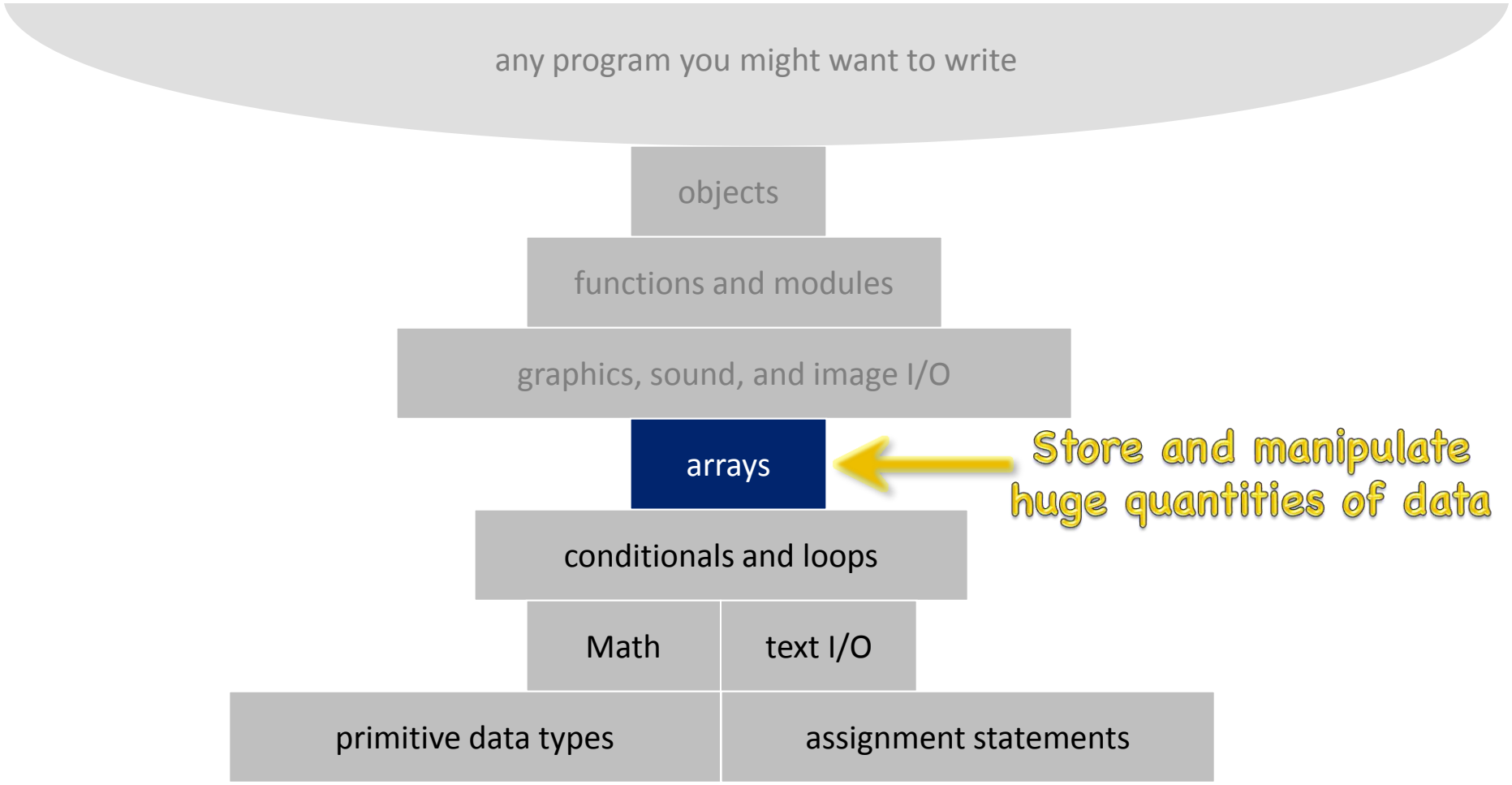
Arrays



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