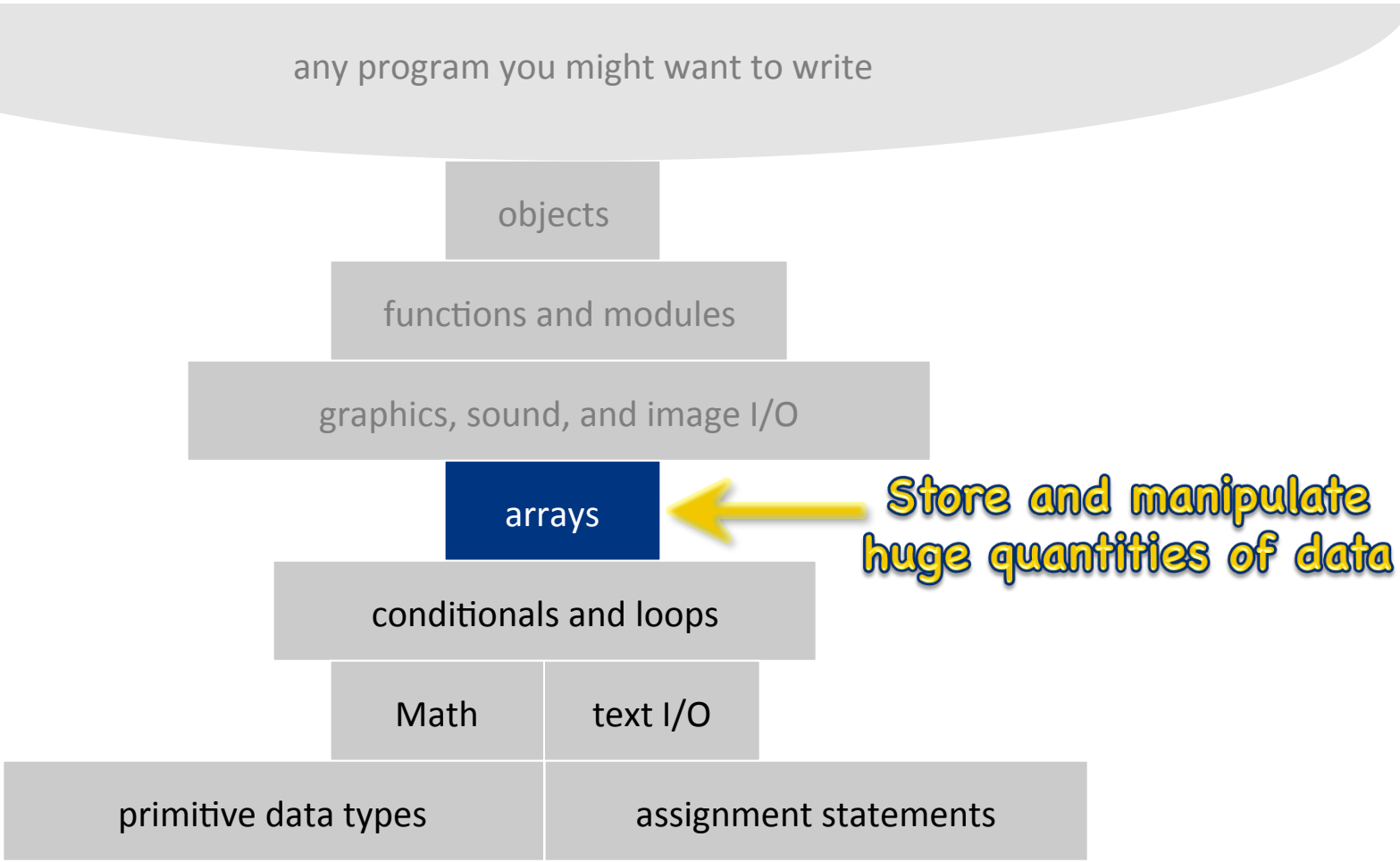
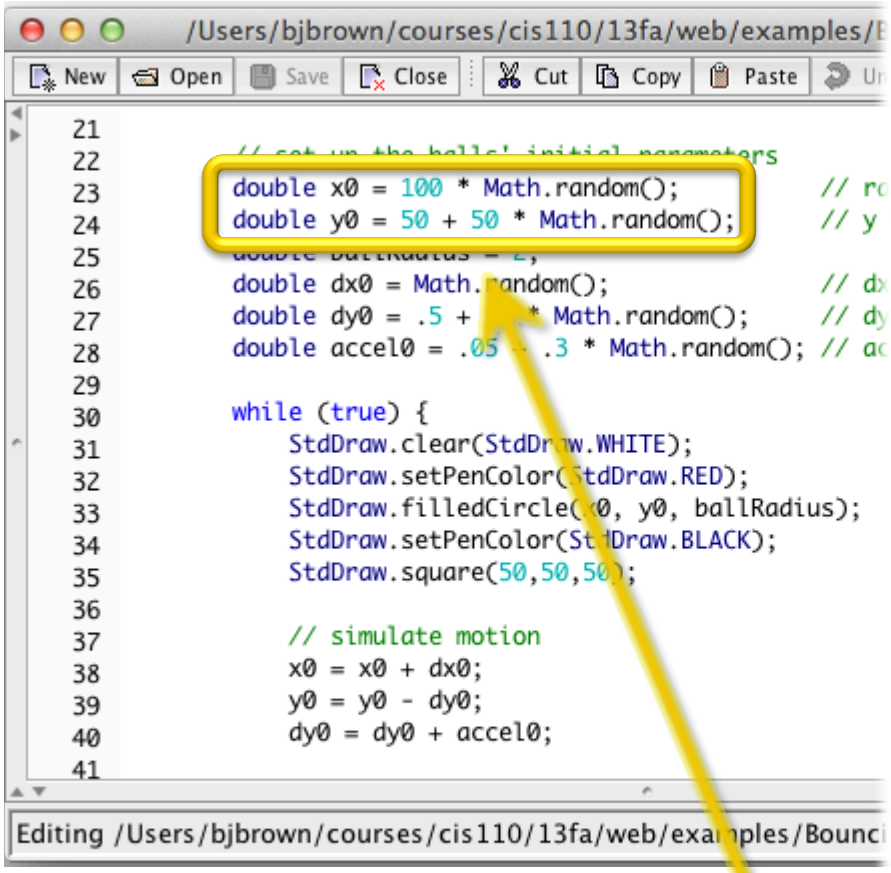
Arrays

