Simple Java YEAH Hours

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What are YEAH hours?

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Held soon after each assignment is released

Help you to get an early start on your assignments

Future dates TBA

Slides will be posted!

Roadmap

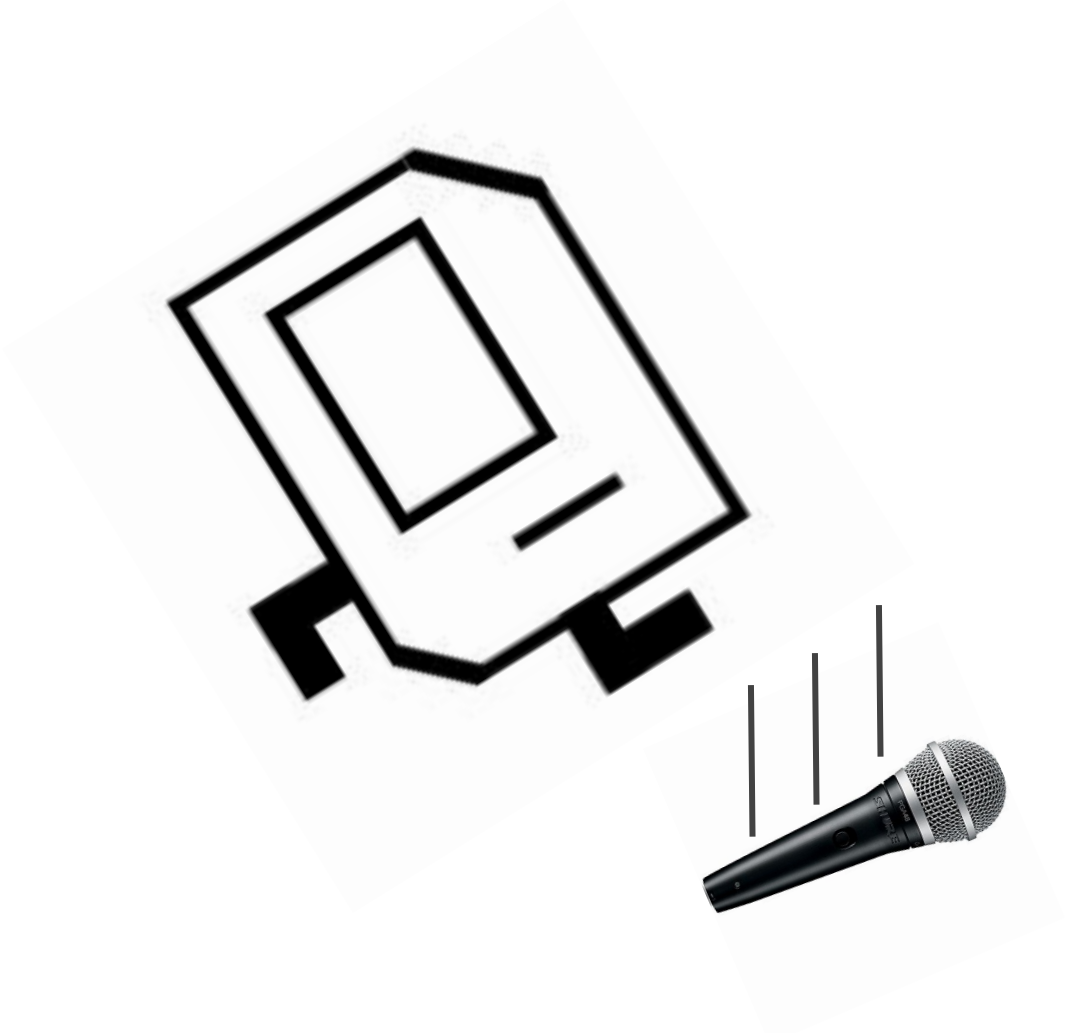
Review

Assignment overview and tips

Questions

Dropping the mic on Karel

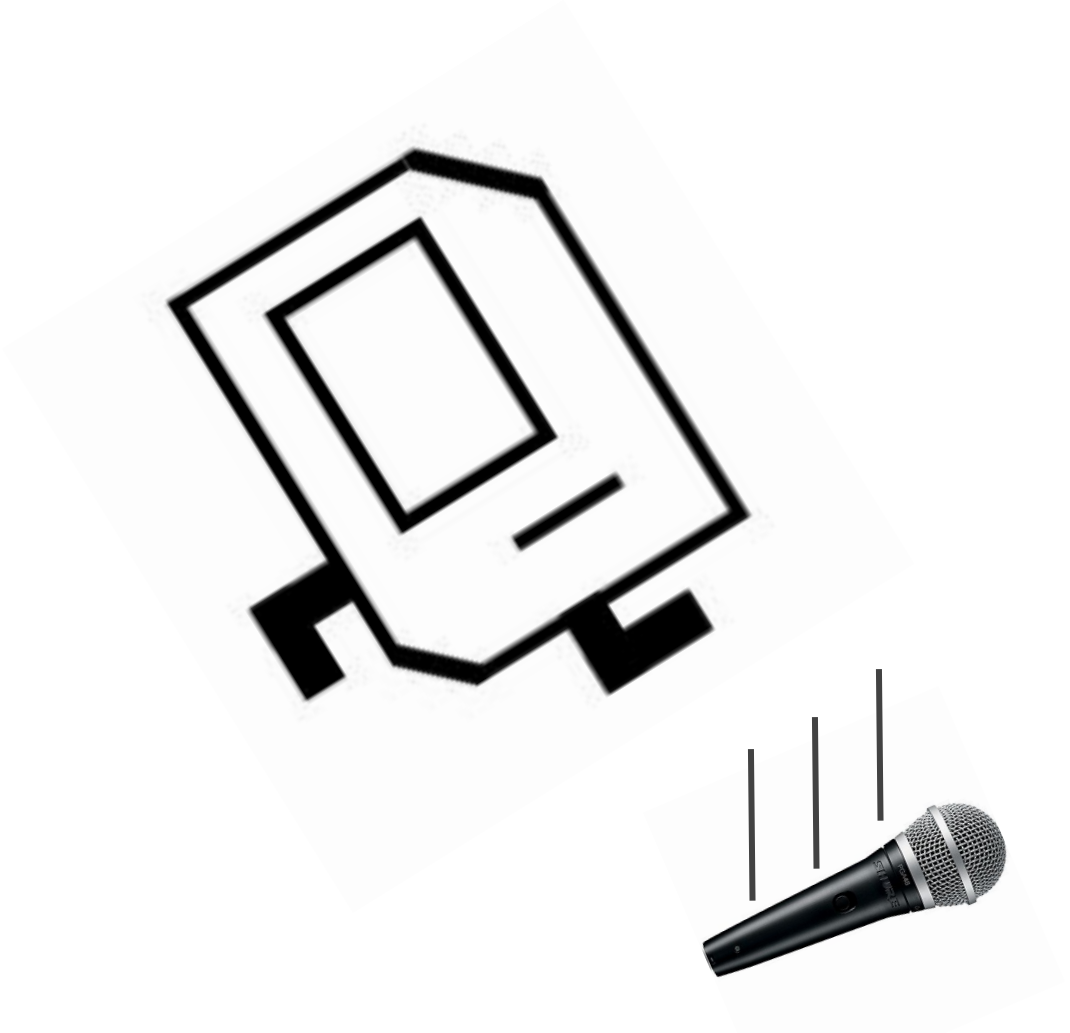
Karel taught us a lot of things!



Dropping the mic on Karel

Karel taught us a lot of things!

Control Flow



Dropping the mic on Karel

Karel taught us a lot of things!

Control Flow

Decomposition & Top Down Design

Dropping the mic on Karel

Karel taught us a lot of things!

- Control Flow
- Decomposition & Top Down Design
- Algorithmic Strategy

Control Flow in Karel

```
for (int i = 0; i < 5; i++) {      // do whatever is in the loop 5 times
     if (beepersPresent()) {       // what to do if a particular condition is true
          move();
     } else {                      // what to do if that condition is false
          putBeeper();
     }
}

while (frontIsClear()) {          // do this until a particular condition is false
     move();
     putBeeper();
}
```

Control Flow outside Karel

```
for (int i = 0; i < 100; i++) {    // do whatever is in the loop 100 times
     if (i % 2 == 0) {             // what to do if a particular condition is true
          println("Even: " + i);
     } else {                      // what to do if that condition is false
          println("Odd: " + i);
     }
}

while (true) {                     // loop indefinitely
     if (agentOfChaos()) {
          break;                   // ~~savagely~~ immediately end while loop
     }
     print("Good prevails!");
}
```

