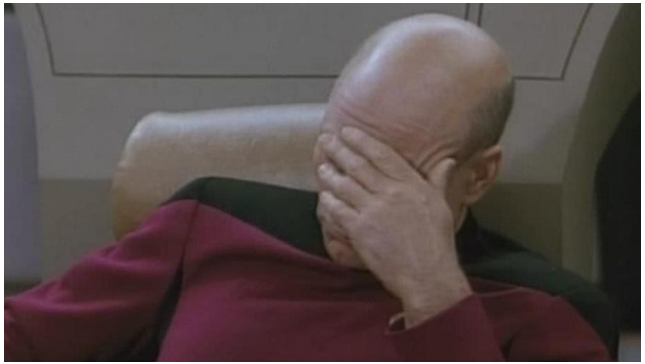
Why did the Java Developer quit his job?

Because he didn't get arrays.



Module 1-7

Collections: Lists

Objectives

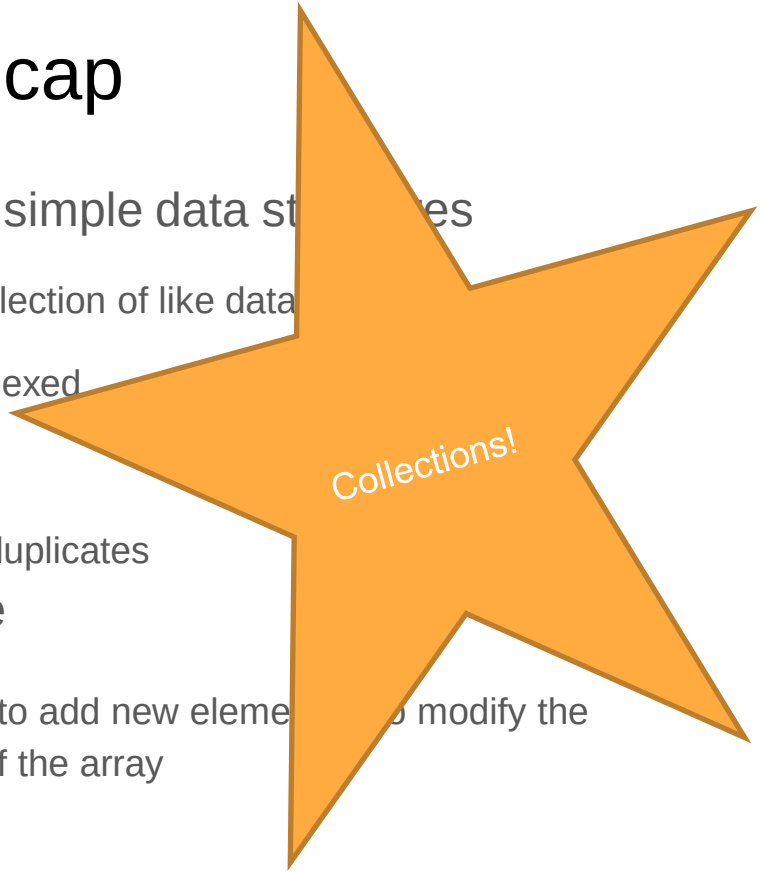
- Describe the purpose and use of Collections
- Describe the differences between a List and an array and the different use-cases for them
- Demonstrate an understanding of packages in Java to help organize them
- Understand the common API operations of a List and how to use them
- Use the for-each loop to iterate through a collection
- Identify from syntax what variables are arrays and what are Lists

Objectives

1. What are Collections and why we use them
2. Differences between array and List
3. Packages in Java for organization
4. For-each loop to iterate through a collection
5. (Stack and Queue data structures)

Array Recap

- Arrays are simple data st es
  - Hold collection of like data
  - Zero-indexed
  - Sorted
  - Allows duplicates
- Not flexible
  - Difficult to add new eleme o modify the length of the array



Collections

1. Classes that live in a package
2. Come from standard library of classes
    1. java.util package
3. Already written for you!

Package

- Organizes classes within libraries
- Creates scope to prevent two classes with same name from overlapping
- Can use import statement or fully qualified statement

```
java.util.Scanner input = new java.util.Scanner(System.in);
```

- java.lang package automatically imported
    - String class, System class, wrapper classes (Boolean, Integer, Double)

List class

A List is:

- Zero-indexed like array
- Ordered set of elements (accessible by index)
- Allows duplicates
- Dynamic in size

- Java List is an interface, so we use ArrayList
    - Called Programming to an Interface
- Must be imported from java.util package

List syntax

List <T> objectName = new ArrayList<>();

```
List <String> names = new ArrayList<>();

names.add("Rick");
names.add("Beth");
names.add("Jerry");
names.add(0, “Sam”);

for (int i = 0; i < names.size(); i++) {
  System.out.println(names.get(i));
}
```

- T stands for data type
- The add method is overloaded – add name is the same, but takes in different parameter listings

List methods

```
List <String> moreNames = new ArrayList<>(Arrays.asList("Tom",
"Tim", "Joe", "Jim"));

System.out.println(moreNames.size());  // prints 4
moreNames.add(0, "Jane");
System.out.println(moreNames); // prints out array elements
moreNames.remove(3);           // removes element in pos 3

System.out.println(moreNames.contains("Tom"));  // prints true

moreNames.removeAll(moreNames);
// removes all elements from ArrayList

System.out.println(moreNames.isEmpty()); // prints true
```

- The add method is **overloaded** – add method name is the same, but takes in different parameter listings

Let’s code!