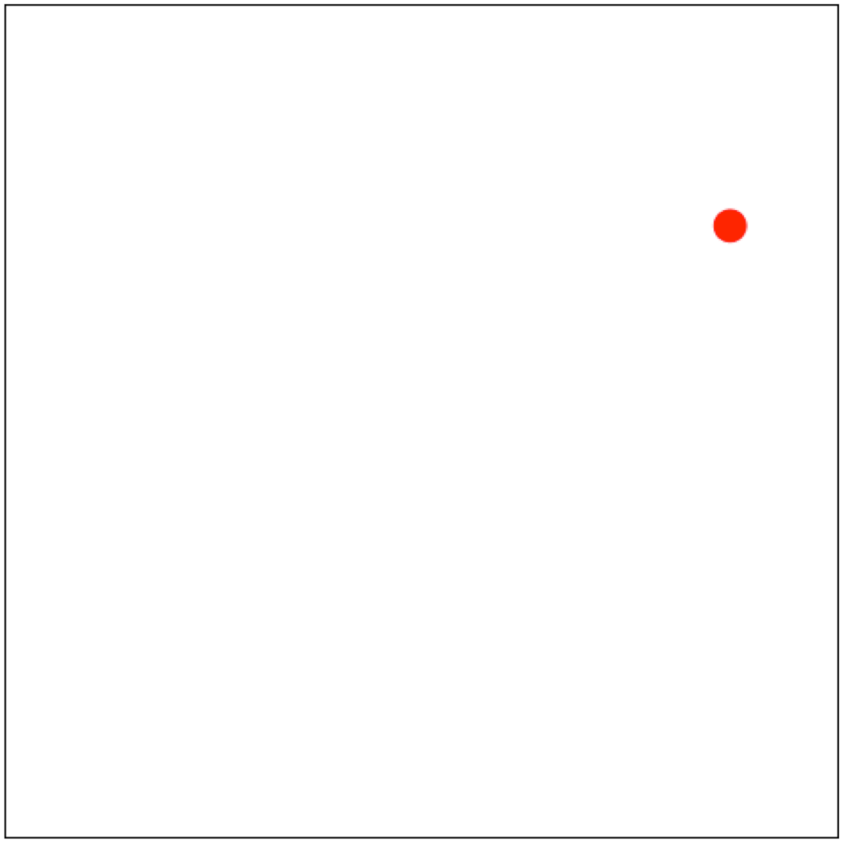


Penn Engineering

Section 1.4

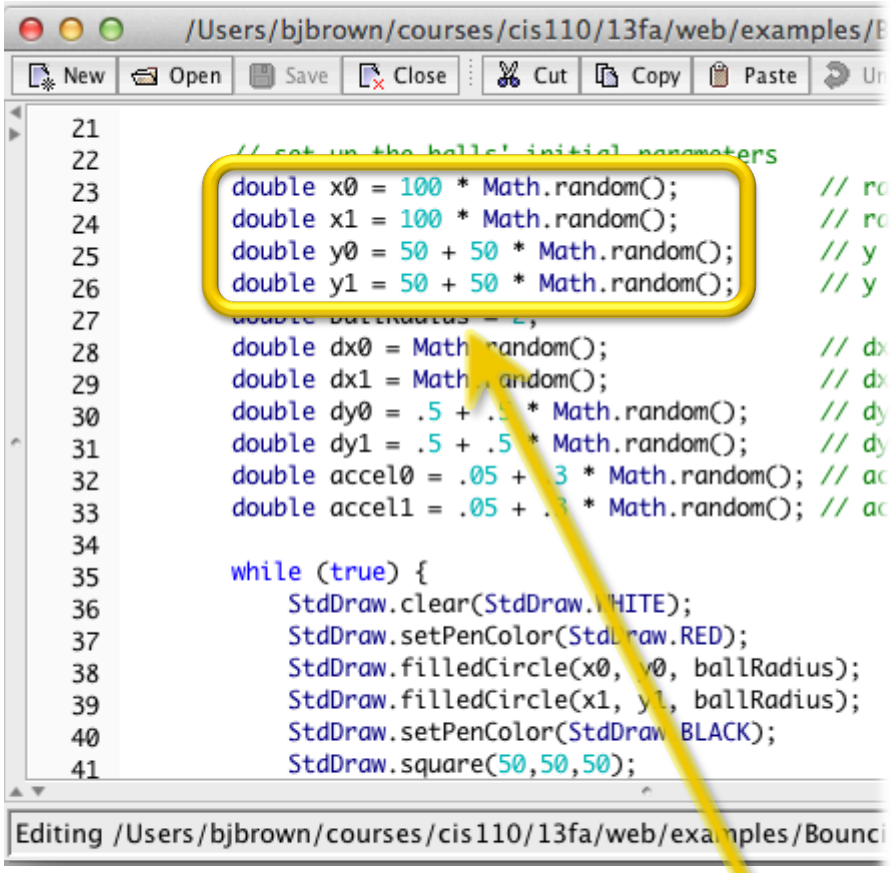
Why Arrays?

