

# Control in Java and Programming

- The computer executes your program one statement at a time, from top to bottom within the method/function that's called.

```
public int daysIn(int month) {  
    if (month == 1) return 31;  
    if (month == 2) return 28;  
    if (month == 3) return 31;  
    ...  
}
```

- What is the anatomy of a function? Of an if-statement? How do we specify these?

# Lydia Kavradi

- Awards
  - Grace Murray Hopper
  - Brilliant 10

"I like to work on problems that will generally improve the quality of our life,"

*What's the thing you love most about science?*

"Working with students and interacting with people from diverse intellectual backgrounds. Discovery and the challenge of solving a tough problem, especially when it can really affect the quality of our lives. I find the whole process energizing."



# Specifying language constructs

```
public Type Name(parameter-list) {  
    statement-list  
}
```

```
parameter-list:: empty-list || non-empty-list
```

```
non-empty-list:: Type Name
```

```
non-empty-list:: Type Name, non-empty-list
```

```
if ( boolean-expression ) {  
    statement-list  
}
```

# zero-one, true-false, boolean

```
if ( a == b ) {  
    statement-list  
}
```

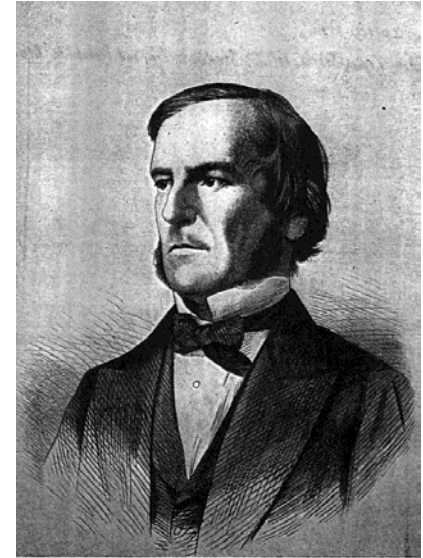
```
if ( a relational-operator b ) {  
    statement-list  
}
```

```
if ( bool-exper conditional bool-expr ) {...}
```

```
if ( boolean-function ) {...}
```

==, !=, <, >, <=, >=

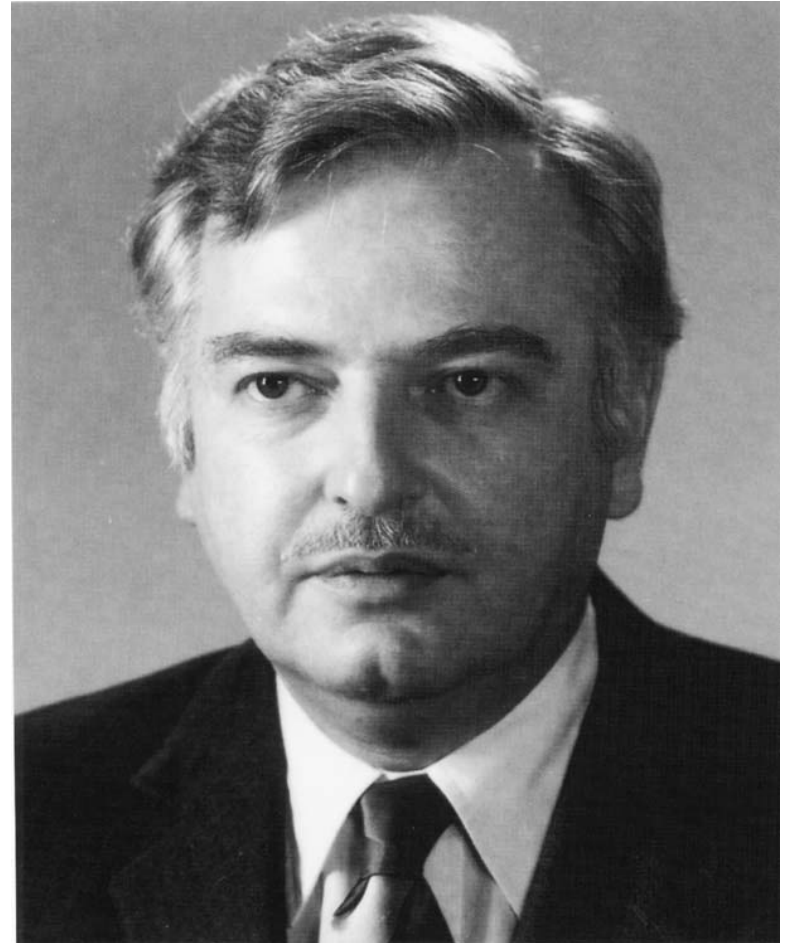
&& ||, !



GEORGE BOOLE

# John Kemeny, (1926-1992)

- **Invented BASIC, assistant to Einstein, Professor and President of Dartmouth**
  - Popularized computers being ubiquitous on campus/at home
  - BASIC ported to early personal computers by Gates and Allen
- **Initially BASIC was free, but many different dialects arose. In 1985 Kemeny and Kurtz shipped TRUE BASIC, to challenge Pascal in academia**
  - What's used today?



