Changing Control

Testing and Repetition

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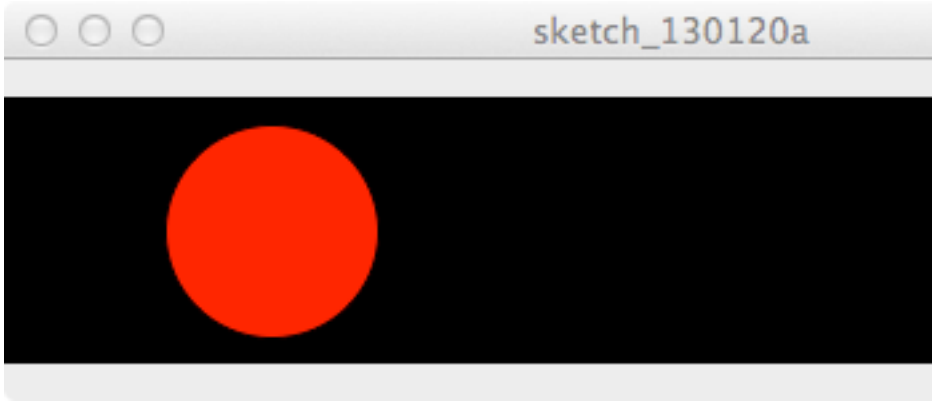
Let's Begin W/ Idea From Last Lab

- We saw how to change the color of the ball and its direction with a mouse & key clicks
- Recall

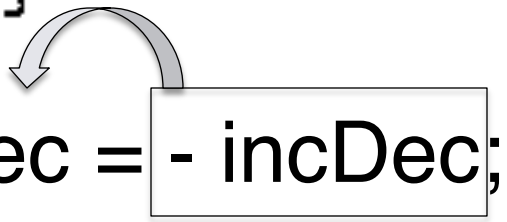



```
void keyPressed ( ) {
  incDec = - incDec;
}
void mousePressed( ) {
  int temp;
  temp = bPos;
  bPos = gPos;
  gPos = rPos;
  rPos = temp;
}
```

First: Assignment (=) At Work

- Rule: Assignment always moves information from right to left, as in

```
void keyPressed ( ) {
   incDec = - incDec;
}
```



- Rule: Always evaluate (compute) the right side, then assign the result to the name on the left side …

Expressions

- Facts about expressions
  - Expressions are formulas using:

    + - * / % || ! && == < <= >= > !=

  - Operators can only be used with certain data types and their result is a certain data type
  - Putting in parentheses is OK, and it's smart
- Rules about expressions
  - Expressions can usually go where variables can go

Expressions, the Picture

- Facts
  - Expressions are formulas: a+b points*wgt (year%4 == 0) 7 != 4 (age>12) && (age<20)
  - "Need & give data types"
    - + - * / % < <= => > want numbers;
    - && ! || want logical (Boolean) values
    - == and != want operands to be same type
  - "Parentheses are good": (a * b) + c is the same as a*b+c, but easier to read

mod (%) is what's left after divide

- a%b (read, "a mod b") is the amount left after "b divides into a evenly"
- Examples:
  - `0 % 3` is 0
  - `1 % 3` is 1
  - `2 % 3` is 2
  - `3 % 3` is 0
  - `4 % 3` is 1
  - `5 % 3` is 2
  - `6 % 3` is 0