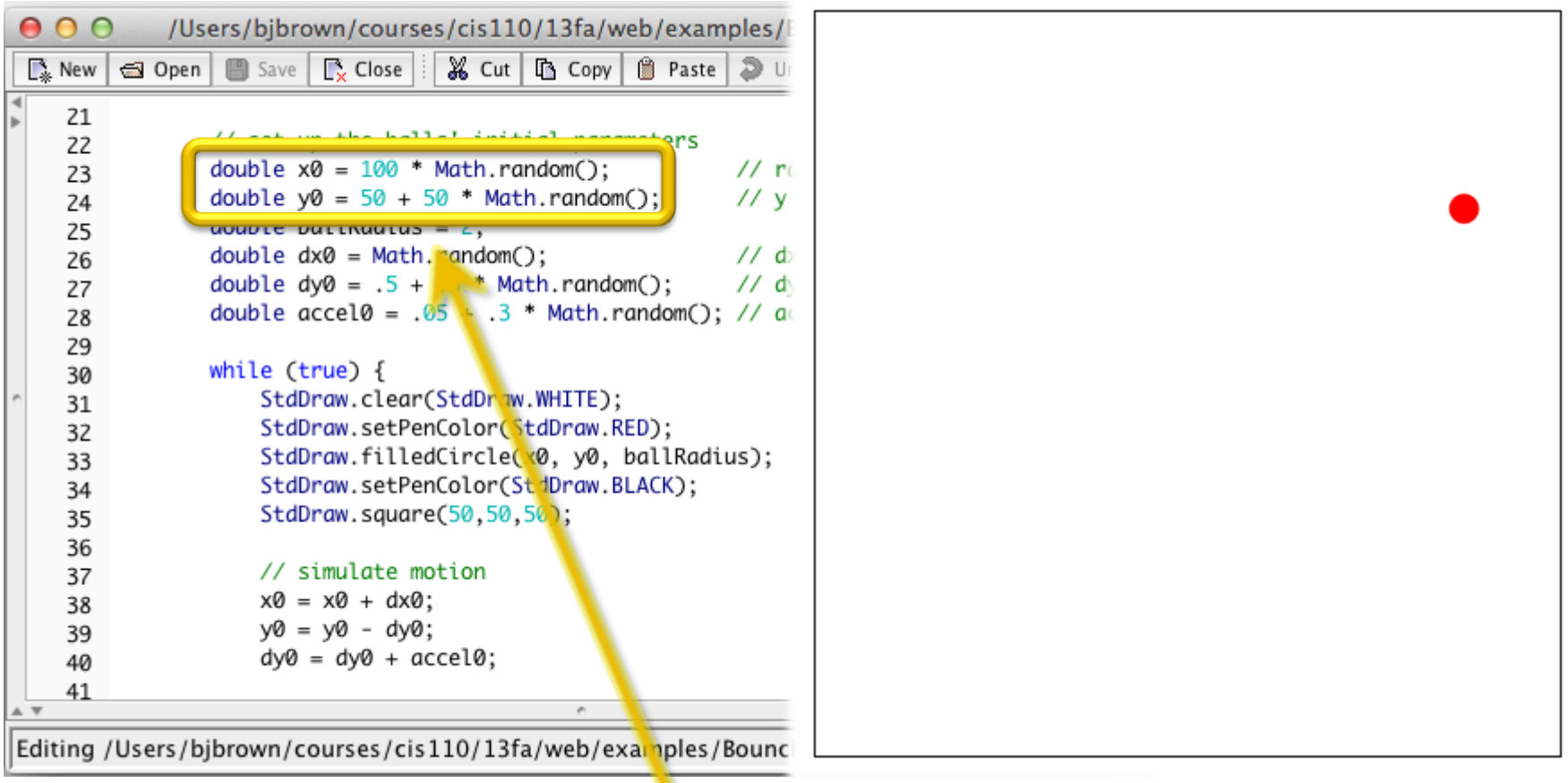
Why Arrays?



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Why Arrays?