Control Flow-ception

```
for (int i = 0; i < 10; i++) {
     for (int j = 0; j < 10; j++) {
          if (i == j) {
               println(“i and j are equal!”);
          } else {
               int difference = i - j;
               if (difference > 0) {
                    println(“i is bigger than j by ” + difference + “!”);
               } else {
                    println(“j is bigger than i by ” + difference + “!”);
               }
          }
     }
}
```

Graphics

```
GRect rect = new GRect(50, 50, 200, 200);
rect.setFilled(true);
rect.setColor(Color.BLUE);

GOval oval = new GOval(0, 0, getWidth(), getHeight());
oval.setFilled(false);
oval.setColor(Color.GREEN);

GLabel text = new GLabel("banter", 200, 10);

add(text);
add(rect);
add(oval);
```

Graphics

```
GRect rect = new GRect(50, 50, 200, 200);
rect.setFilled(true);
rect.setColor(Color.BLUE);

GOval oval = new GOval(0, 0, getWidth(), getHeight());
oval.setFilled(false);
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GLabel text = new GLabel("banter", 200, 10);

add(text);
add(rect);
add(oval);
```

Things to remember

- Coordinates are `doubles`
- Coordinates are measured from the top left of the screen
- Coordinates of a shape are coordinates of its top left corner
- Coordinates of a label are coordinates of its bottom left corner
- Remember to `add` objects to the screen!
- Use the online documentation!

Primitive variables

```
int x = 7;   // declare and initialize a variable
x = 9;       // change the value of x
x = x + 1;   // increment (add 1 to) x.  A.K.A. x++
x = x + 2;   // add 2 to x.             A.K.A. x += 2
x /= 2       // divide x by 2, and truncate result

double d = 3.5;

boolean isThisTrue = true;
isThisTrue = !isThisTrue;  // flip isThisTrue
```

Primitive variables

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int x = 7;    // declare and initialize a variable
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double d = 3.5;

boolean isThisTrue = true;
isThisTrue = !isThisTrue;  // flip isThisTrue
```

Things to remember

- The expressive hierarchy:
  `boolean < char < int < double`
- Compare variables using ==
  `if (x == 7) {...}`
- Conditional operators: && and ||
  `if (x == 7 && y == 6.3)`
  `if (x == 7 || x == 6)`
  Avoid this:
  `if (x == 7 || 6)`
- Use constants!

```
private static final int MY_NUM = 10;
```

Variable scope

Variables live inside the block in which they're declared

Scope for i

Scope for y

```
for (int i = 0; i < 5; i++) {
    int y = i * 4;
}
i = 3; // Error!
y = 2; // Error!

... // in some code far, far away
int y = 0;
for (int i = 0; i < 5; i++) {
    y = i * 4;
}
y = 2;
```

Scope for y

Methods, parameters and variables

(covered in Wednesday's lecture)

Methods

```
private returnType methodName(type param1, type param2, ...) {
    // sick code here
}
```

- A method header provides some guarantees about the method (what it returns, how many parameters it takes)
- Parameters and return values generalize the methods we saw in Karel to allow the use of variables
- If a method returns something, that something needs to be stored in a variable

```
returnType storedValue = methodName(/* params */);
```

- Primitive variables passed into a method are passed by value


```
private returnType methodName(type parameter1, type parameter2,...)

private int returnsInt() {...}
private void drawsRect(int width, int length) {...} //void is no type
public boolean frontIsClear() {...} //look familiar?
```

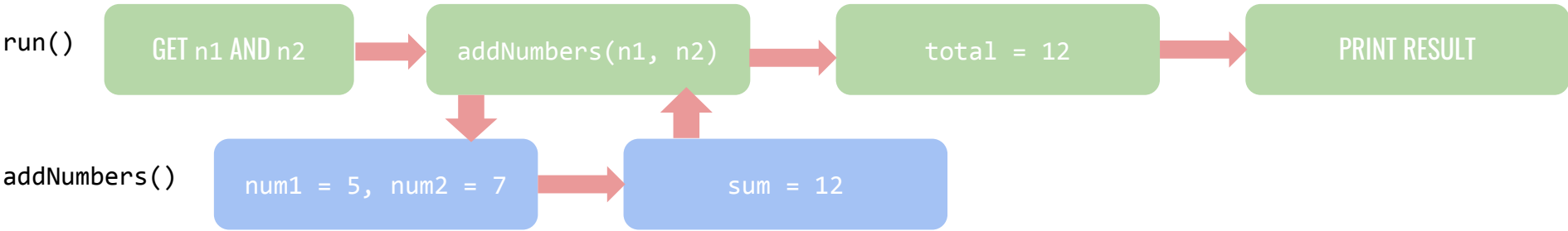
Parameters and a return value are both optional!

Example: Methods and Parameters