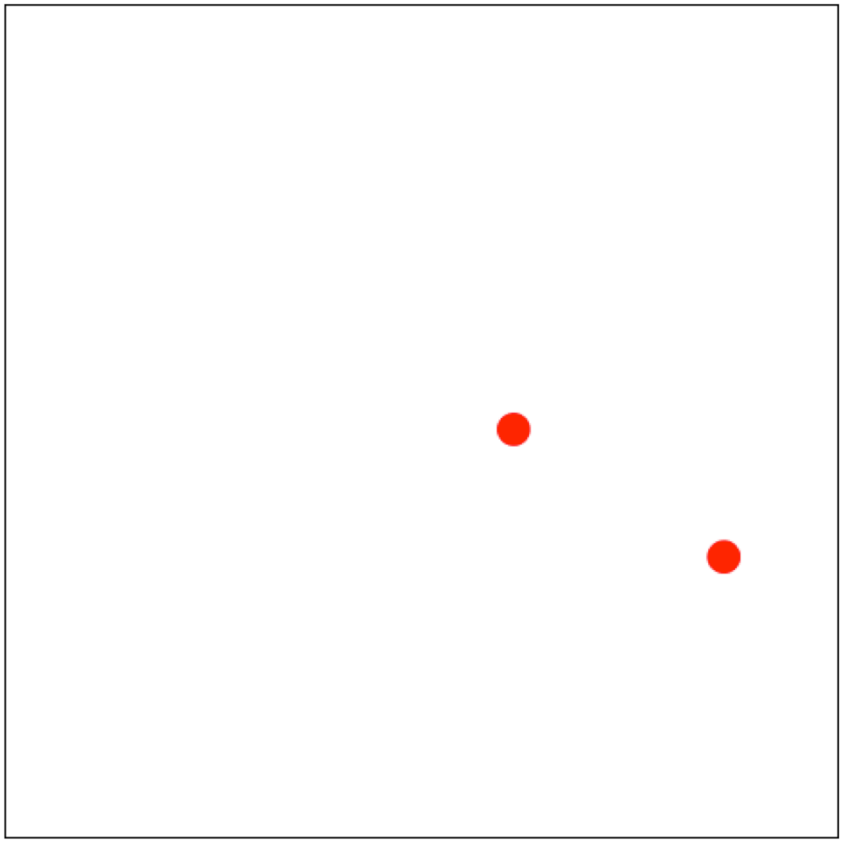




One bouncing ball

Why Arrays?





Two bouncing balls

Why Arrays?

/Users/bjbrown/courses/cis110/13fa/web/examples/Bc

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```
21
22          // set up the balls' initial parameters
23          double x0 = 100 * Math.random();          // ra
24          double x1 = 100 * Math.random();          // ra
25          double x2 = 100 * Math.random();          // ra
26          double x3 = 100 * Math.random();          // ra
27          double x4 = 100 * Math.random();          // ra
28          double x5 = 100 * Math.random();          // ra
29          double x6 = 100 * Math.random();          // ra
30          double x7 = 100 * Math.random();          // ra
31          double x8 = 100 * Math.random();          // ra
32          double x9 = 100 * Math.random();          // ra
33          double x10 = 100 * Math.random();          // r
34          double x11 = 100 * Math.random();          // r
35          double x12 = 100 * Math.random();          // r
36          double x13 = 100 * Math.random();          // r
37          double x14 = 100 * Math.random();          // r
38          double x15 = 100 * Math.random();          // r
39          double x16 = 100 * Math.random();          // r
40          double x17 = 100 * Math.random();          // r
```

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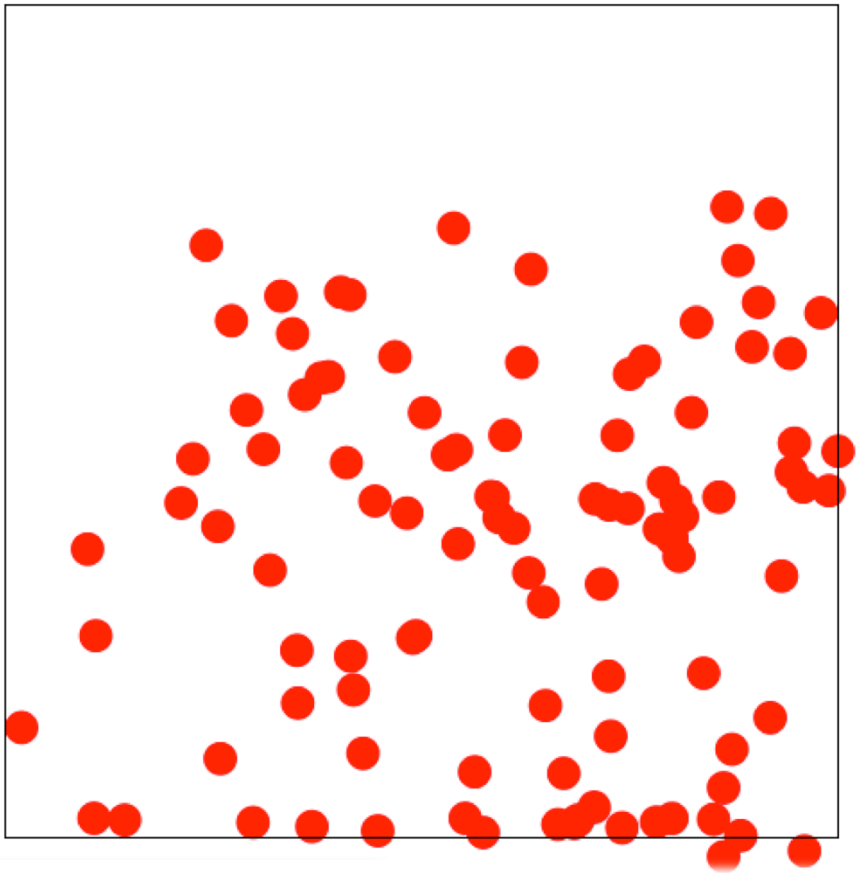


100 bouncing balls

Declaring Arrays

Array: Indexed sequence of values of the same type

