CSCI 132:
Basic Data Structures and Algorithms

ArrayLists

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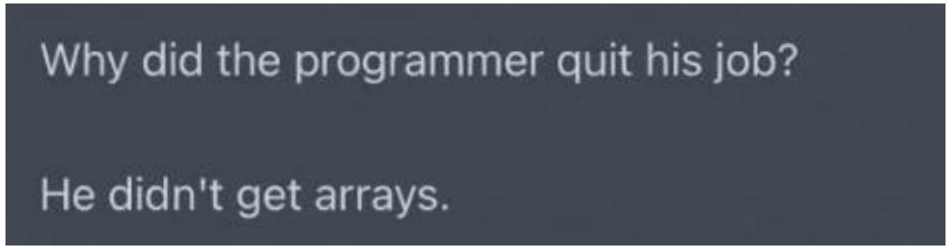
Fall 2024

Announcements

- Lab 4 due **tomorrow** at 11:59 PM
- Program 1 due on Sunday @ 11:59 PM


Why did the programmer quit his job?

He didn't get arrays.

Array Limitations

Cons

- **Can't change the length** *What can we do about this?*
- Can only store one data type

```
int[] myArray = {1, 2, 3};
System.out.println(Arrays.toString(myArray));

int[] newArray = new int[myArray.length + 1];          // Create a new array that is one spot bigger
for(int i = 0; i < myArray.length; i++) {
      newArray[i] = myArray[i];                        // Fill new array with contents of old array
}

int new_value = 4;
newArray[myArray.length] = new_value;                  // add new value to array
myArray = newArray;                                    // Update reference variable
```

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```

// Create a new array that is one spot bigger

// Fill new array with contents of old array

This process can be expensive

```
int new_value = 4;
newArray[myArray.length] = new_value;
myArray = newArray;
```

// add new value to array

// Update reference variable

Array Limitations

Cons

- **Can't change the length**

Solution

Create new array, copy everything over
(this can be expensive ☹)

```
int[] myArray = {1, 2, 3};
System.out.println(Arrays.toString(myArray));

int[] newArray = new int[myArray.length + 1];
for(int i = 0; i < myArray.length; i++) {
            newArray[i] = myArray[i];
}

int new_value = 4;
newArray[myArray.length] = new_value;
myArray = newArray;
```

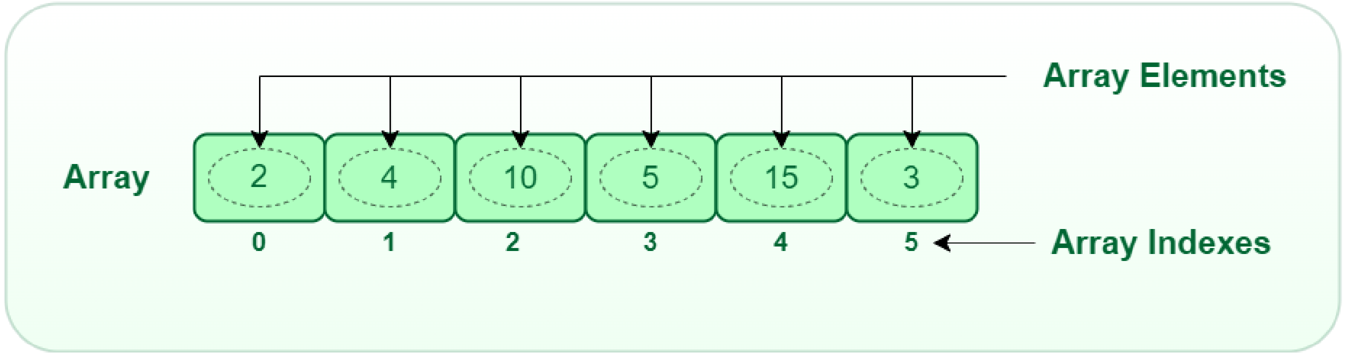
- **Can only store one data type**

Solution

Store an object, use two separate arrays, use a different data structure

An **ArrayList** is a data structure that can hold multiple, similar values (just like an array), BUT

- Dynamic, can easily resize
- Can easily add new elements and remove elements
- Like a Python list ☺



Somebody took `arrays`, and made them better

- Still have indices
- Still can only store one data type

Java **ArrayLists**

We first need to remember to import it ☺

```
import java.util.ArrayList;
```

Creating a new ArrayList

```
ArrayList<String> mylist = new ArrayList<String>();
```

We must specify what datatype the ArrayList will hold

Reference Variable

We never have to specify the size, because we can now easily grow/shrink our ArrayList!

