

Aliasing

CSSE 230 Day 4

Diagnostic Quiz Review
Comparable, Comparator,
and Function Objects

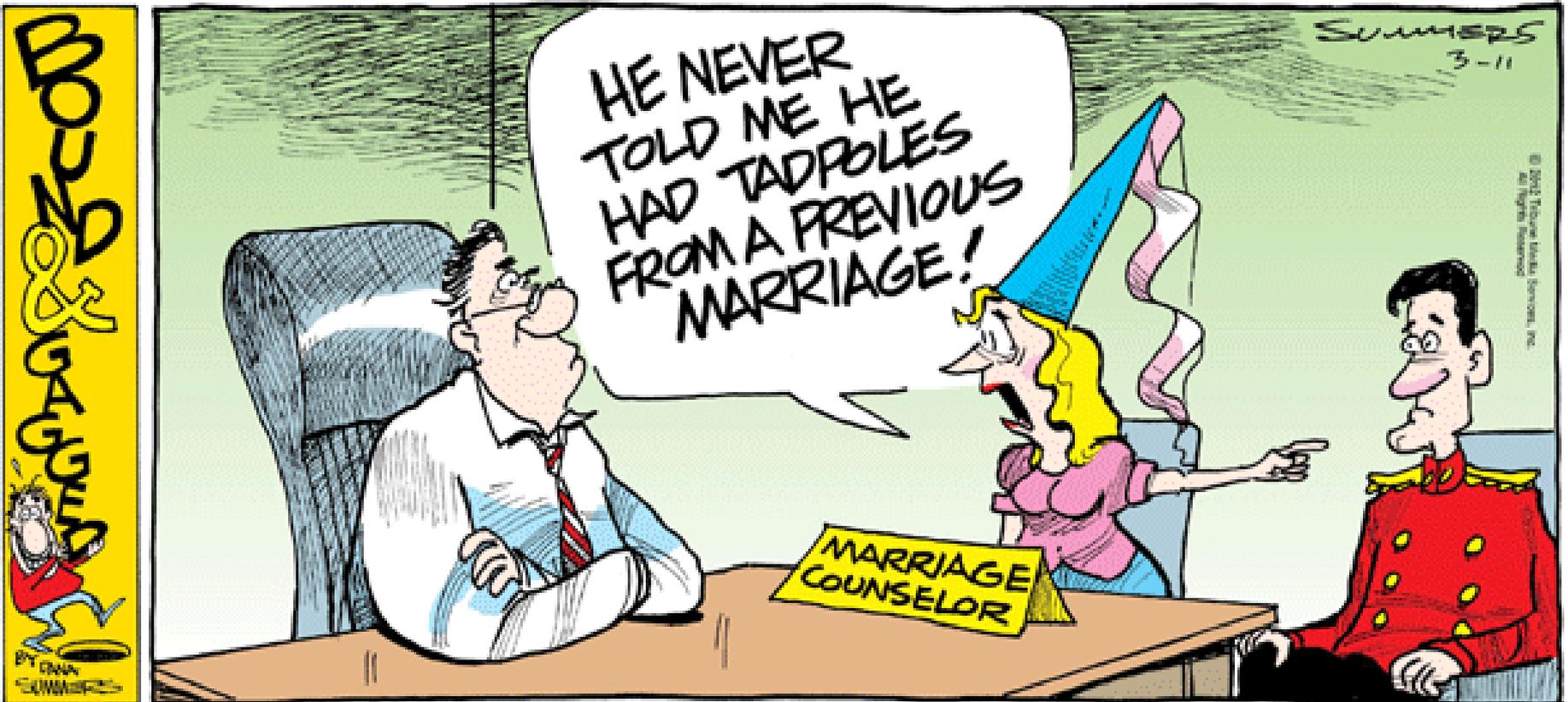
What language is this? What
is it an example of?

```
f := x->3*x&2 + 4*x - 2;  
plot(f(x), x=-3..2);
```