Primitive Wrapper objects

Lists and other collections can only hold objects!

```
List <Integer> ages = new ArrayList<>();

ages.add(29);
ages.add(21);
ages.add(35);
ages.add(32);

for (int i = 0; i < ages.size(); i++) {
  System.out.println(ages.get(i));
}
```

- Wrapper class wraps primitive types so they can be references types
- Autoboxing is process of converting primitive type to reference type (moving from stack to heap)
- Unboxing is moving from heap to stack, converting back to primitive type

Autoboxing

- Automatic process (Java does it) of converting primitive type to reference type

```
Integer myInt = 10;
Double price = new Double(15.99);
```

- Unboxing is reversing – going from reference to primitive

```
int myPrimitiveInt = myInt;
```

Foreach loop

```
List <Integer> ages = new ArrayList<>();

ages.add(29);
ages.add(21);
ages.add(35);
ages.add(32);

for (Integer age: ages) {
  System.out.println(age);
}
```

- Convenience method to iterate through a collection
- Cannot modify contents during iteration
- Useful for when you don’t need the index, just want to go through to each element

Queues

- List, but used in a certain way to get certain result
- VERY COMMON data structure
- FIFO
  - First In, First Out
  - Elements are inserted at end of list, and deleted from beginning
- Line of customers waiting to be helped
- Print queue (documents printed in order received)

Queue syntax

Queue <T> objectName = new LinkedList<>();

```
Queue <String> todoList = new LinkedList<>();

todoList.offer("Rick");
todoList.offer("Beth");
todoList.offer("Jerry");
todoList.offer(“Sam”);

while (todoList.size() > 0) {
    String nextTodo = todoList.poll();
    System.out.println("NEXT ON MY LIST: " +
              nextTodo);
}
```

- To add elements to Queue, we can use add or offer (offer is preferred because add will throw an exception)
- To remove elements, we can use remove or poll (poll is preferred because remove will an exception)

Stacks

- List, but with different behavior
- VERY COMMON data structure
- LIFO
  - Last In, First Out
  - Elements are inserted at front of list, and deleted from beginning
- Plates at a buffet
- Undo feature of an edit

Stack syntax

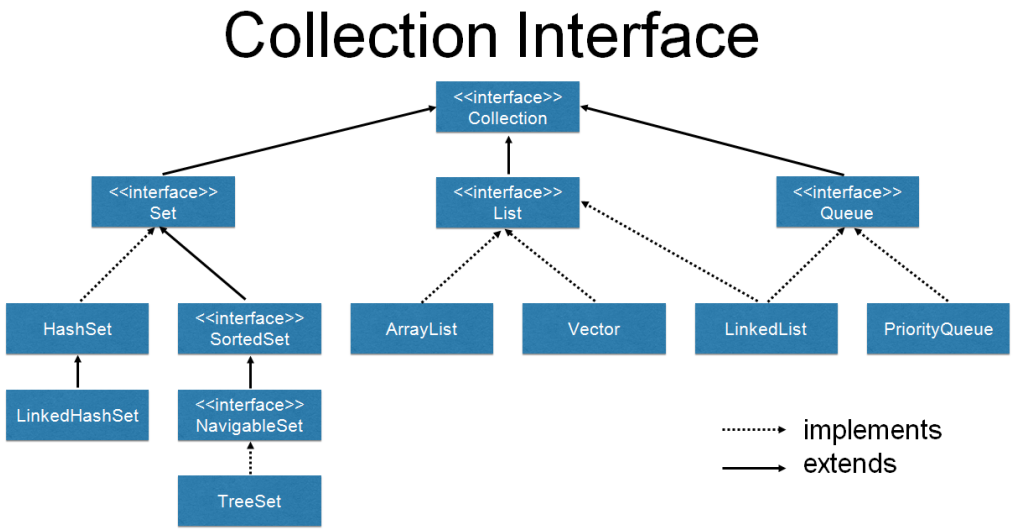
Stack <datatype> objectName = new Stack<>();

```
Stack <String> numberStack = new Stack<>();

numberStack.push("123");
numberStack.push("456");
numberStack.push("789");

while (numberStack.size() > 0) {
    String number = numberStack.pop();
    System.out.println(number);
}
```