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We can add stuff to the ArrayList using the `.add()` method (built in method!)

```
mylist.add("Jack");
```

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    newArray[i] = myArray[i];
}

int new_value = 4;
newArray[myArray.length] = new_value;
myArray = newArray;
```

Under the hood, it is

1. Creating a new array
2. Copy old contents
3. Add new element at the end
4. Updating reference variable

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```
import java.util.ArrayList;
```

Creating a new ArrayList

```
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```

We can add stuff to the ArrayList using the `.add()` method (built in method!)

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mylist.add("Jack");
```

To access elements in the array, we use the .get() method (we cannot use the square bracket index [ ])

```
System.out.println(mylist.get(2));   // this will print the String at index 2
```

Java **ArrayLists**

We first need to remember to import it ☺

```
import java.util.ArrayList;
```

Creating a new ArrayList

```
ArrayList<String> mylist = new ArrayList<String>();
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We can add stuff to the ArrayList using the `.add()` method (built in method!)

```
mylist.add("Jack");
```

To access elements in the array, we use the .get() method (we cannot use the square bracket index [ ])

```
System.out.println(mylist.get(2)); // this will print the String at index 2
```

We can remove stuff by index, or by searching for a specific element

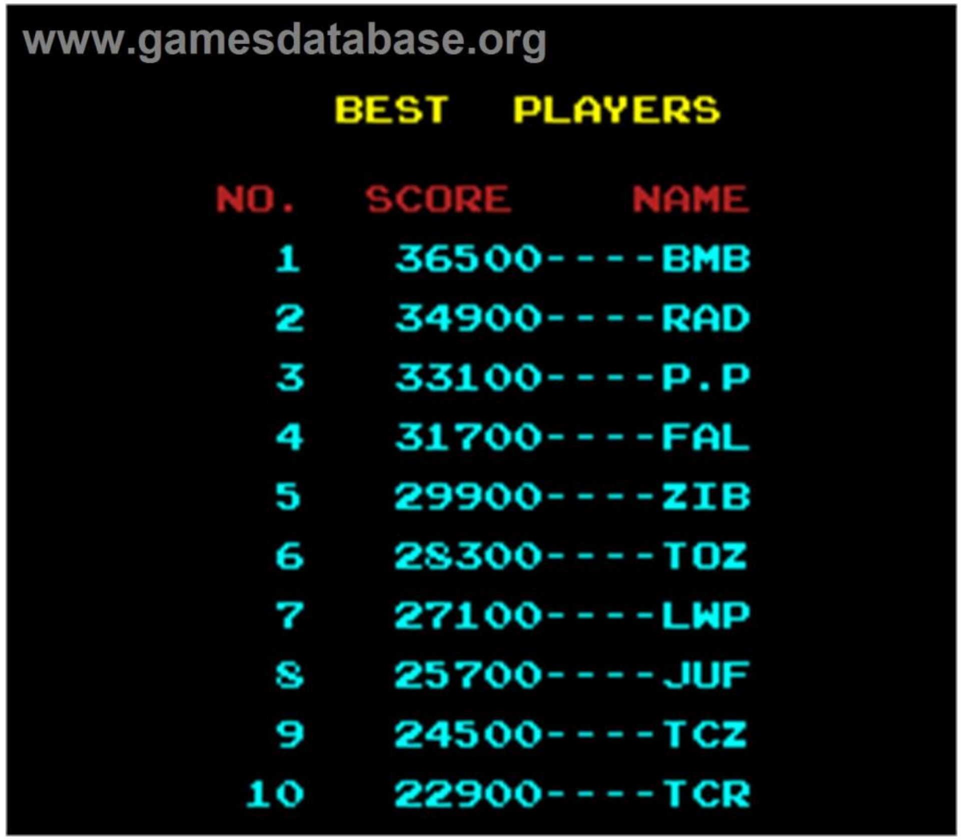
```
mylist.remove("Eli");
mylist.remove(0);
```

Java **ArrayLists**

```
import java.util.ArrayList;
        public class ArrayListDemo {

        public static void main(String[] args) {
                ArrayList<String> mylist = new ArrayList<String>();

                mylist.add("Jack");
                mylist.add("Tory");
                mylist.add("Sam");
                mylist.add("Eli");

                System.out.println(mylist);
                System.out.println(mylist.get(2));

                mylist.remove("Eli");
                mylist.remove(0);

                System.out.println(mylist);
                System.out.println(mylist.isEmpty());
        }
}
```

Java **ArrayLists** Example

Let’s write a program that will keep track of high scores on an arcade machine



```
www.gamesdatabase.org
              BEST   PLAYERS

        NO.    SCORE       NAME
         1      36500----BMB
         2      34900----RAD
         3      33100----P.P
         4      31700----FAL
         5      29900----ZIB
         6      28300----TOZ
         7      27100----LWP
         8      25700----JUF
         9      24500----TCZ
        10      22900----TCR
```

Each entry will have the player name (String), and their score (Int)

The program should allow for

- Adding a new high score
- Removing a score
- Print out scoreboard
- Print out top N scores
- Search for score by name

And we must use an **ArrayList** to hold all this information!