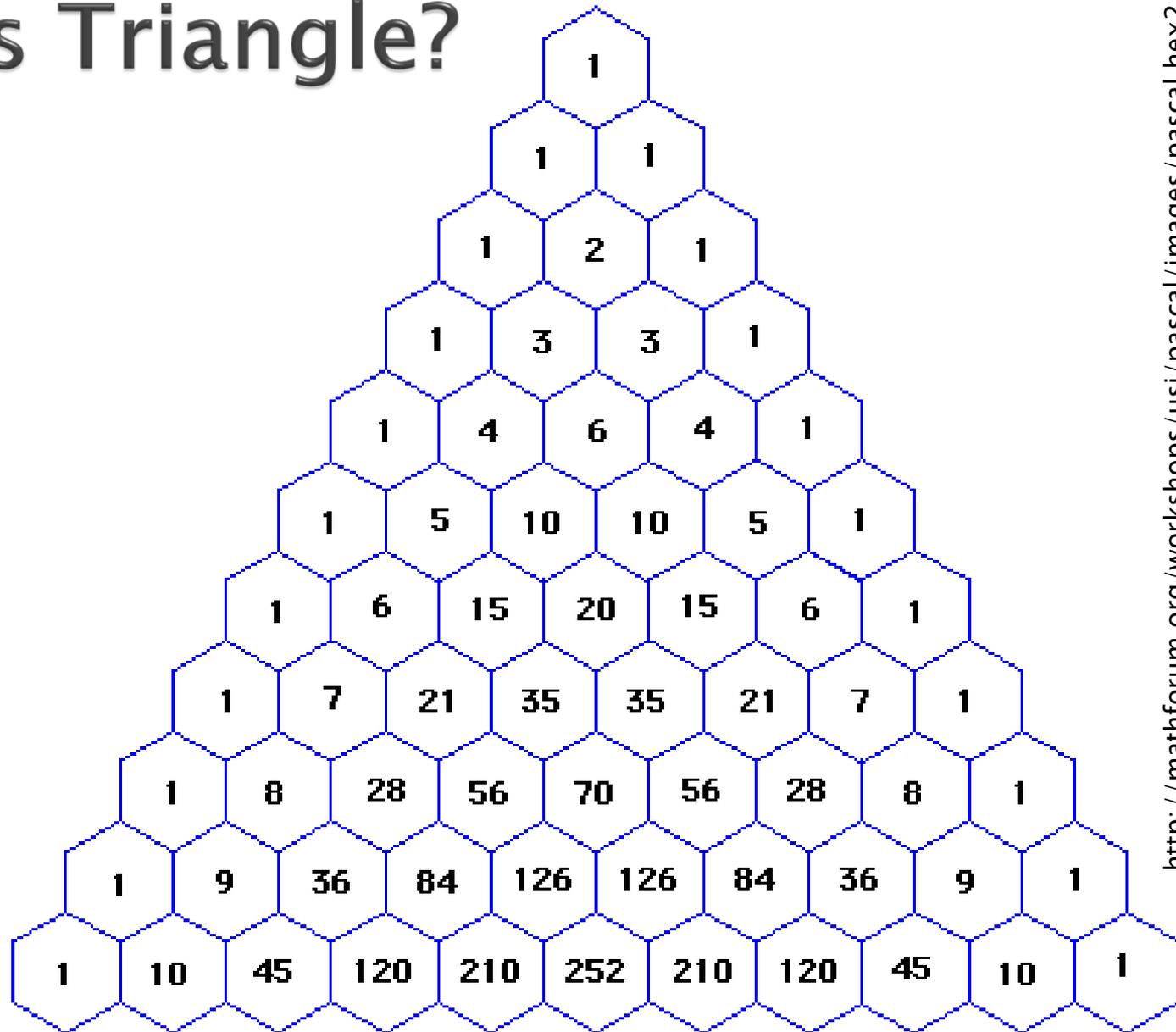
Check out from SVN: DiagQuizReview

Questions?