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

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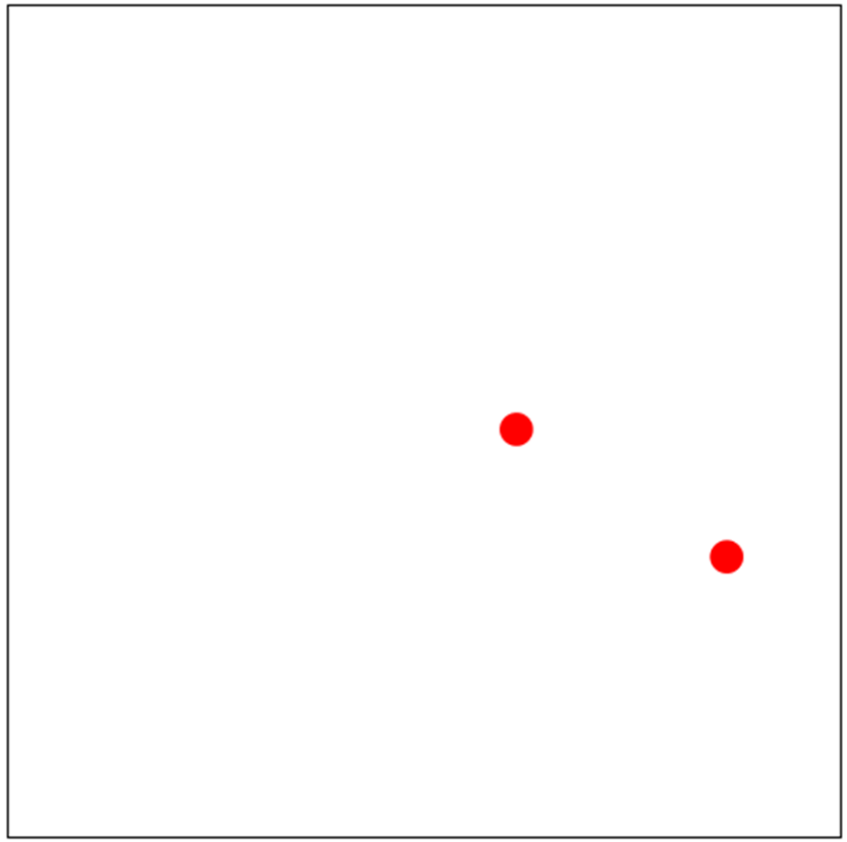
```
21
22          // set up the balls' initial parameters
23          double x0 = 100 * Math.random();          // r
24          double x1 = 100 * Math.random();          // r
25          double y0 = 50 + 50 * Math.random();      // y
26          double y1 = 50 + 50 * Math.random();      // y
27          double ballRadius = 2;
28          double dx0 = Math.random();               // d
29          double dx1 = Math.random();               // d
30          double dy0 = .5 + .5 * Math.random();     // d
31          double dy1 = .5 + .5 * Math.random();     // d
32          double accel0 = .05 + .3 * Math.random(); // a
33          double accel1 = .05 + .3 * Math.random(); // a
34
35          while (true) {
36              StdDraw.clear(StdDraw.WHITE);
37              StdDraw.setPenColor(StdDraw.RED);
38              StdDraw.filledCircle(x0, y0, ballRadius);
39              StdDraw.filledCircle(x1, y1, ballRadius);
40              StdDraw.setPenColor(StdDraw.BLACK);
41              StdDraw.square(50,50,50);
```

Editing /Users/bjbrown/courses/cis110/13fa/web/examples/Bounc



Two bouncing balls

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Why Arrays?