```
// easy alternative
double[] x = new double[100];
```

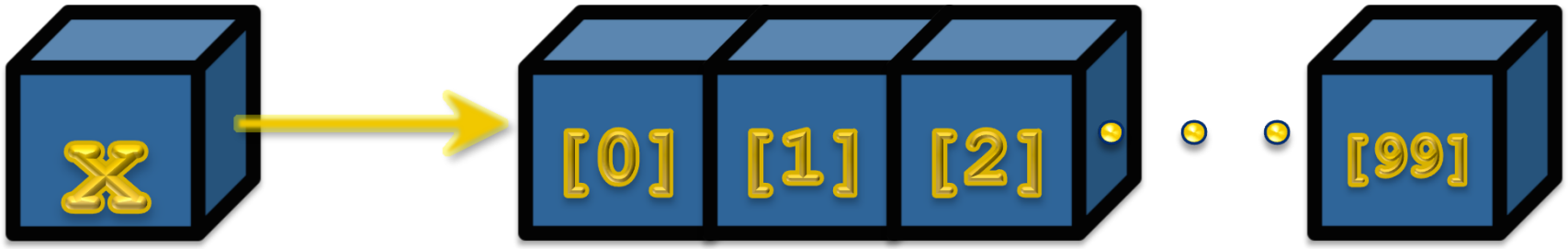
x will contain an array of many doubles

Declaring Arrays

Array: Indexed sequence of values of the same type

```
// easy alternative
double[] x = new double[100];
```

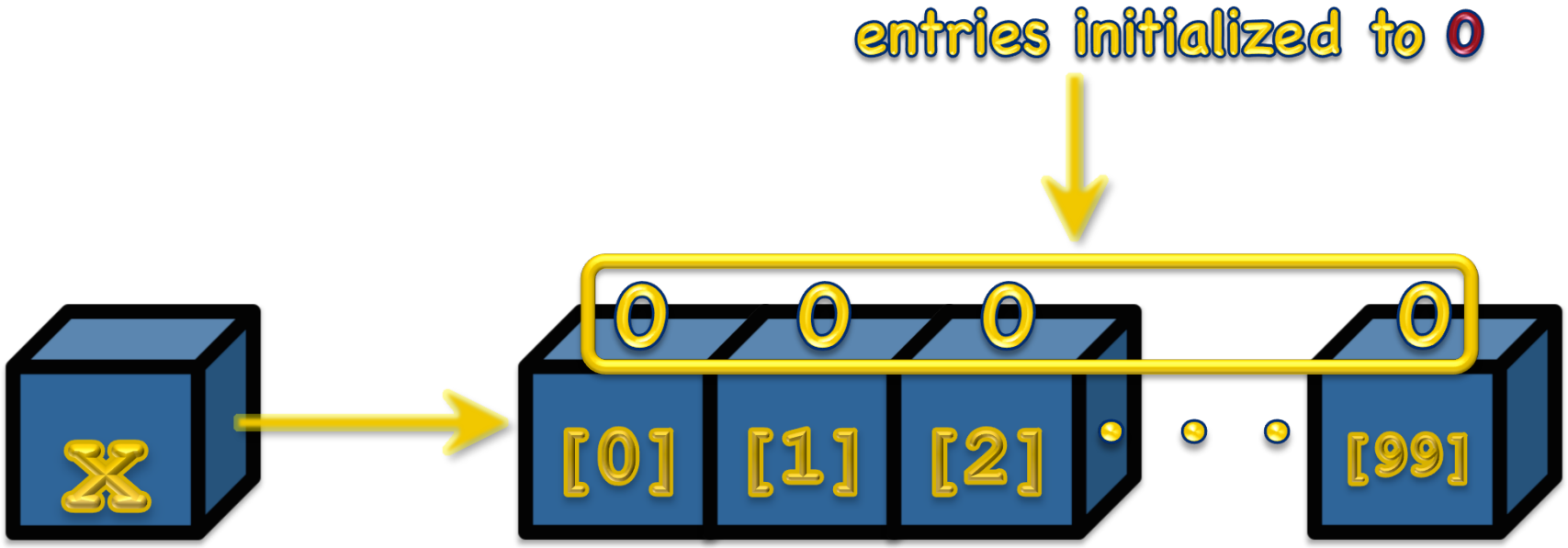
- find space for 100 doubles
- store location in x



Declaring Arrays

Array: Indexed sequence of values of the same type