- ▶ WarmupAndStretching?
- ▶ Written Assignment 2?

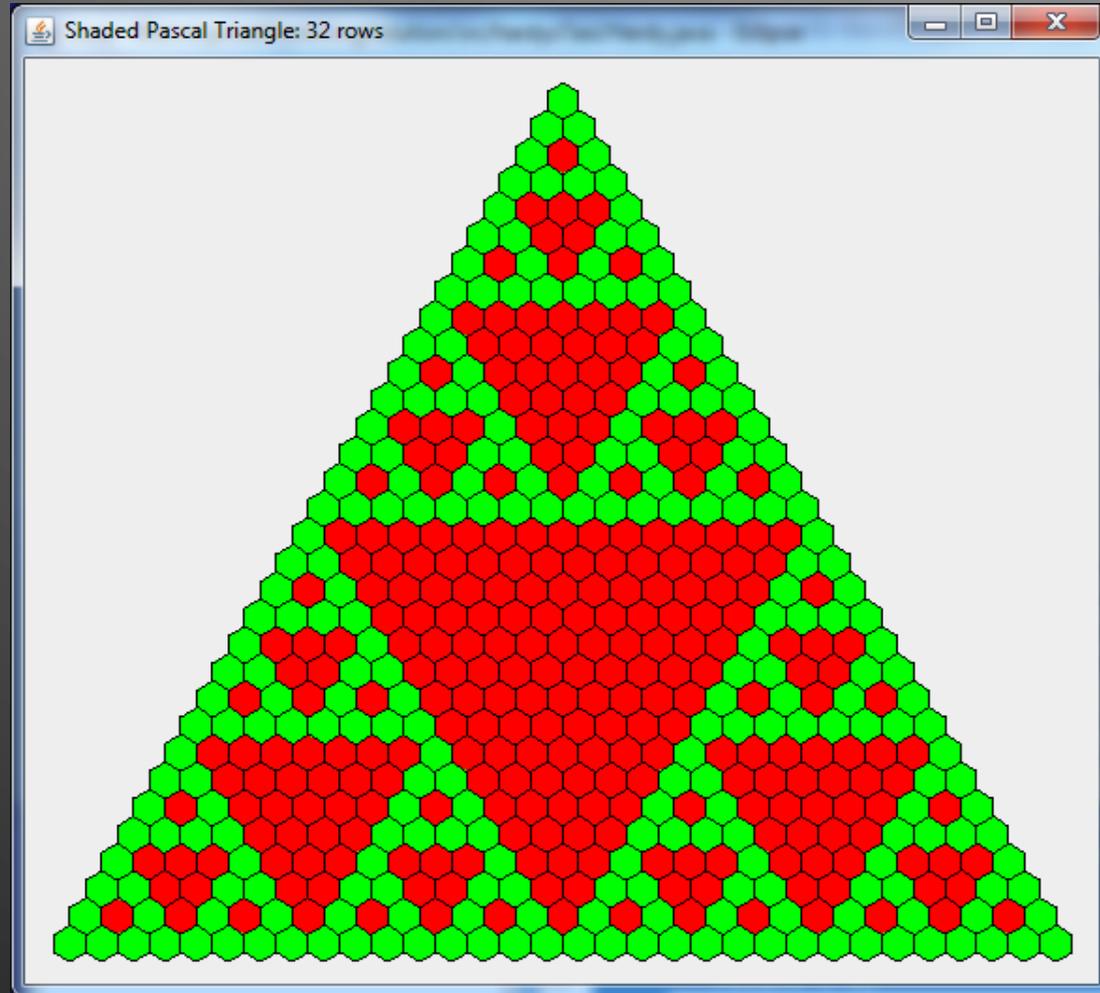


Ever notice the patterns in Pascal's Triangle?