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

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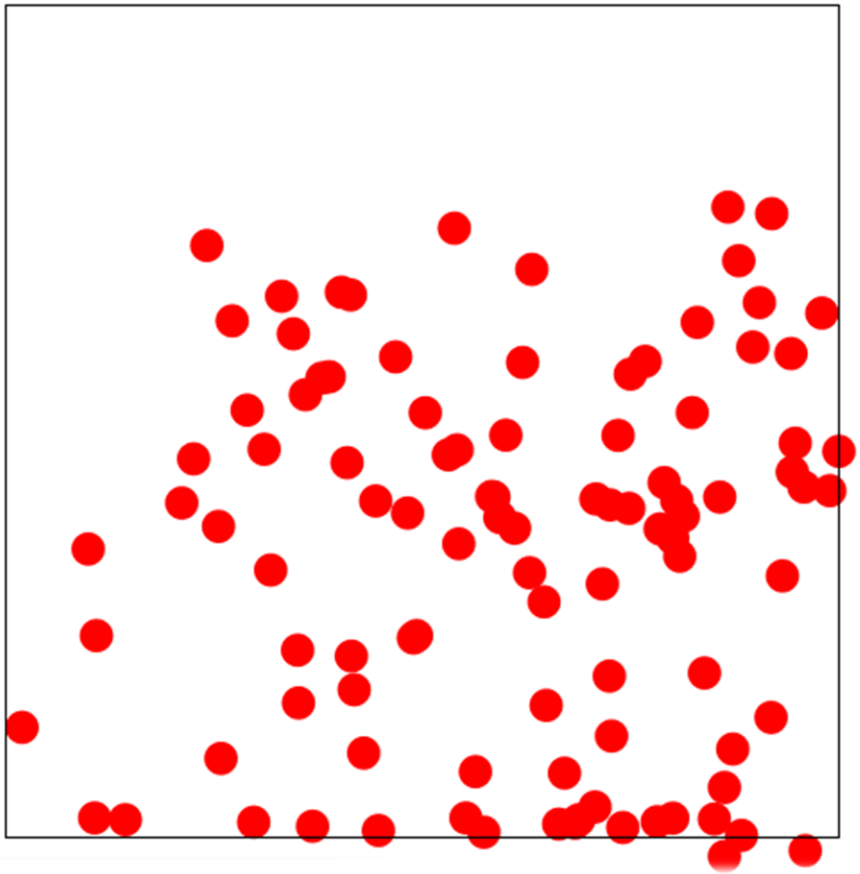
```
21
22          // set up the balls' initial parameters
23          double x0 = 100 * Math.random();          // r
24          double x1 = 100 * Math.random();          // r
25          double x2 = 100 * Math.random();          // r
26          double x3 = 100 * Math.random();          // r
27   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

Editing /Users/bjbrown/courses/cis110/13fa/web/examples/Bounc



100 bouncing balls

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Section 1.4

Declaring Arrays

Array: Indexed sequence of values of the same type

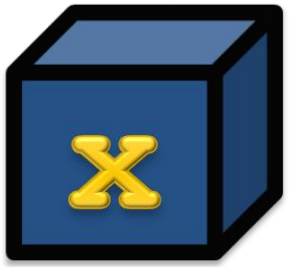
```
// easy alternative
double[] x = new double[100];
```

Declaring Arrays

Array: Indexed sequence of values of the same type

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

x will contain an array of many doubles

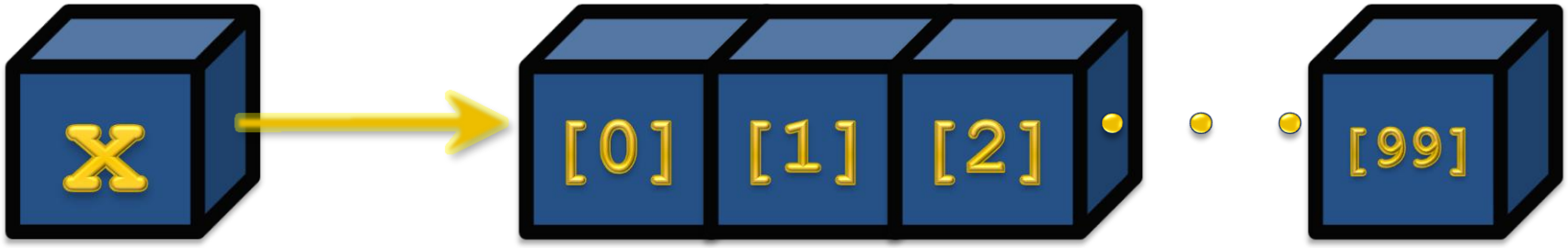


Declaring Arrays

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

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double[] x = new double[100];