```
// easy alternative
double[] x = new double[100];
```



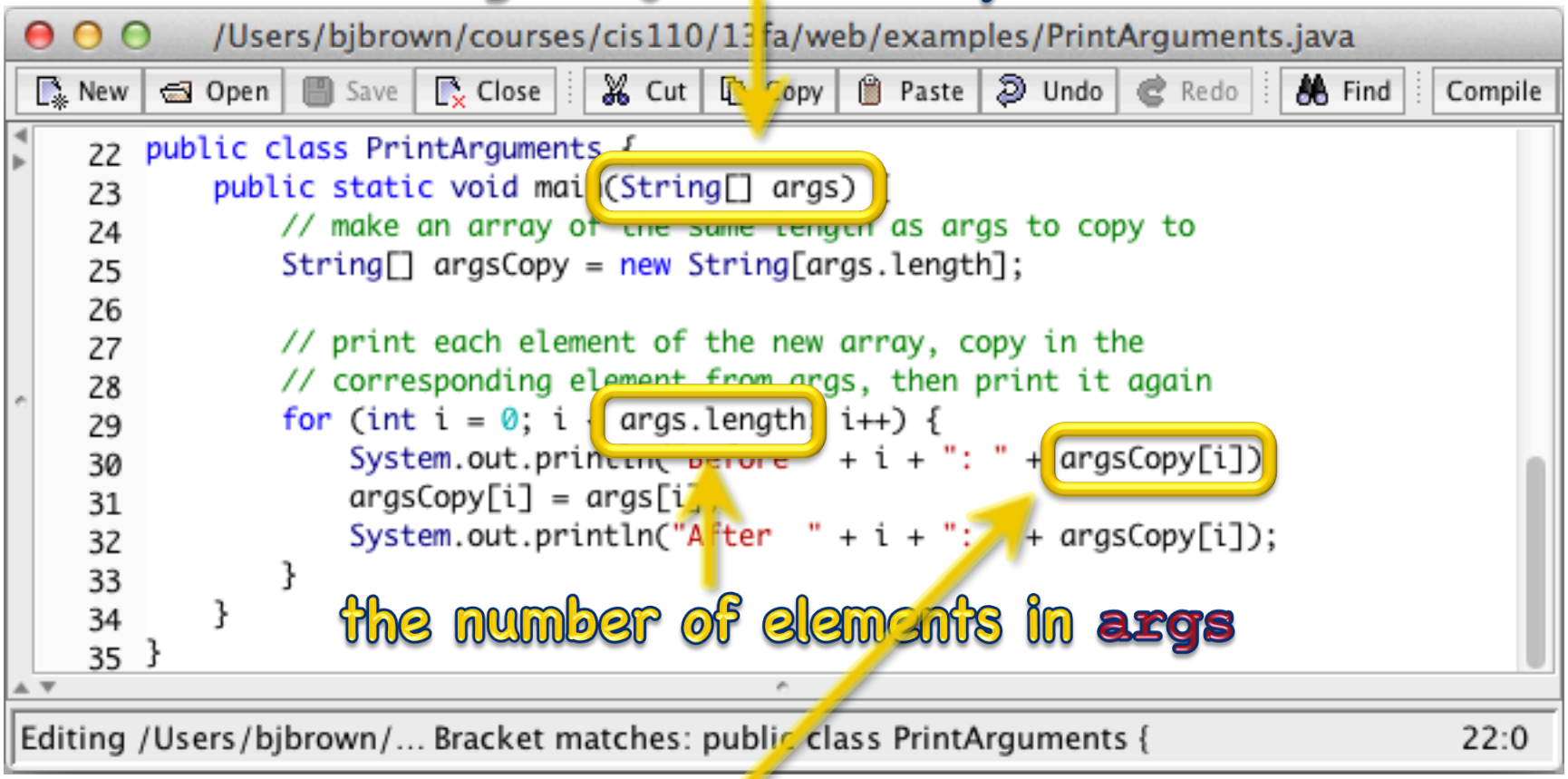
Declaring Arrays

Array: Indexed sequence of values of the same type