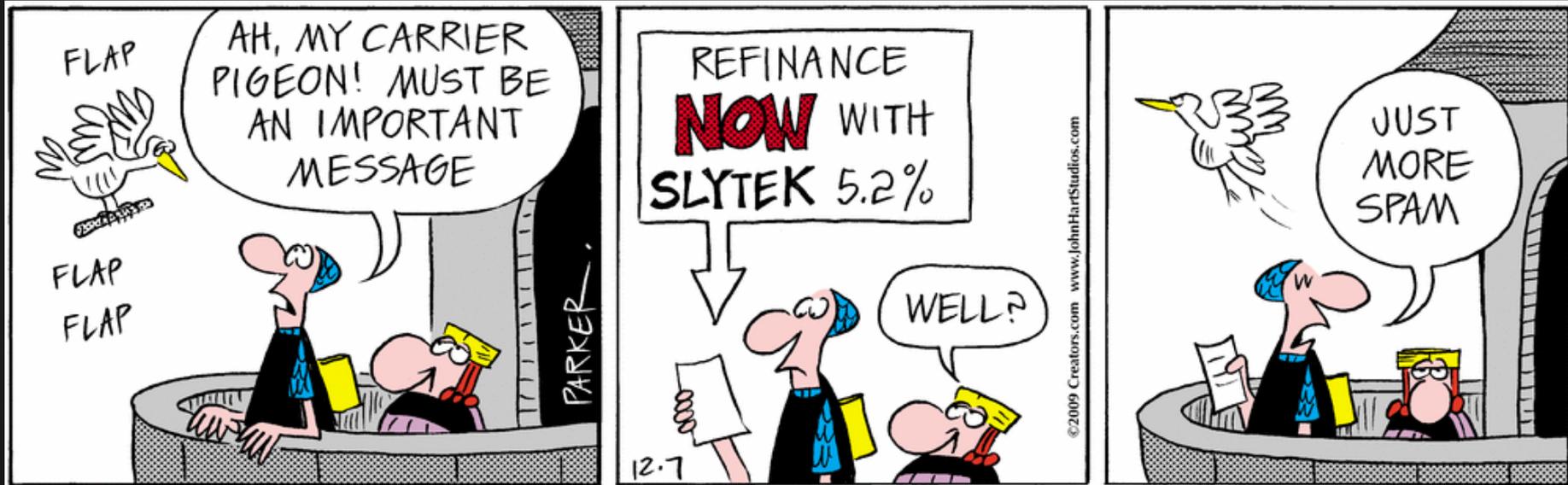


PascalChristmasTree

- Demo
- Partner?
 - See main schedule page
- Exchange contact info



Diagnostic Quiz Review



Some questions that many students missed

Expression questions

- ▶ Give a **very simple** Java expression that is equivalent to:

!(x && !x)

BTW: Never write something like
`if (a.isVisible() == true)`

- ▶ What are the values of each of the following expressions, if `x==5` and `y==7` ?

x + ' ' + y

x + " " + y

x + y + " "

Simple big-Oh questions

- ▶ What is the worst-case Big-Oh running time of an unsuccessful sequential search of an unordered array that contains N elements?
- ▶ What is the worst-case Big-Oh running time of an unsuccessful binary search of an array that contains N
- ▶ What is the Big-Oh running time of merge sort of an array that contains N elements?

Method Selection

Overloading vs. Overriding

- ▶ In Eclipse, open:
 - examples.StaticParamsDemo*
- ▶ from the *DiagQuizReview* project
 - from Weiss, Figure 4.45, page 166.
- ▶ Section 4.9 begins:
 - "A common myth is that all methods and all parameters are bound at runtime. This is not true."
 - Methods that are static, final, or private are bound at compile time.

Note that all of the code from the Weiss book is available on the course web site. You can run it, modify it, and experiment.

Aliasing

- ▶ How many objects are created in this code?

```
MyNumber a = new MyNumber();  
a.setNum(5);  
MyNumber b = new MyNumber();  
b.setNum(6);  
MyNumber c = a;  
System.out.println(c);
```

- ▶ What is “aliasing”?

