CSE8A Lecture 5

• TODO:
  – PSA2 Interview due by Sunday 1/27 noon
  – FINISH PSA3 WITH YOUR PARTNER by Tu 1/29 11:59pm!
  – PSA3 Interview due by Friday 2/1 noon

• Read next class: Section 5.1-5.2.

• PLAY WITH CODE!
  – Get stuck, then figure out how to get unstuck – it’s how you learn!
Your discussion groups

• Did you know…you were assigned not just a seat, but a group!

• Examine this layout to see who is in your group.
  – You **MUST** be discussing with the people shown in your group (same color) on this chart!
  – **NOT** just “anybody nearby to you”!
  – This prevents anybody from being left out (example: stuck between two groups neither of which really claims them) or other problems.
Your discussion groups

• Please take a moment to:
  – Shake hands with everyone in your group
  – Tell each other your names
  – What was your favorite TV or movie character when you were 8 years old?
CSE8A Today

- Arrays: from 2D to 1D, unraveling your arrays
- Debugging tips and tricks
What pixels does this code modify?

```java
Pixel[] pixelArray = this.getPixels();
int value = 0;
int index = 0;
while (index < pixelArray.length/4)
{
    value = pixelArray[index].getRed();
    value = (int) (value * 0.5);
    pixelArray[index].setRed(value);
    index = index + 1;
}
```
Pixel arrays and pixels in Pictures

• A Picture is a 2-dimensional array of pixels
  – Each pixel in the Picture has (x,y) coordinates, with x==0, y==0 at the upper-left-hand corner of the picture

• A Pixel[] pixel array is a 1-dimensional array of pixels
  – Each Pixel in the array has an integer index I, with I==0 indexing the first Pixel in the array

• How do the two relate to each other…?
Pixel arrays and pixels in Pictures

• How do the two relate to each other…?

```java
Picture pic = new Picture("mypic.jpg");
Pixel[] pixArray = pic.getPixels();
```

![Diagram showing pixel array and pixel relationships](image.png)
Pixel arrays and pixels in Pictures

• How do the two relate to each other…?
  Picture pic = new Picture("mypic.jpg");
  Pixel[] pixArray = pic.getPixels();

• The top row of pixels comes first in pixArray, then the second row of pixels, etc.

• pixArray[i] corresponds to what (x,y) in pic?

  \[ i = y \times \text{pic.getWidth}() + x \]

• Try it!
This code is supposed to increase red by 1.5, but...

```java
Pixel[] pixelArray = this.getPixels();
int value = 0;
int index = 0;

while (index < pixelArray.length)
{
    value = pixelArray[index].getRed();
    value = (int)1.5 * value;
    pixelArray[index].setRed(value);
    index = index + 1;
}
```
Debugging Loops: Tracing variables

Step 1: Have a mental model of what the variables are supposed to do
Step 2: Add print statements to make sure variables are doing what you think are.

Pixel[] pixelArray = this.getPixels();
int value = 0;
int index = 0;

while (index < pixelArray.length)
{
    value = pixelArray[index].getRed();
    value = (int)1.5 * value;

    pixelArray[index].setRed(value);
    index = index + 1;
}

Think Step 1 (1 min)
Discuss Step 1 (2 mins)
Debugging Loops: Tracing variables

Where should you insert the following print statements in the code below?
System.out.println( “Old value of red is ” + value );
System.out.println( “New value of red is ” + value );

Pixel[] pixelArray = this.getPixels();
int value = 0;
int index = 0;

while (index < pixelArray.length) {
    value = pixelArray[index].getRed();
    value = (int)1.5 * value;
    pixelArray[index].setRed(value);
    index = index + 1;
}

A. 1 & 2
B. 1 & 3
C. 2 & 3
D. 3 & 4
E. 2 & 4
DEBUGGING: This code should swap the red and blue components at each Pixel; what does it ACTUALLY do?

```java
Pixel[] pixelArray = this.getPixels();
int value = 0;
int index = 0;
while (index < pixelArray.length)
{
    Pixel pix = pixelArray[index];
    value = pix.getRed();
    value = pix.getBlue();
    pix.setRed(value);
    pixelArray[index].setBlue(value);
    index++;
}
```

How could we fix it?

A. It sets the red value to be the same as blue
B. It has a compiler error
C. It sets the blue value to be the same as red
D. It really does swap them
Swapping: A better way

```java
Pixel[] pixelArray = this.getPixels();
int value = 0;
int index = 0;
while (index < pixelArray.length)
{
    Pixel pix = pixelArray[index];
    //<<CODE GOES HERE>>
    index++;
}

value = pix.getRed();
pix.setBlue(pix.getRed());
pix.setRed(value);

value = pix.getRed();
pix.setRed(pix.getBlue());
pix.setBlue(value);
```

Solo (2 mins)
Discuss (2 mins)
Group vote (30 sec)
Pixel[] pixelArray = this.getPixels();
int value = 0;
Pixel p = null;
for(int index = 0; index < pixelArray.length - 1; index++)
{
    p = pixelArray[index];
    q = pixelArray[index+1];
    p.setRed(q.getRed());
    p.setBlue(q.getRed());
    p.setGreen(q.getGreen());
}
What picture most accurately describes what this code does?

Pixel[] pixelArray = this.getPixels();
int value = 0;
Pixel p = null;
for(int index = 0; index < pixelArray.length-1; index++)
{
    p = pixelArray[index+1];
    q = pixelArray[index];
    p.setRed(q.getRed());
    p.setBlue(q.getRed());
    p.setGreen(q.getGreen());
}
Why does this code have an error?

A. It tries to access pixelArray[-1]
B. It tries to access pixelArray[0]
C. It tries to access pixelArray[pixelArray.length]
D. It tries to access pixelArray[pixelArray.length+1]
E. None of the above

```java
Pixel[] pixelArray = this.getPixels();
int value = 0;
Pixel p = null;
for(int index = 0; index < pixelArray.length; index++)
{
    p = pixelArray[index];
    q = pixelArray[index+1];
    p.setRed(q.getRed());
    p.setBlue(q.getRed());
    p.setGreen(q.getGreen());
}
Fill in the for(…….) to loop over pixels bottom right to top left

• Like this:

```java
Pixel[] pixArr = this.getPixels();

for (                                  )
{
    //Some code doing set on pixArr[i]
}
```
TODO

• FINISH PSA3, do interview
• Go to discussion section for help getting started
• Read next class: Section 5.2
• PLAY WITH CODE!
  – Get stuck, then figure out how to get unstuck – it’s how you learn!