```
// easy alternative
double[] x = new double[100];
```

Using Arrays

args is just an array!



the number of elements in args

Strings default to special value null (no value)

Interactions Pane Exercises

```
> int[] arr = new int[4]
> arr.length


> arr[arr.length]


> for (int i = 0; i < arr.length; i++)
      System.out.println(i);


> System.out.println(arr)
```

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N Bouncing Balls

/Users/bjbrown/courses/cis110/13fa/web/examples/B

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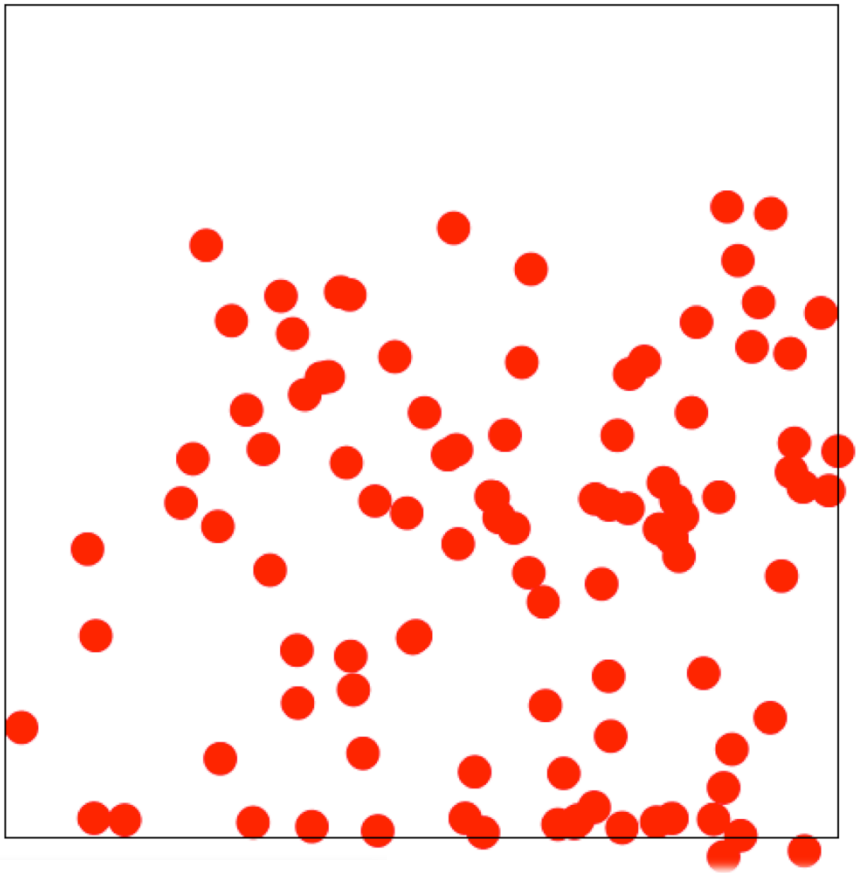
```
24
25          // set up the parallel arrays to store ball inf
26          double[] x  = new double[nBalls];
27          double[] y  = new double[nBalls];
28          double[] dx = new double[nBalls];
29          double[] dy = new double[nBalls];
30          double[] accel = new double[nBalls];
31
32          double ballRadius = 2; // all balls are the sa
33
34          // set up the balls' initial parameters
35          for (int i = 0; i < nBalls; i++) {
36              x[i] = 100 * Math.random();          // ra
37              y[i] = 50 + 50 * Math.random();      // y
38              dx[i] = Math.random()                // dx
39              dy[i] = .5 + .5 * Math.random();     // dy
40              accel[i] = .05 + .3 * Math.random(); // ac
41          }
42
43          while (true) {
