
Manipulating Pictures, Arrays, and Loops part 3

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Learning Goals

- Understand at a conceptual and practical level
 - What is an algorithm?
 - What is a program?
 - How to translate an algorithm to code
 - What is a comment?
 - What happens if you multiply by 0.5 instead of divide by 2?
 - How to improve a method

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Changing from For-each to While

- In a for-each loop something needs to keep track of the current pixel
 - And change each time through the loop
 - To sure that we have gone through all of the pixels
- We can loop through all elements in an array by starting with index 0, then index 1, and so on till index (length - 1)
 - And get the pixel at the current index value

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Reduce Red Algorithm

- Get the array of Pixel objects from the current picture
- Declare a variable to hold the red value
- Declare the index variable and set it to 0
- Declare a variable to refer to the current pixel
- Loop while index is less than the length of the array
 - Get the pixel at the index value
 - Get the current red value from the pixel
 - Divide the current red value by 2
 - Set the red for the current pixel to the changed value
 - Increment the index

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Loop Algorithm to Code

- How to write (code) the loop?
 - Use a while loop with a counter for the index starting at 0

```
int index = 0;
```
 - Add a variable to refer to the current pixel

```
Pixel pixelObj = null;
```
 - Loop while the index is less than the length of the array

```
while (index < pixelArray.length)
```
 - Get the current pixel from the array of pixels for the current index

```
pixelObj = pixelArray[index];
```

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Loop Algorithm to Code - Continued

- Get the red value at the pixel

```
value = pixelObj.getRed();
```
- Divide the red value by 2

```
value = value / 2;
```
- Set the pixel red value

```
pixel.setRed(value);
```
- Add one to (increment) the index
 - `index = index + 1;`

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Decrease Red Method

```
public void decreaseRed()           // get the red value
{                                   value = pixelObj.getRed();
    Pixel[] pixelArray = this.getPixels();
    int value = 0;                  // decrease the red value
    Pixel pixelObj = null;         value = value / 2;
    int index = 0;

    // set the pixel red
    // loop through all the pixels   pixelObj.setRed(value);
    while(index < pixelArray.length)
    {                                 // increment the index
        // get the current pixel     index = index + 1;
        pixelObj = pixelArray[index]; }
    }
```

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Method Names

- If we add this new method to Picture.java and compile will we get an error?
 - We will have two methods with the same name and both take no parameters
 - We can have two methods with the same name
 - As long as the parameter list is different
- We need to name one of them differently
 - Rename the first one to decreaseRedForEach

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Comments

- Comments are explanations of your code to help people understand your code
 - They are ignored by the compiler
- There are several kinds in Java
 - `//` a comment that lasts to the end of the line
 - `/*` a comment that can take up several lines until a `*/`
 - `/**` a Javadoc comment that is used to create html documentation of your code `*/`

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Decrease Red Exercise

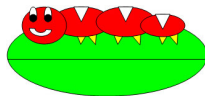
- In DrJava
 - Add the method decreaseRed() to Picture.java
 - Before the last `}` which ends the class definition
 - Compile the method
 - Click the Compile All button
 - Test it by doing the following in the interactions pane

```
> String fileName = "C:/intro-prog-java/mediasources/caterpillar.jpg";
> Picture picture1 = new Picture(fileName);
> picture1.explore();
> picture1.decreaseRed();
> picture1.explore();
```

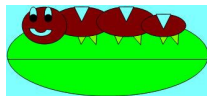
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decreaseRed Method Result

- Before method



- After method



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Using Multiplication by 0.5

- You could have also multiplied the red value by 0.5 and then cast back to integer
 - `value = value * 0.5;`
- Change the line that divided by 2 and try to compile this
 - In the decreaseRed method

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Loss of Precision

- If you try the code on the previous slide you will get a compiler error

```
Interactions Console Compiler Output
1 error found:
File: C:\src\prog-jsw\src\main\PictureJenm.java, Line: 107
Error: possible loss of precision
Found:   double
Required: int
```

- Possible loss of precision
- It is complaining about putting a double value into a int variable
 - Loss of fractional part

```
....
110 // decrease the red value by 50% (1/2)
111 value = value * 0.5;
112
113 // set the red value of the current pixel
114 pixel.setRed(value);
115
116
```

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Casting to Solve Loss of Precision Error

- It will compile if we tell the compiler we know about the possible loss of precision
 - And that it is intended
 - By using a cast to int
value = (int) (value * 0.5);
 - Notice that we cast the result of the multiplication back to an integer
- Casting is forcing a value into a type (type) expression

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Put Declarations Outside Loops

- When you need a variable in a loop it is best to declare it before the loop
 - Otherwise you are declaring a new variable each time through the loop
 - Which is slower than just changing the value associated with the variable
- In some languages you must declare all variables at the beginning of a method (function)
- In Java you can declare variables anywhere in a method
 - As long as you declare them before you use them
 - They are known in the block they are declared in

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Shortcuts for Common Operations

- In programming you often need to add one to a value
index = index + 1;
- You may use the shortcut
index++; or ++index;
- If you wanted to subtract 1 instead
index = index - 1;
index--; or -- index;

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Summary

- An algorithm is a description of how to solve a problem
- A program implements an algorithm in a programming language
- A comment is an explanation of your code to help people understand it
 - Comments are ignored by the computer
- If you multiply by a floating point number you can't put this in an integer variable
 - Unless you cast to integer
- You should declare variables before the body of the loop
 - That you will need in the loop

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