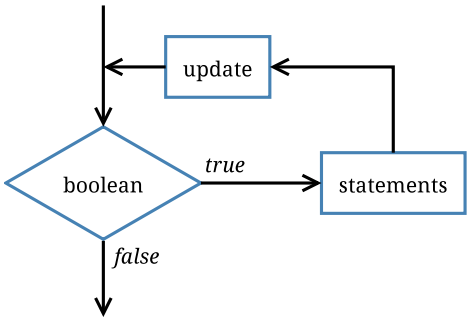
Model 1 For Loops

The `for` loop combines ***initialize***, ***test***, and ***update*** into one line of code.

```
// Loop A: count forwards
for (i = 1; i <= 10; i++) {
    System.out.println(i);
}

// Loop B: count backwards
for (i = 10; i >= 1; i--) {
    System.out.println(i);
}
```



Questions (10 min)

Start time:

1. Identify the components of each `for` loop.

Loop A:

a) initialize `i = 1`

b) test `i <= 10`

c) update `i++`

Loop B:

a) initialize `i = 10`

b) test `i >= 1`

c) update `i--`

2. Rewrite each `for` loop as a `while` loop.

Loop A:

```
i = 1;
while (i <= 10) {
    System.out.println(i);
    i++;
}
```

Loop B:

```
i = 10;
while (i >= 1) {
    System.out.println(i);
    i--;
}
```

3. What do each of the `for` loops output to the screen? Be specific.

The first loop prints the numbers 1 to 10, and the second loop prints the numbers 10 to 1. Each number is on its own line.

4. Describe how to change the `for` loops to print even numbers only (i.e., the output should be 2 4 6 8 10 and 10 8 6 4 2).

Change loop A to: `for (i = 2; i <= 10; i += 2)`

Change loop B to: `for (i = 10; i >= 2; i -= 2)`

5. In mathematics, the factorial of an integer n (denoted by $n!$) is the product of all positive integers less than or equal to n. For example, the factorial of 5 is:

$$5! = 5 * 4 * 3 * 2 * 1 = 120$$

The following code computes the factorial of 5:

```
fact = 1;
i = 5;
while (i > 1) {
    fact *= i;
    i--
}
```

a) Rewrite the code above using a `for` loop instead of a `while` loop.

```
fact = 1;
for (i = 5; i > 1; i--) {
    fact *= i;
}
```

b) How would you change the code to compute the factorial of 12?

Simply change `i = 5` to `i = 12`.