44              // draw the balls
```

Editing /Users/bjbr...Bracket matches: for (int i = 0; i < nBalls; i



declare arrays to track balls

N Bouncing Balls

/Users/bjbrown/courses/cis110/13fa/web/examples/B

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```
24
25          // set up the parallel arrays to store ball inf
26          double[] x  = new double[nBalls];
27          double[] y  = new double[nBalls];
28          double[] dx = new double[nBalls];
29          double[] dy = new double[nBalls];
30          double[] accel = new double[nBalls];
31
32          double ballRadius = 2; // all balls are the sa
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34          // set up the balls' initial parameters
35          for (int i = 0; i < nBalls; i++) {
36              x[i] = 100 * Math.random();                 // ra
37              y[i] = 50 + 50 * Math.random();             // y
38              dx[i] = Math.random();                      // dx
39              dy[i] = .5 + .5 * Math.random();            // dy
40              accel[i] = .05 + .3 * Math.random();        // ac
41          }
42
43          while (true) {
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```
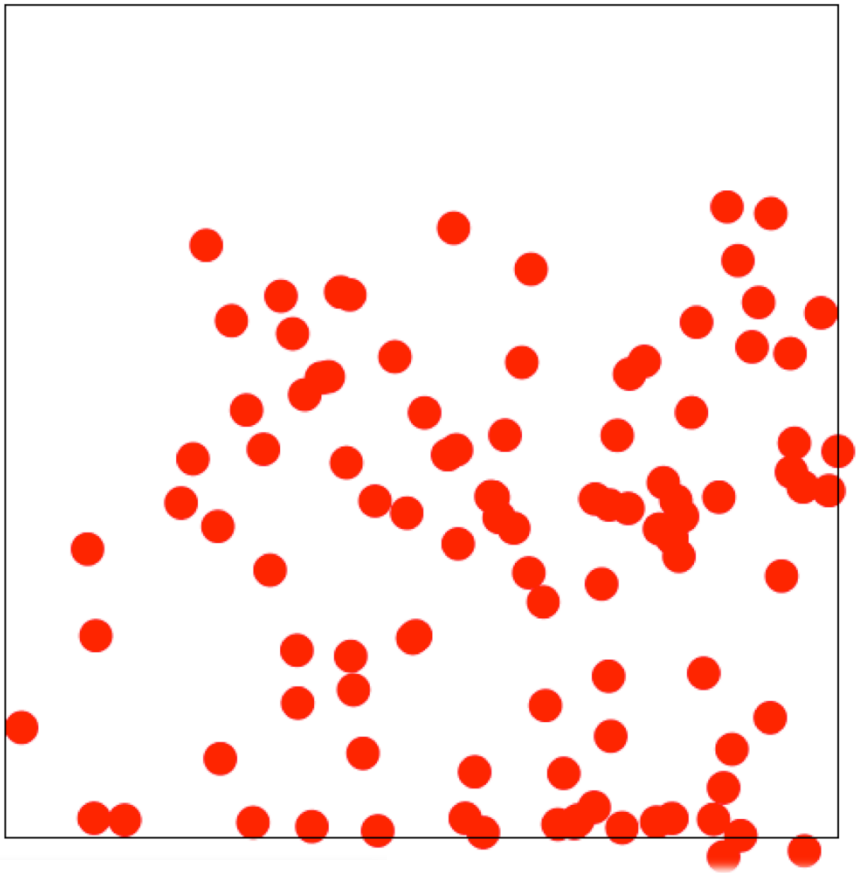

Editing /Users/bjbr...Bracket matches: for (int i = 0; i < nBalls; i



initialize values with a for loop

Array-Processing Examples

create an array with random values

