Iteration

- **While Loops**
  - Syntax
    ```java
    initialize
    while (boolean_exp) {
      work_to_be_done
      update
    }
    ```
  - Example
    ```java
    int counter = 10;
    while (counter > 0) {
      System.out.println(counter);
      counter--;
    }
    System.out.println("Blast Off!");
    ```
  - What is the output?
  - What if we exchange order of two statements in loop?

- **For Loops**
  - Syntax
    ```java
    for (initialization; boolean_exp; update) {
      work_to_be_done
    }
    ```
  - Example
    ```java
    for (int counter = 10; counter > 0; counter--) {
      System.out.println(counter);
    }
    System.out.println("Blast Off!");
    ```
  - What is the output?
  - When is update performed?
  - What is value of counter after loop?

- **Do-While Loops**
  - Syntax
    ```java
    initialize
    do {
      work_to_be_done
      update
    } while (boolean_exp);
    ```
  - Example
    ```java
    int counter = 10;
    do {
      System.out.println(counter);
      counter--;
    } while (counter > 0);
    System.out.println("Blast Off!");
    ```
  - What is the output?
  - What if we exchange order of two statements in loop?

- **Which Kind of Loop Do I Use?**
  - While Loop
    - Don’t know how often it’s going be
    - Update can be anywhere in the loop body
  - For Loop
    - Know how often in advance
    - All information controlling loop together, in front
  - Do-While Loop
    - Least popular
    - Often used with data input
  - What is the minimum number of times each of these loop?
    - While?
    - For?
    - Do-while?
Iteration – Common Problems

- **Infinite Loops**
  - What causes them?
    - Always bad?
- **Semicolons**
- **Testing with != or ==**
  - Doubles
  - Increments other than 1
- **Scope of loop control variable (for loops)**
- **Off by one**
  - Starting at 0 vs 1
  - Using < vs <=

Iteration

- **Can nest loops (and almost everything else)**
  - Usually no special problems
  - Often used for matrices, tables, images...
  - Can hide by putting inner loop into helper method
- **What is the output from the following?**

  ```java
  for (int k = 0; k < 8; k++) {
    for (int j = 0; j <= k % 4; j++) {
      System.out.print("*");
    }
    System.out.println();
  }
  ```

  **Trace!**

Iteration

- **While-loop controlled by Sentinel Value**
  - Often loop continues until something is found or computed
  - Often involves I/O
    - Read input until something is encountered (sentinel) that means stop
    - When processing
      - Repeat until answer doesn’t improve any more
  - Example: “indexOf(String s, char toFind)”

  ```java
  int k = 0;
  while (k < s.length() && s.charAt(k) != toFind) {
    k++;
  }
  if (k == s.length())
    return -1;
  return k;
  ```

What is an image?

- **Lots of pixels**
- **Each pixel represents a color**

One color

RGB (45, 10, 67)
Classwork today - Images

- Read in an image.
- Modify transformColor method
  - Given a Color, create and return a new Color
  - See API for Color class
  - “Magically” transformation is applied to all pixels in the image
  - Image is transformed to new image
  - Darken darkens the image

Example: Change red Color a little

```java
public Color transformColor (Color current) {
    int red = current.getRed();
    int blue = current.getBlue();
    int green = current.getGreen();
    return new Color(red + 50, green, blue);
}
```

CAREFUL!
What could possibly go wrong?