Even: a number `n` is even if `n%2 == 0`

Leap Year: `year` is a leap year if `year%4 == 0`

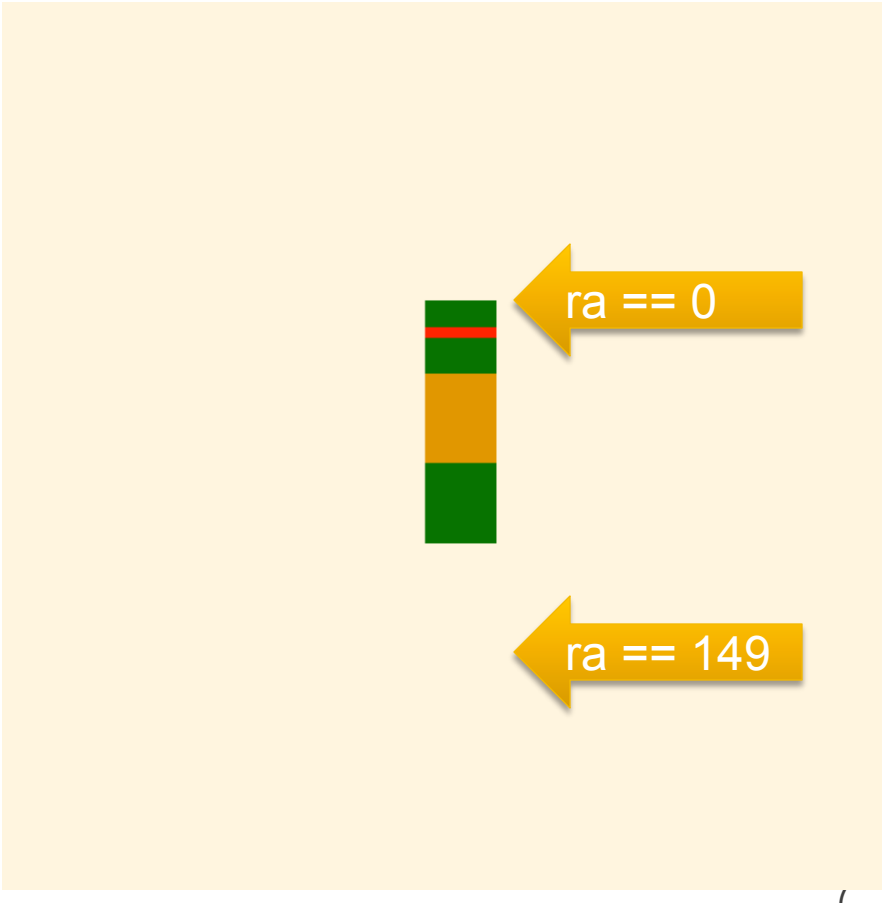
Asian Zodiac: `year1` and `year2` are the same sign if `year1%12 == year2%12`

Raff Jumps, Then Floats Down

- As numbers get larger, mod will cause them to "drop to 0" … this is a Ninja move

Just Do It

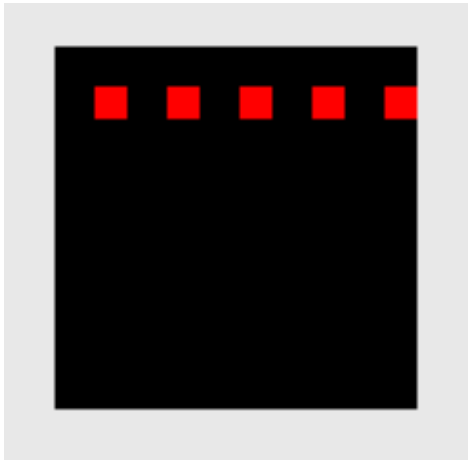
```
int ra = 0;

void setup( ) {
  size(500,500);
  noStroke();
}

void draw() {
  background(255, 245, 220);
  raff( );
  ra = (ra + 1)%150;
}

void raff( ) {
  fill(0,100,0);
  rect(240,260+ra, 40, 45);
       ...
```



Repetition (or looping)