```
double[] a = new double[N];
for (int i = 0; i < N; i++)
   a[i] = Math.random();
```

print the array values, one per line

```
for (int i = 0; i < N; i++)
   System.out.println(a[i]);
```

find the maximum of the array values

```
double max = Double.NEGATIVE_INFINITY;
for (int i = 0; i < N; i++)
   if (a[i] > max) max = a[i];
```

compute the average of the array values

```
double sum = 0.0;
for (int i = 0; i < N; i++)
   sum += a[i];
double average = sum / N;
```

copy to another array

```
double[] b = new double[N];
for (int i = 0; i < N; i++)
   b[i] = a[i];
```

reverse the elements within an array

```
for (int i = 0; i < N/2; i++)
{
   double temp = b[i];
   b[i] = b[N-1-i];
   b[N-i-1] = temp;
}
```

Explicit Value Initialization

- list contents of array instead of using new
- array size determined by values

```
String[] rank = {
   "2", "3", "4", "5", "6", "7", "8", "9",
   "10", "Jack", "Queen", "King", "Ace"
};

String[] suit = {
   "Clubs", "Diamonds", "Hearts", "Spades"
};

int i = (int) (Math.random() * 13);   // between 0 and 12
int j = (int) (Math.random() * 4);    // between 0 and 3

System.out.println(rank[i] + " of " + suit[j]);
```

what does this print out?