Default Constructors

- ▶ What does Java do if no constructor is declared for a class?
 - How can we instantiate the class?
 - What values do the fields get?

```
class Jambalaya {  
    int beans;  
    double rice;  
    Insect crayfish;  
  
    public String toString() {  
        return beans + " " + rice + " " + crayfish;  
    }  
}
```

More Big-Oh Practice

```
for (int i = 0; i < n; i++)  
    for (int j = 0; j < i; j++)  
        sum++;
```

34% of students answered $N \log N$.
Where could the log come from?

```
for (int i = 0; i < n; i++)  
    for (int j = 0; j < n * n; j++)  
        for (int k = 0; k < j; k++)  
            sum++;
```

```
for (int i = 1; i < n; i = i * 2)  
    sum++;
```

One more distinction

- ▶ *throw* versus *throws*
 - Part of exception handling
 - Signal an error with: *throw new ExceptionType()*
 - Abdicate responsibility with:
void myMethod() throws ExceptionType {
 ...
}

Interlude

- ▶ Computer Science is no more about computers than astronomy is about _____.

Donald Knuth

Interlude

- ▶ Computer Science is no more about computers than astronomy is about telescopes.

Donald Knuth

Function Objects and Generics

Comparable and Comparator

Comparable review:

- ▶ *interface java.lang.Comparable<T>*
- ▶ Type Parameter: *T* – the type of objects that this object may be compared to
- ▶ *int compareTo(T o)*
 - Compares *this* with *o* for order.
 - Returns a negative integer, zero, or a positive integer as this object is less than, equal to, or greater than the specified object
 - Primitive type comparison: $x < y$
 - Comparable comparison: $obj1.compareTo(obj) < 0$
 - Implement findMax in RectangleSorters now

Limitations of Comparable!

- ▶ There is more than one natural way to compare Rectangles!
- ▶ What if we want to compare using
 - Height?
 - Width?
 - Closeness of aspect ratio to the golden ratio, ϕ
- ▶ It would be nice to be able to create and pass comparison methods to other methods ...

$$\phi = \frac{a+b}{a} = \frac{a}{b} = \frac{1+\sqrt{5}}{2}$$

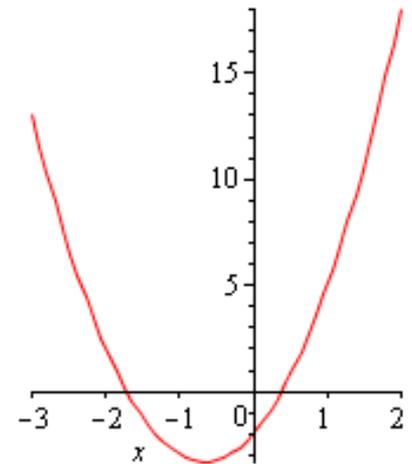
Function Objects (a.k.a. Functors)

- ▶ Why do methods have arguments in the first place?
- ▶ We'd like to be able to pass a method as an argument to another method

```
> f := x->3*x^2 + 4*x - 2;
```

$$f := x \rightarrow 3x^2 + 4x - 2$$

```
=  
> plot(f(x), x=-3..2);
```



```
=  
> solve(f(x), x);
```

$$-\frac{2}{3} + \frac{\sqrt{10}}{3}, -\frac{2}{3} - \frac{\sqrt{10}}{3}$$

Java Function Objects

- ▶ What's it all about?
 - Java doesn't (yet) allow passing functions as arguments.
 - So, we create objects whose sole purpose is to pass a function into a method
 - Called **function objects**
 - a.k.a. functors, functionoids, more fun than a barrel of monkeys
- ▶ Useful function object example: *Comparator*
- ▶ Implement one in RectangleSorters now

Sorting Arrays and Collections

- ▶ *java.util.Arrays* and *java.util.Collections* are your friends!

You can sort by any means you like: just pass your Comparator as a second argument to `Arrays.sort()` or `Collections.sort()`.

On the CountMatches problem,
create and use function objects...

...but not Comparators

See written assignment 2