# Equality of values and objects

```
int x = 3*12;
if (x == 36) {is-executed}
String s = new String("genetic");
String t = s.substring(0,4);
if (t == "gene") {not executed}
if (t.equals("gene")) {is-executed}
```

- **Primitive types are boxes**
- **Object types are labels on boxes**
  - If we don't call new there's no box for the label
  - No box is called *null*, it means no object referred to or referenced by variable/pointer/reference

# Objects and values

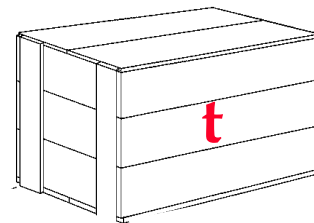
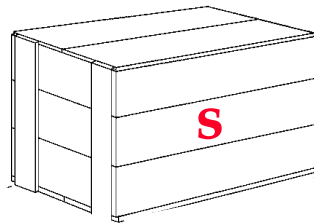
- Primitive variables are boxes
  - think memory location with value
- Object variables are labels that are put on boxes

```
String s = new String("genome");
```

```
String t = new String("genome");
```

```
if (s == t) {they label the same box}
```

```
if (s.equals(t)) {contents of boxes the same}
```



*What's in the boxes? "genome" is in the boxes*

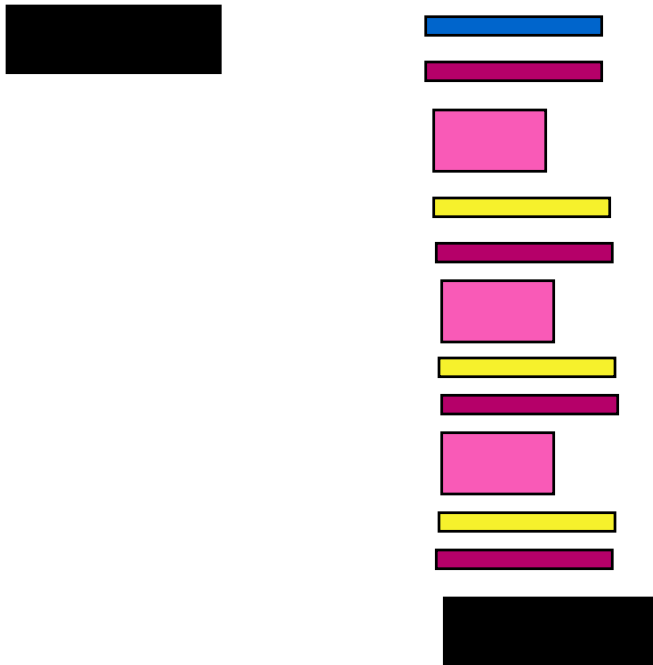
# Objects, values, classes

- For primitive types: `int`, `char`, `double`, `boolean`
  - Variables have names and are themselves boxes (metaphorically)
  - Two `int` variables assigned 17 are equal with `==`
- For object types: `String`, `Sequence`, others
  - Variables have names and are labels for boxes
  - If no box assigned, created, then label applied to *null*
  - Can assign label to existing box (via another label)
  - Can create new box using `new`
- Object types are references or pointers or labels to storage



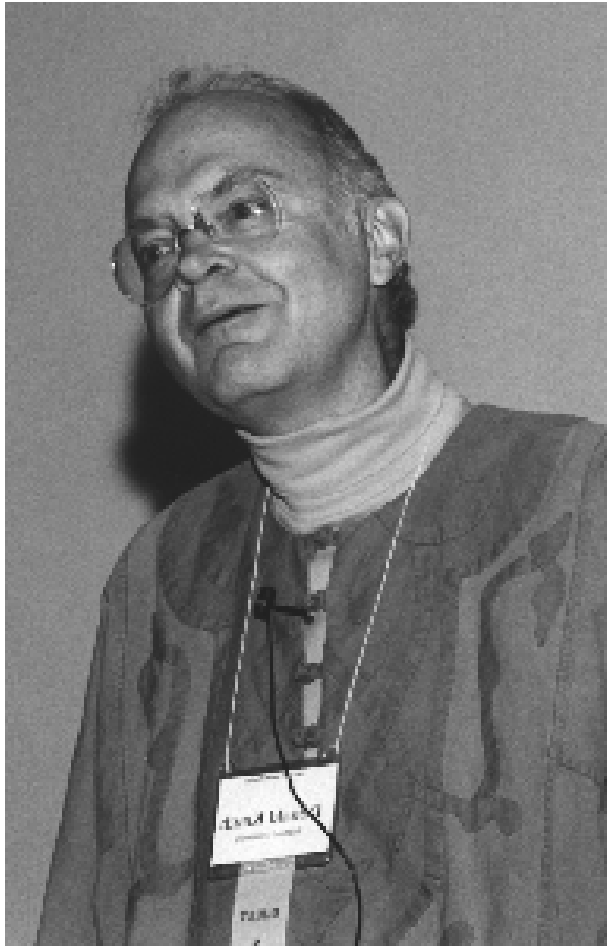
# Anatomy of for-loop

```
String s = new String("agt");  
String rs = new String("");  
for(int k=0; k < 3; k++){  
    rs = rs + s.charAt(k);  
}
```



- **Initialization happens once**
- **Loop test evaluated**
  - If true body executes
  - If false skip after loop
- **After loop body, increment executed and test re-evaluated**
- **What should be true about test?**
- **What about body?**
- **What about together?**

# Don Knuth (Art of Programming)



*“My feeling is that when we prepare a program, it can be like composing poetry or music; as Andrei Ershov has said, programming can give us both intellectual and emotional satisfaction, because it is a real achievement to master complexity and to establish a system of consistent rules.”*

*“We have seen that computer programming is an art, because it applies accumulated knowledge to the world, because it requires skill and ingenuity, and especially because it produces objects of beauty.”*