```
public void run() {
     println("Choose 2 numbers!");
     int n1 = readInt("Enter n1"); //5
     int n2 = readInt("Enter n2"); //7

     int total = addNumbers(n1, n2);
     println ("The total is " + total);
}
```

```
                                        5          7
private int addNumbers(int num1, int num2) {
     int sum = num1 + num2;    //12
     return sum;
}
```



Returning in different places

```
private int multipleReturns(int x) {

      if (x == 5) {
            return 0;
      }

      return 1; // this only happens if x != 5
      return 5; // never gets to this line
}

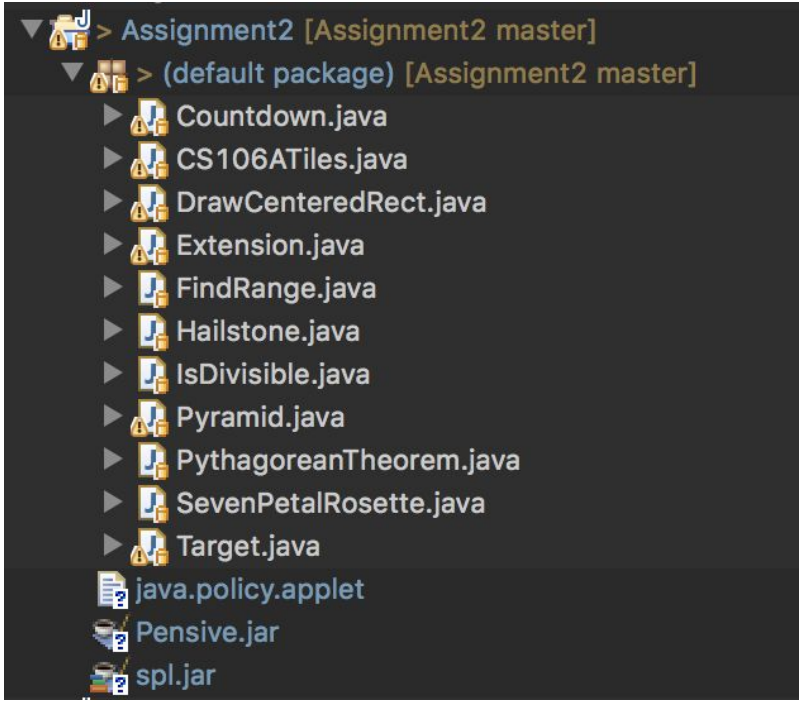

// note: every path through the method ends
with a single return statement

// note: a function ends immediately after it
returns
```

Assignment 2!

High level overview

- Due Monday 28/1/2019
- 10 Problems
  - You can do the first 9 today
  - You can improve your style after Wednesday's lecture
    - *[Use methods]* questions
  - You can do the 10th after Friday's lecture



Problem 1 Draw a blue, filled rectangle in the center of the screen with dimensions 350 x 270

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Questions to ask yourself:

1. How do I find the center of the screen?
2. Given the location of the center of the screen, where should I put the rectangle?

Useful ideas from lecture

- Coordinates are measured from the top left of shapes and the window

Useful methods:

- `getWidth()` tells you the width of the canvas
- `getHeight()` tells you the height of the canvas
- `rect.getWidth()` tells you the width of `rect`
- `rect.getHeight()` tells you the height of `rect`
- See lecture/video and `GRect` documentation for more!

Problem 2 Print out a countdown down from 10 to 1 and then print “Liftoff!”

#rocketscience

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Questions to ask yourself:

1. What sort of control flow structure best suits this problem?
2. What’s a nice way to represent what the current number is?

Useful ideas from lecture

- You can use the variables inside `for` loops!

Problem 3 Pythagorean Theorem

Questions to ask yourself:

1. What data type should I store numbers as?
2. How many variables do I need?

```
Enter values to compute the Pythagorean theorem.
a: 3.5
b: 4.2
c = 5.4671747731346585
```

Useful ideas from lecture

- Primitive data types
- The expressive hierarchy

Useful methods

- `math.sqrt(n)` tells you the square root of `n`
- Look at the lecture for more!

Problem 4 Keeping track of the largest and smallest

Questions to ask yourself:

1. What sorts of things do you need to store?
2. How do you initialize variables?