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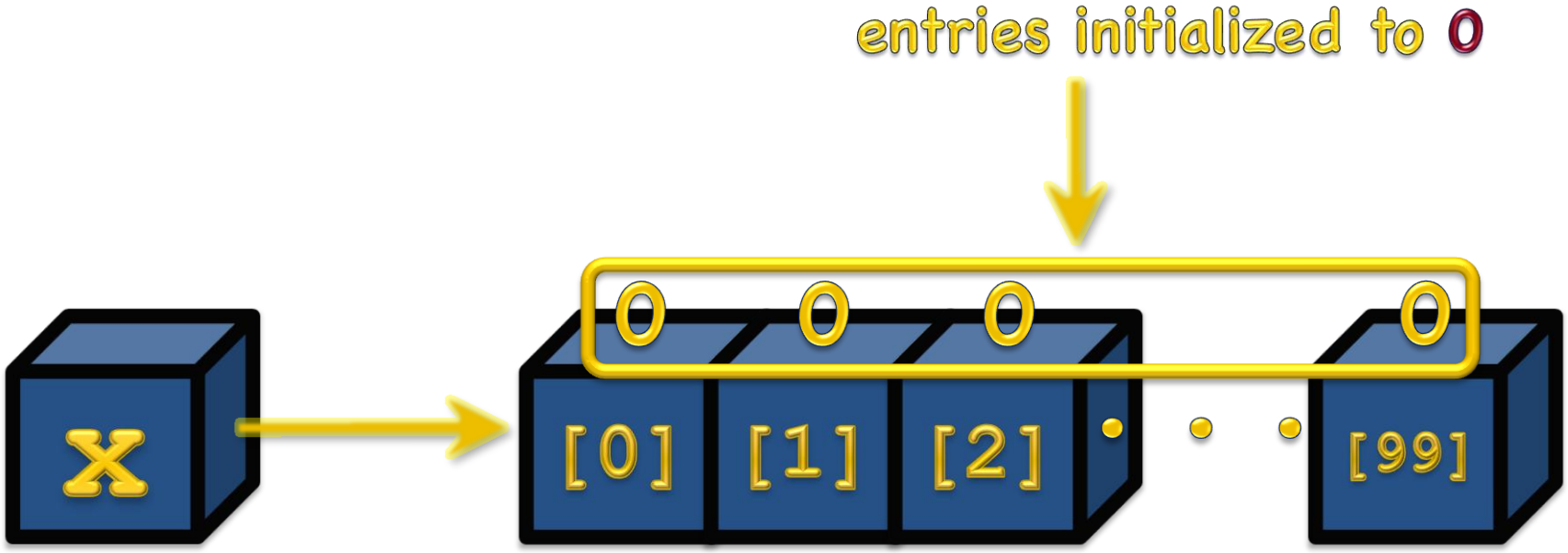

Declaring Arrays

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double[] x = new double[100];
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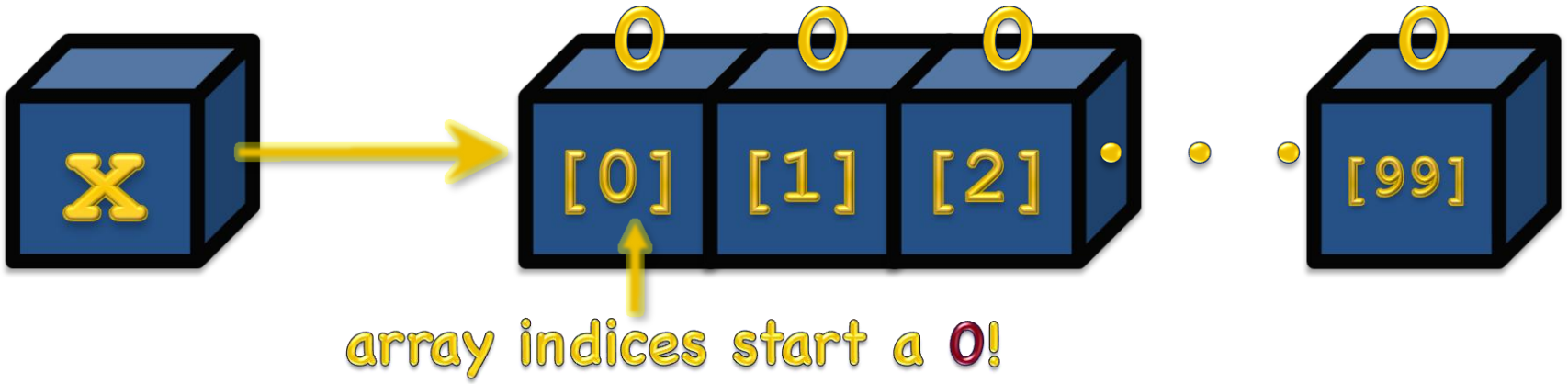

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Programming in Java

Section 1.4

Using Arrays

/Users/bjbrown/courses/cis110/13fa/web/examples/PrintArguments.java

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```
22 public class PrintArguments {
23     public static void main(String[] args) {
24         // make an array of the same length as args to copy to
25         String[] argsCopy = new String[args.length];
26
27         // print each element of the new array, copy in the
28         // corresponding element from args, then print it again
29         for (int i = 0; i < args.length; i++) {
30             System.out.println("Before " + i + ": " + argsCopy[i]);
31             argsCopy[i] = args[i];
32             System.out.println("After  " + i + ": " + argsCopy[i]);
33         }
34     }
35 }
```

