Collections

The Plan

- Why use collections?
- What collections are available?
- Accessing the elements of a collection?
- Examples
- Practice

Why use collections?

Consider the code below. What if you wanted 1000 scores? Why is this code not designed well?

```
int score0, score1, score2, score3, ..., score100;

score0 = input.nextInt();
score1 = input.nextInt();
...
score100 = input.nextInt();

int sum = score0 + score1 + score2 + ... + score100;
double average = sum / 100.0;
```

Collections & Loops

Recall:

- ❑ Loops
  - o group repeatedly executed code for uniformity
  - o make the number of repetitions easily changeable
  - o can be combined with selection to make more complex algorithms

Collections Enable

- Easily declaring any number of variables
- Referring to each variable in the collection
- Grouping similar variables under one name
- Grouping similar code that acts on the variables
- Changing the number of variables easily

Why use collections?

The code below uses an array to average the 100 scores. What change would make it do 1000 scores?

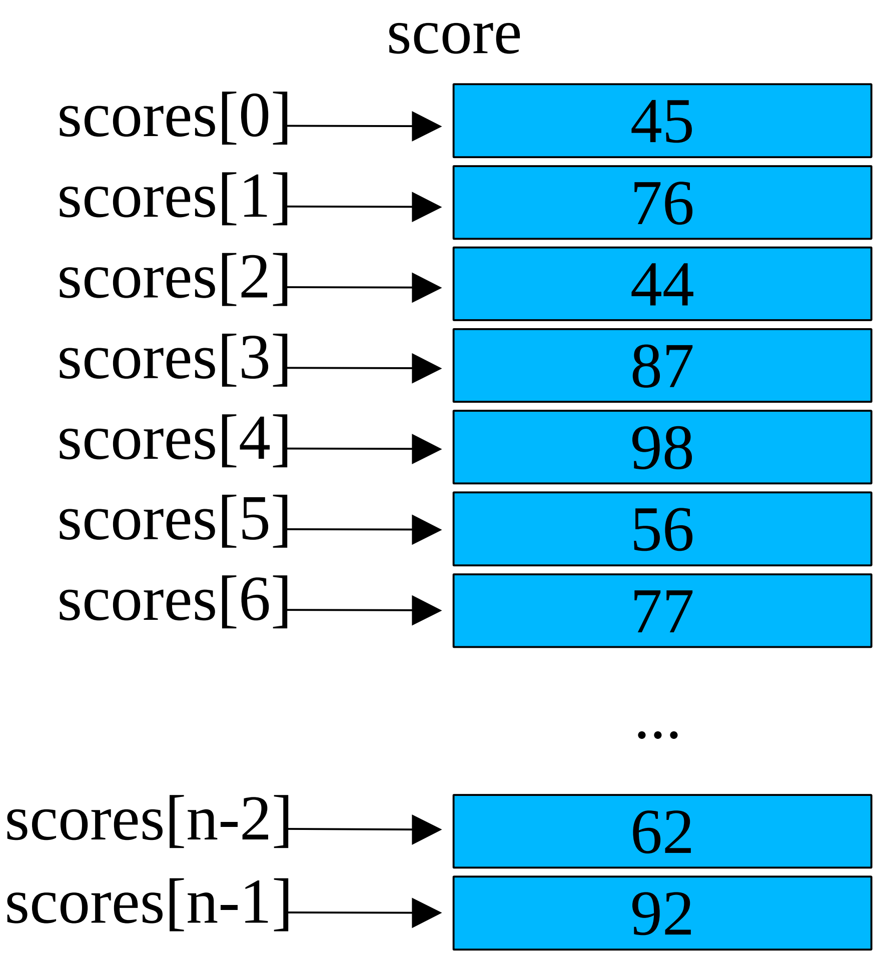
```
int[] scores = new int[100];

double sum = 0;
for (int i = 0; i < scores.length; i++)
{
  scores[i] = input.nextInt();
  sum += scores[i];
}

double average = sum / scores.length;
```

What a Collection looks like

`scores` is an array

`scores[i]` is an int

arrays are only one
way to collect variables



What collections are available?

- Arrays
- java.util.Collection
  - ArrayList
  - LinkedList
  - HashSet
  - LinkedHashSet
- java.util.Map
  - HashMap
  - TreeMap

Arrays

- Store primitives or particular Objects
- Size is *immutable*
- Contain `length` field
- Is an Object
- Indexed ***0*** to ***length-1***
- Can generate **ArrayIndexOutOfBoundsException**

ArrayLists

- Generic, so must specify what kind of thing to hold
- Size is typically *dynamic*
- Has a `size()` method
- Is an Object
- Indexing varies
- Has `toArray(Object[])` method for converting to an array.

Using an ArrayList

- Can hold any number of scores, does not need to be known beforehand:

```
ArrayList<Integer> scores = new ArrayList<Integer>();

double sum = 0;
for (int i = 0; i < 100; i++)
{
  scores.add(input.nextInt());
  sum += scores.get(i);
}

double average = sum / scores.size();
```

- Note, must hold `Integer` objects instead of `int` primitives --- usually not a problem

Enhanced for loop

- Works for any kind of collection
- Simpler syntax for accessing each variable in the collection:

```
// given array scores, with each value initialized
double sum = 0;
for (int current : scores)
{
  sum += current;
}



// given ArrayList scores, with each value initialized
sum = 0;
for (Integer current : scores)
{
    sum += current;
}
```

Practice

- Declare an array of integers
- Initialize the array to be able to hold 10 integers
- Set the values in the array to be the first ten squares (i.e. 1, 4, 9, 16, 25 ...)
- Sum the values
- Output the average
- Alter your code to do the first 100 integers instead

More Practice

- Change the code in pong so that the paddles and walls are stored in a collection instead of individual variables

- Play wackadot with a random number of enemy dots (e.g., from 3 to 10) set at the beginning of each game