```
This program finds the largest and smallest numbers.
? 11
? 17
? 42
? 9
? -3
? 35
? 0
smallest: -3
largest: 42
```

Useful ideas from lecture

- Loop structures
- Variable scope
- Edge cases
- Sentinel values

Problem 5 Hailstone sequence

Questions to ask yourself:

1. What sorts of things do you need to store?
2. How do you initialize variables?

```
Enter a number: 17
17 is odd, so I make 3n + 1: 52
52 is even so I take half: 26
26 is even so I take half: 13
13 is odd, so I make 3n + 1: 40
40 is even so I take half: 20
20 is even so I take half: 10
10 is even so I take half: 5
5 is odd, so I make 3n + 1: 16
16 is even so I take half: 8
8 is even so I take half: 4
4 is even so I take half: 2
2 is even so I take half: 1
The process took 12 to reach 1
```

Useful ideas from lecture

- Loop structures
- Variable scope
- Edge cases
- Sentinel values

Problem 6 Draw a pyramid!

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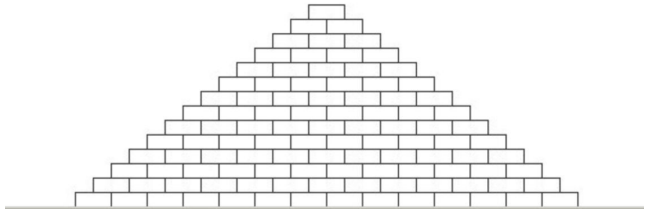
Questions to ask yourself:

1. What sort of control flow structure best suits this problem?
2. How do I decompose this problem?
3. What information do I need to draw a row and the bricks inside a row?



Useful ideas from lecture

- You can use the variables inside `for` loops!
- You can nest `for` loops!
- This checkerboard example from lecture

Useful methods

- `getWidth()` tells you the width of the canvas
- `getHeight()` tells you the height of the canvas
- `rect.getWidth()` tells you the width of `rect`
- `rect.getHeight()` tells you the height of `rect`
- See lecture and `GRect` documentation for more!

** remember that coordinates should be `double`s

Problem 7 Bullseye!

Questions to ask yourself:

1. Can this problem be decomposed?
2. What information is needed to draw each circle?

Useful ideas from lecture

- How methods can be used to encapsulate repeated functionality

Useful methods

- See lecture and `GOval` documentation for more!

Problem 8 CS 106A Tiles

Questions to ask yourself:

1. Can this problem be decomposed?
2. What information is needed to draw each rectangle?

Useful ideas from lecture

- How methods can be used to encapsulate repeated functionality
- Remember that a label's coordinate is its bottom left corner

Useful methods

- `label.getAscent()` tells you the distance between the baseline of the label and the top of the label. This is useful for centering!
- See lecture and `GRect` documentation and `GLabel` documentation for more!

Problem 9 `isDivisibleBy`

Questions to ask yourself:

1. Which of the various cases is the most conclusive? When should I check them?
2. How can I effectively test a method?

Useful ideas from lecture

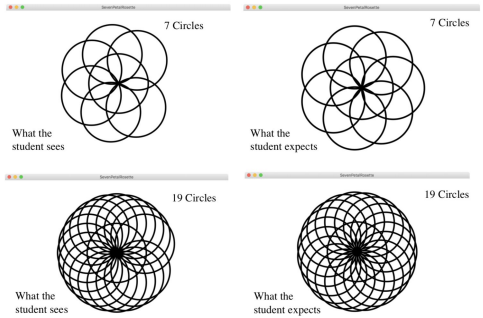
- How can we use the remainder operator
- Testing for edge cases! (Look at the run method)

Problem 10 Debugging

(You can do this after Friday's lecture)

Questions to ask yourself:

1. Where should I be placing breakpoints?
2. Once I've identified a misbehaving variable, how should I correct it?



Useful ideas from lecture

- How to use the debugger (step into/out of methods)

A last few tips and tricks

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- Draw things on paper for Graphics Programs
- Use Top Down Decomposition wherever you can
- Go to the LaIR (6:50-10:50 PM, First floor of Tresidder)!
- Incorporate your IG feedback!
- Use the debugger!
- Work on extensions

Questions?