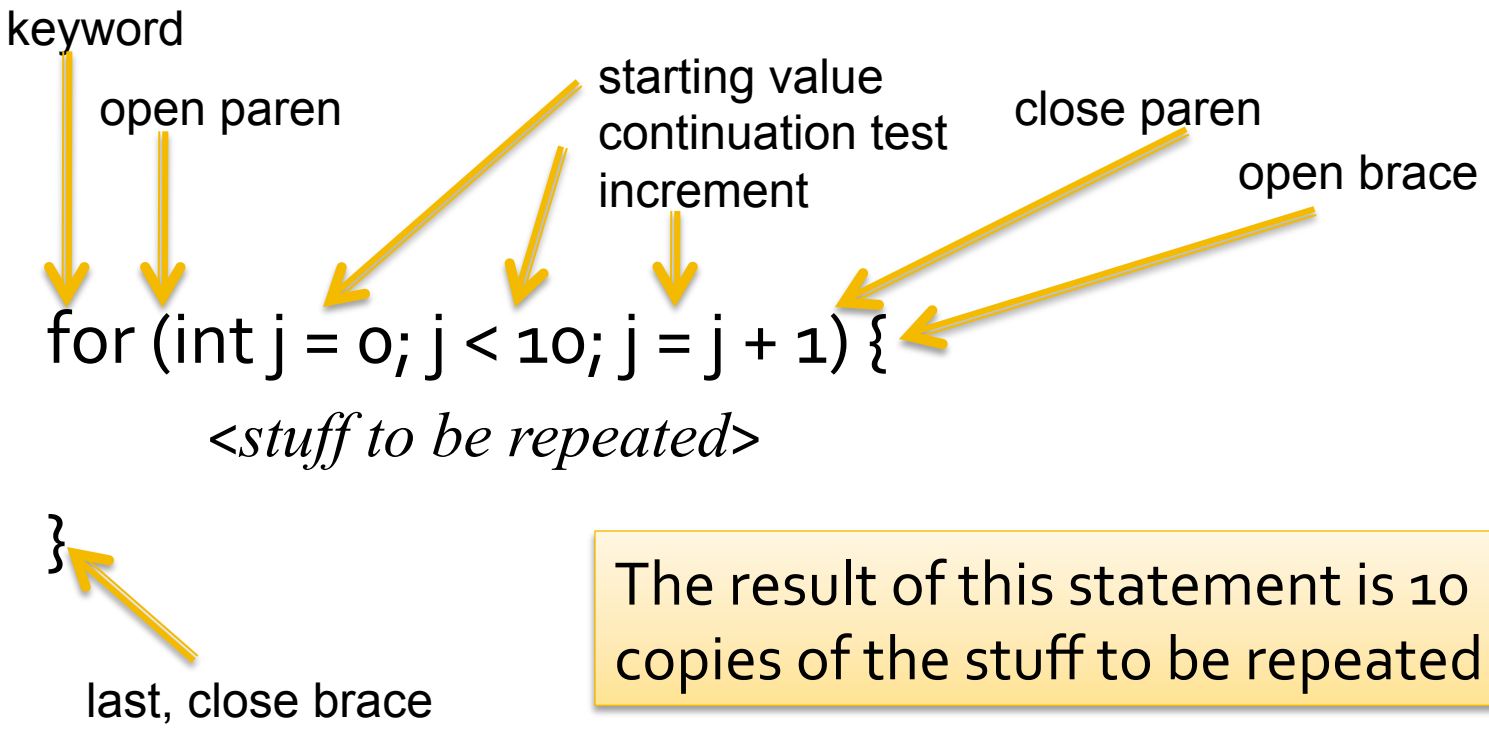
- Repeating commands is a powerful way to use a computer … we could repeat them, but all programming systems have a way to loop:
  - Lightbot 2.0 used recursion, a function calling itself
  - Symbolic Lightbot prefixed a number, 2:Step
- Processing (and other modern languages) use a **for** loop: count 0,1,2,3,4

```
for (i = 0; i < 5; i = i + 1) {
   rect(10+20*i,10,10, 10);
}
```