Editing /Users/bjbrown/... Bracket matches: public class PrintArguments { 22:0

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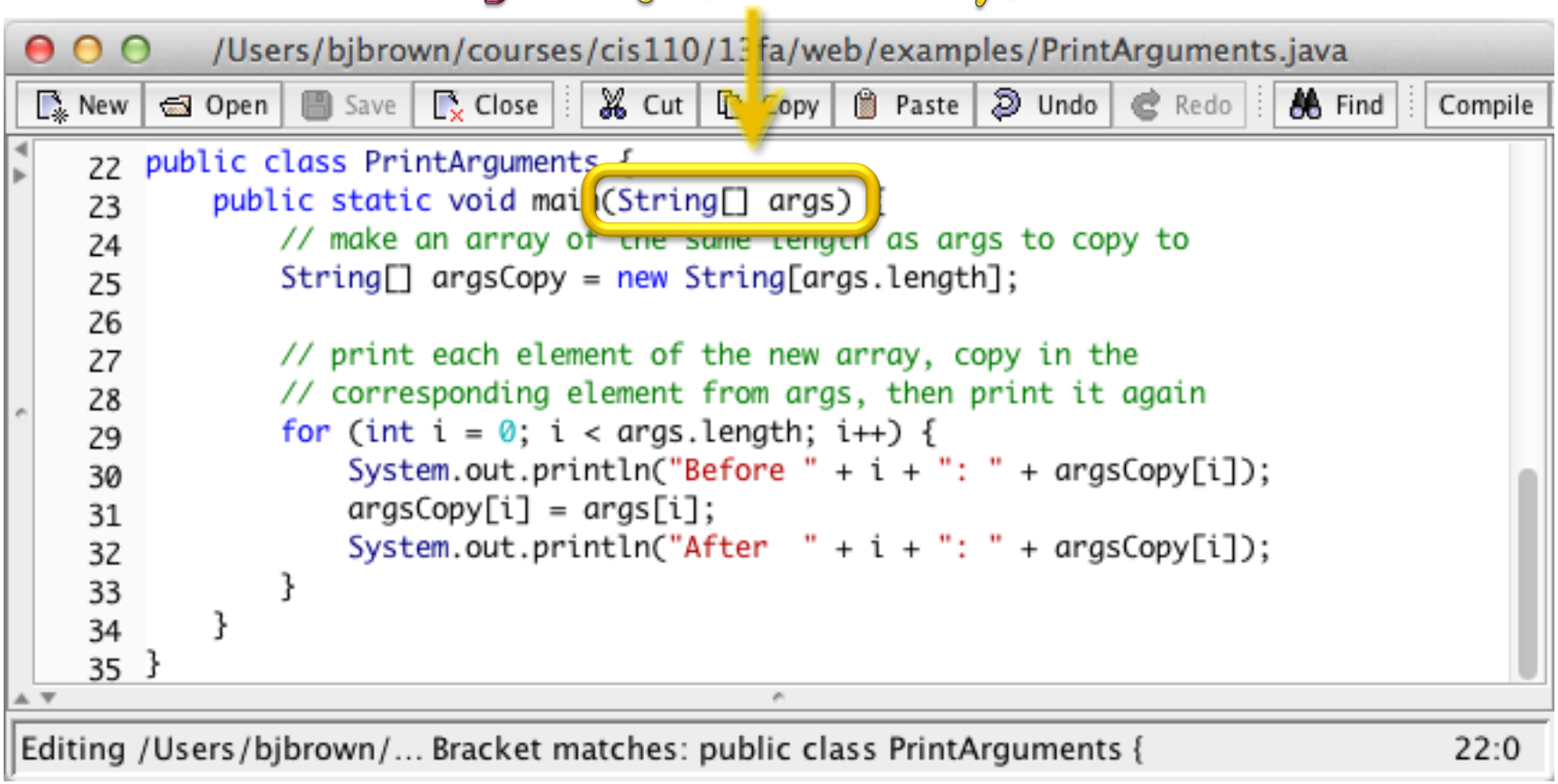
Section 1.4

Using Arrays

args is just an array!