Repetiton, the Picture

- A for loop has several parts, all required …



The result of this statement is 10 copies of the stuff to be repeated

Just Do It

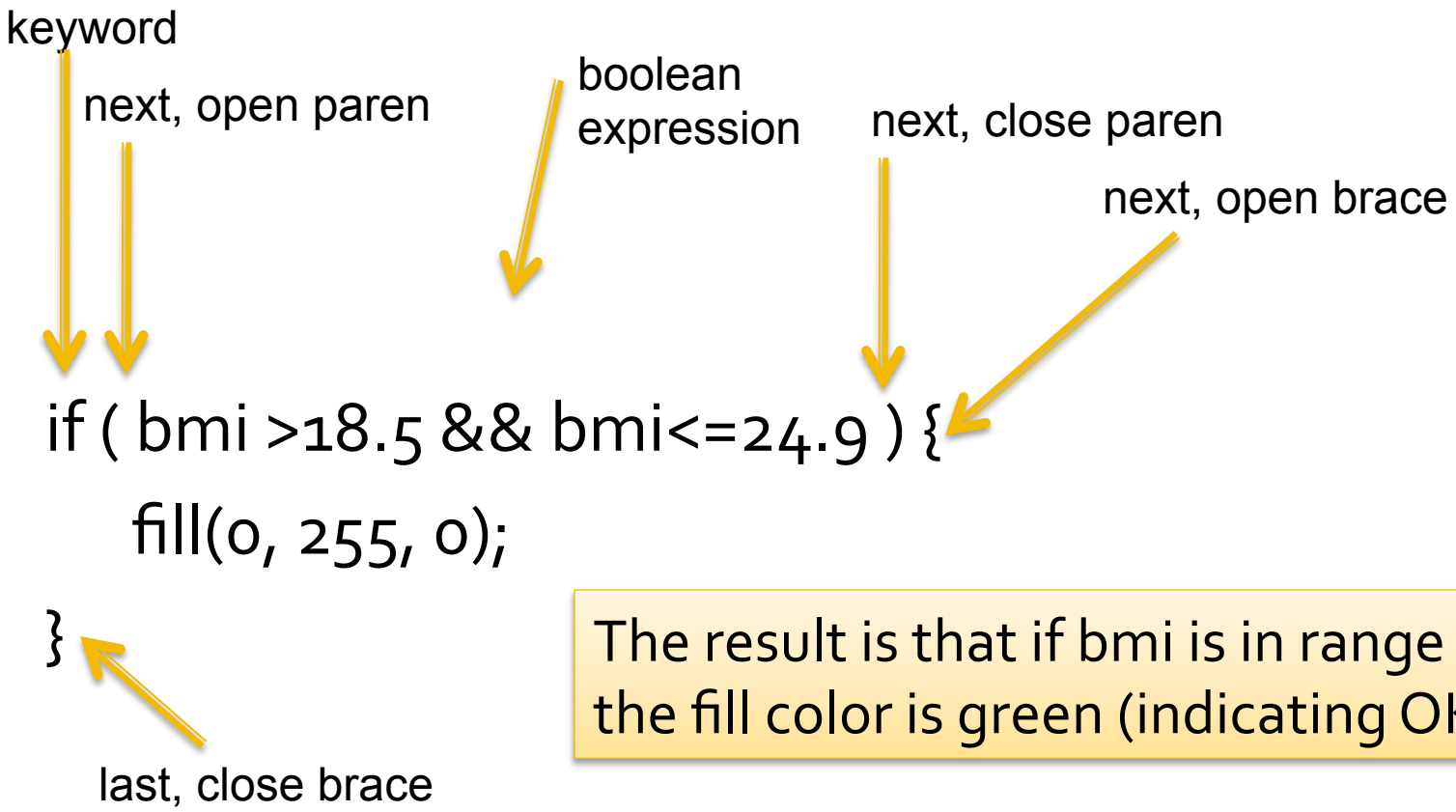
Tests, A/K/A If statements

- The instructions of a program are executed sequentially, one after another … sometimes we want to skip some: Say "Hello" to the **If**
- **If** also has a required form

```
if (year%4 == 0) {
        <stuff to do if condition true>;
}

if (chosen_tint != color(0,0,255)) {     //No TRUE blue!
        fill(chosen_tint);
}
```

Tests, the Picture

- An **If**-statement has a standard form



The result is that if bmi is in range the fill color is green (indicating OK)

Else Statement

- What happens if we want to do something else if the condition is false? What else? **else**!
- The **else** statement must follow an **if** …

```
if (year%4 == 0) {
        <stuff to do if condition true>; //Then Clause
} else {
        <stuff to do if condition false>; //Else Clause
}
```

Else, the Picture

- The standard form may now be obvious

```
if (year%4 == 0) {
        feb_days = 29;
} else {
        feb_days = 28;
}
```

Else must follow if because it does the test

open brace, immediately after "else"

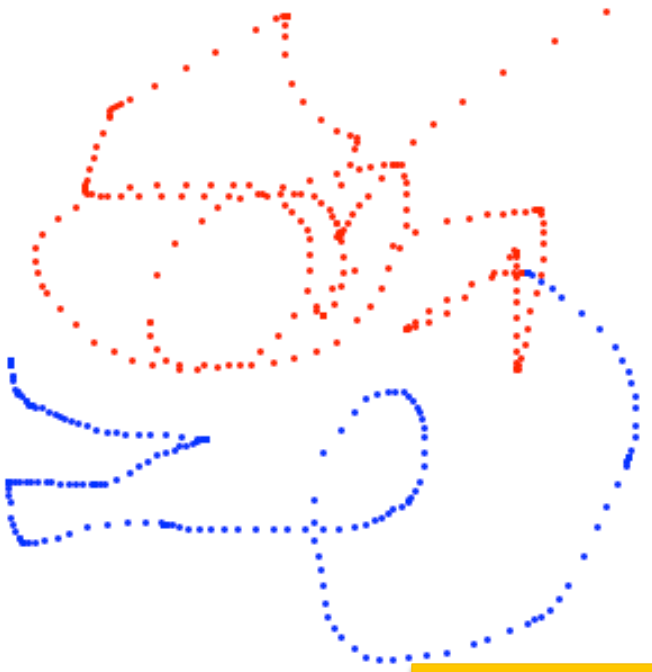
keyword

finally, close brace

The result is sets the number of days in February based on leap year

If/Else, The Demo

- Let's go to processing for an example



mouseDraw §

```
void draw(){
  ellipse(mouseX,mouseY,3,3);
  if(mouseX<10 && mouseY<10) {
    background(255);
  }
  if(mousePressed) {
    fill(0,0,255);
  } else {
    fill(255,0,0);
  }
}
```

Just Do It

Writing Programs

- Naturally, programs are given sequentially, the declarations at the top
- Braces { } are statement groupers … they make a sequence of statements into one thing, like the "true clause of an If-statement"
- All statements must end with a semicolon EXCEPT the grouping braces … they don't end with a semicolon (OK, it's a rare inconsistency about computer languages!)
- Generally white space doesn't matter; be neat!