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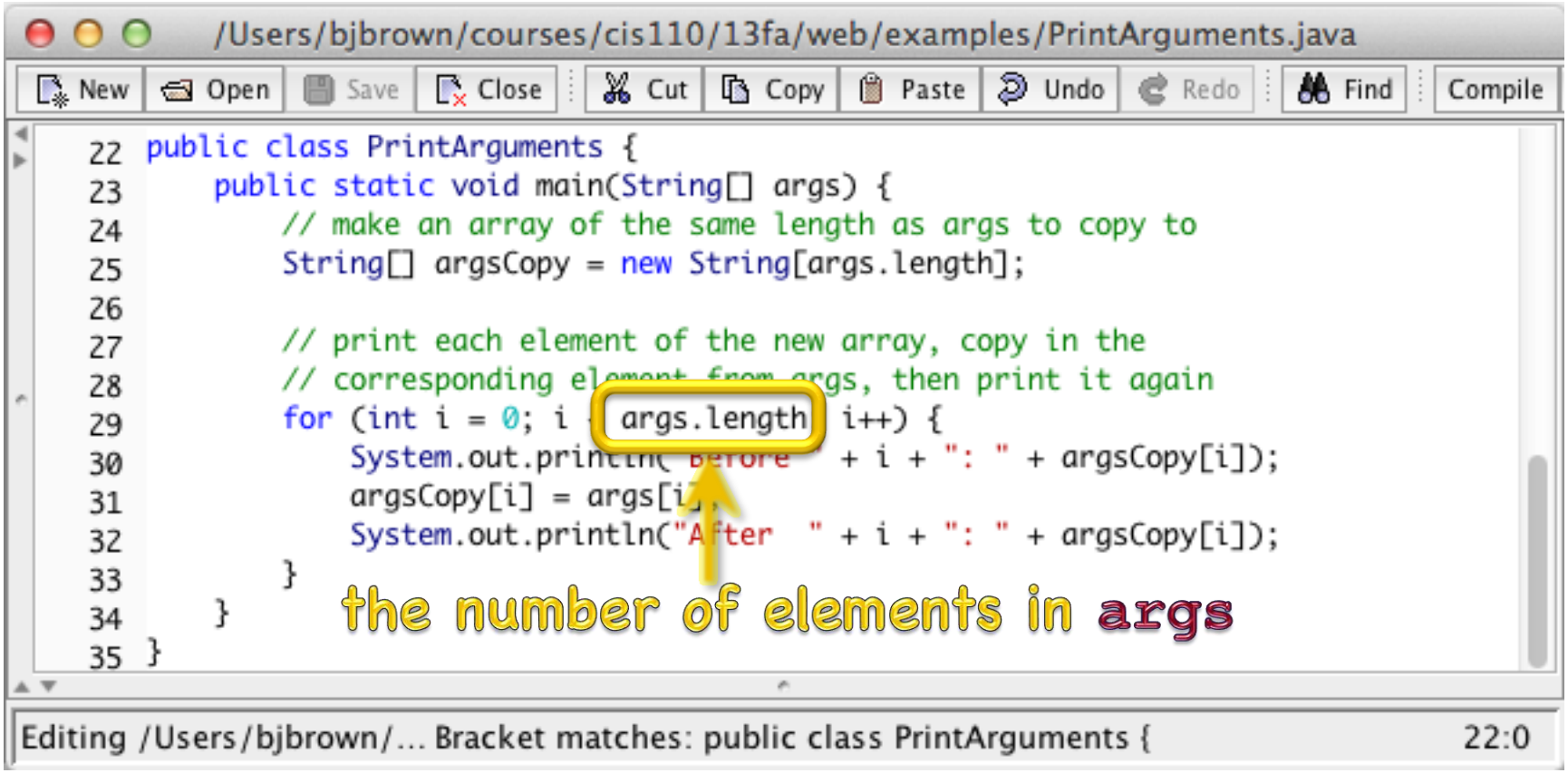
Section 1.4

Using Arrays



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Section 1.4

Using Arrays

/Users/bjbrown/courses/cis110/13fa/web/examples/PrintArguments.java

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27         // print each element of the new array, copy in the
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29         for (int i = 0; i < args.length; i++) {
30             System.out.println("Before " + i + ": " + argsCopy[i]);
31             argsCopy[i] = args[i];
32             System.out.println("After  " + i + ": " + argsCopy[i]);
33         }
34     }
35 }
```

Editing /Users/bjbrown/... Bracket matches: public class PrintArguments { 22:0

Strings default to special value `null` (no value)

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Section 1.4

Interactions Pane Exercises

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

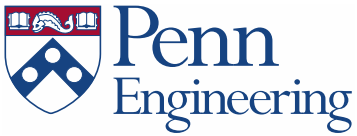

> arr[arr.length]



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



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



Section 1.4

N Bouncing Balls

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

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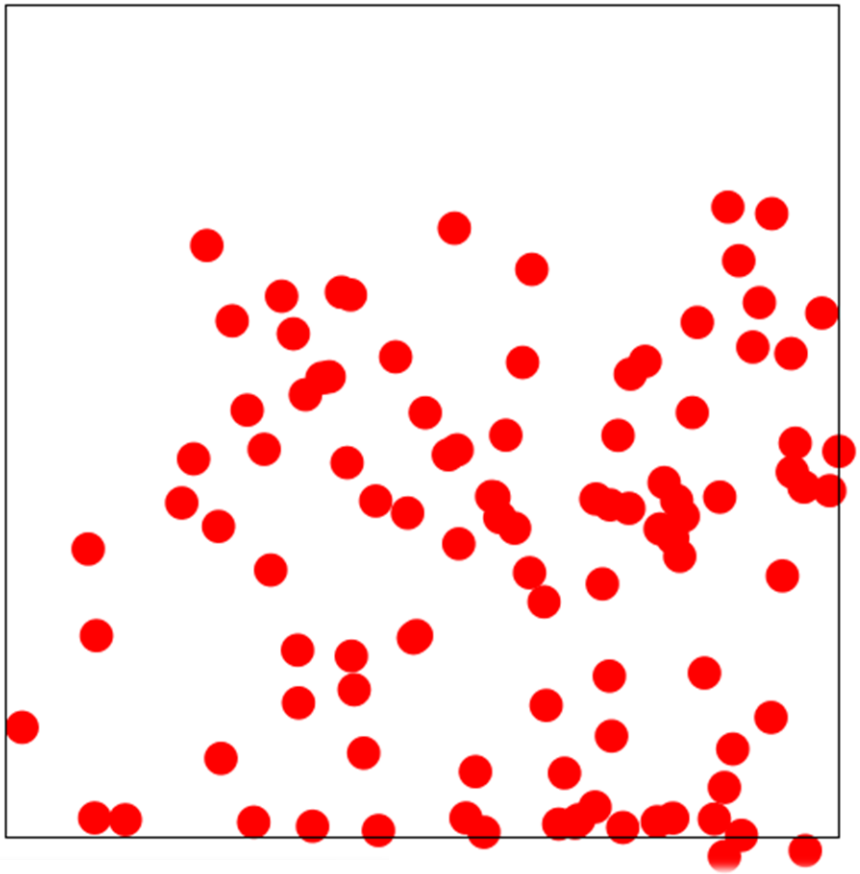
```
24
25          // set up the parallel arrays to store ball inf
26          double[] x  = new double[nBalls];
27          double[] y  = new double[nBalls];
28          double[] dx = new double[nBalls];
29          double[] dy = new double[nBalls];
30          double[] accel = new double[nBalls];
31
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;



declare arrays to track balls

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N Bouncing Balls

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

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24
25          // set up the parallel arrays to store ball inf
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35          for (int i = 0; i < nBalls; i++) {
36              x[i] = 100 * Math.random();
37              y[i] = 50 + 50 * Math.random();
38              dx[i] = Math.random();
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40              accel[i] = .05 + .3 * Math.random();
41          }
42
43          while (true) {
44              // draw the balls
```
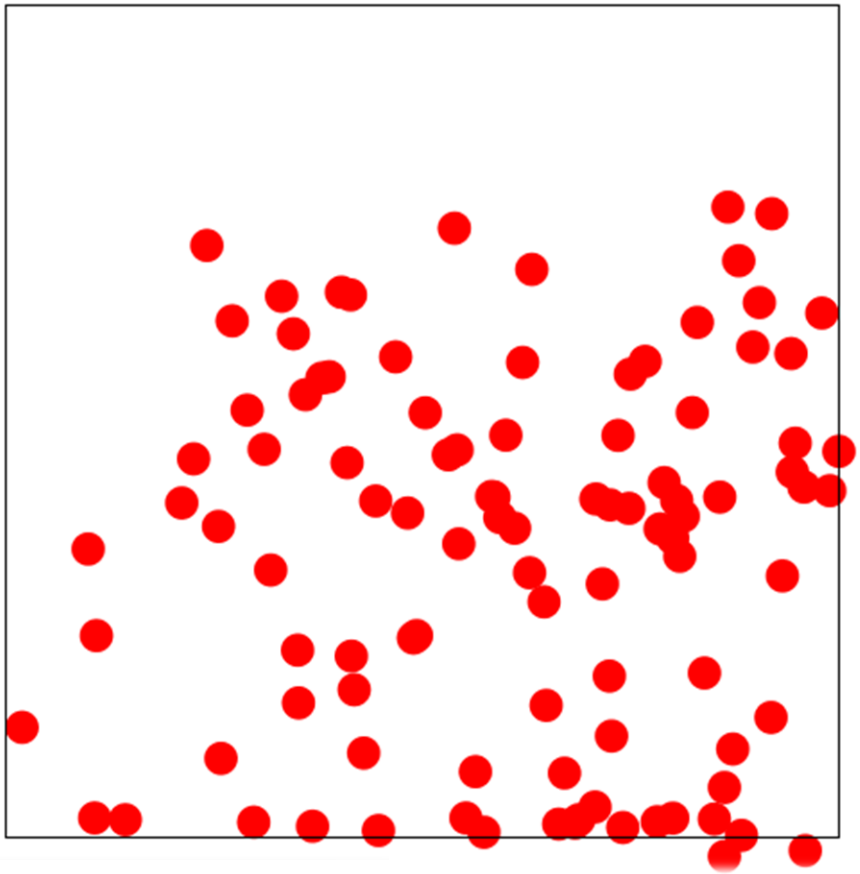

Editing /Users/bjbr...Bracket matches: or (int i = 0; i < nBalls;



initialize values with a for loop

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Section 1.4

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;`
	`}`

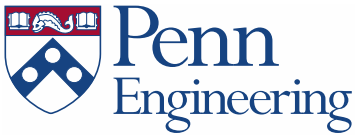
Explicit Value Initialization

```
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]);
```



Section 1.4

Explicit Value Initialization

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

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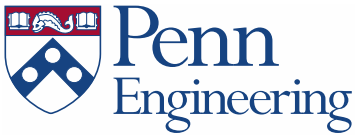

what does this print out?



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