- To add elements to Stack, we push the elements on the stack
- To remove elements, we pop them off the stack

Objectives

- Describe the purpose and use of Collections



Objectives

- Describe the purpose and use of Collections
- Describe the differences between a List and an array and the different use-cases for them

Difference between array vs ArrayList in Java

1. An array is static, you cannot change it's length once created, but ArrayList is dynamic, it can grow to accommodate more elements.
2. The array doesn't support generics, hence they are not type-safe but ArrayList support Generics, hence they provide compile time type-safety.
3. Array takes less memory than ArrayList for storing same number of elements or objects.
4. ArrayList allows you to remove element, but array doesn't provide such methods.
5. Array can accommodate both primitive and objects, but ArrayList can only accommodate objects.
6. Array can be multi-dimensional but ArrayList is always one dimensional.
7. Array provides length attribute and ArrayList provides size() but both are different, length is capacity, while size() return number of elements.

Objectives

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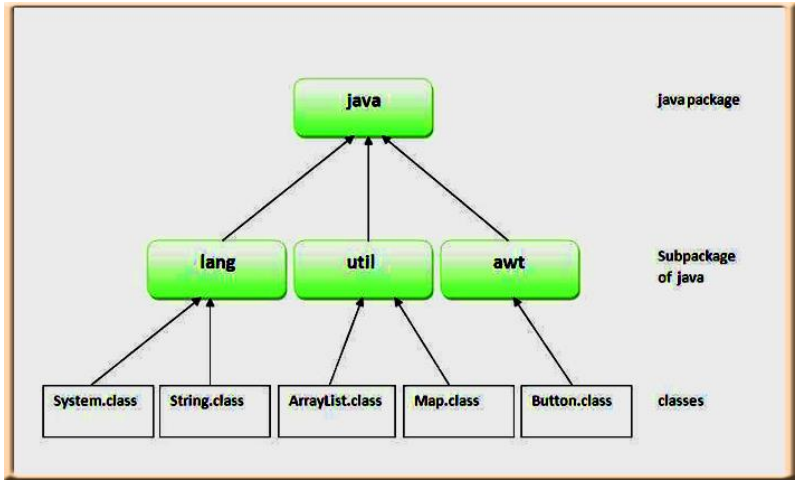
- Understand use of packages in Java to help organize libraries



Objectives

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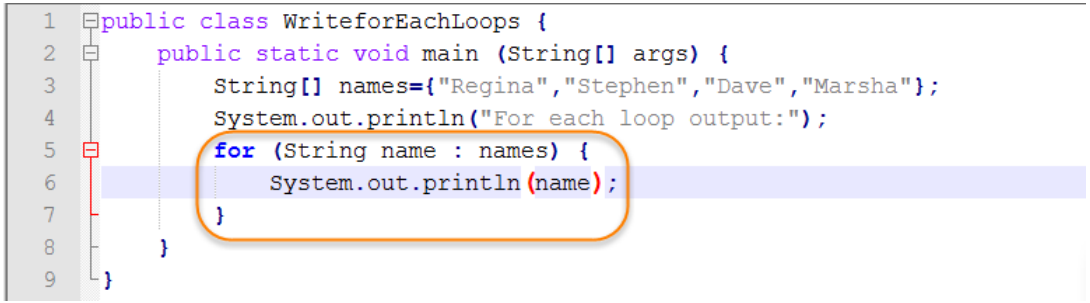
- Students should be able to use the for-each loop to iterate through a collection



Objectives

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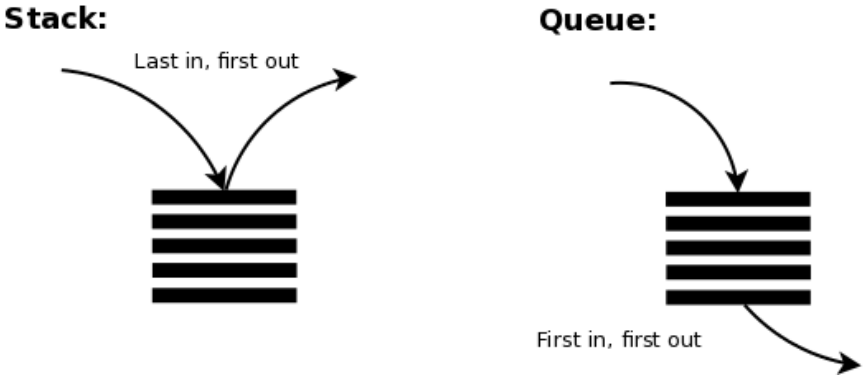
- Describe the differences between a List and an array and the different use-cases for them
- Understand use of packages in Java to help organize libraries
- Students should be able to use the for-each loop to iterate through a collection
- Students should be able to describe what a Stack and Queue are and how they work

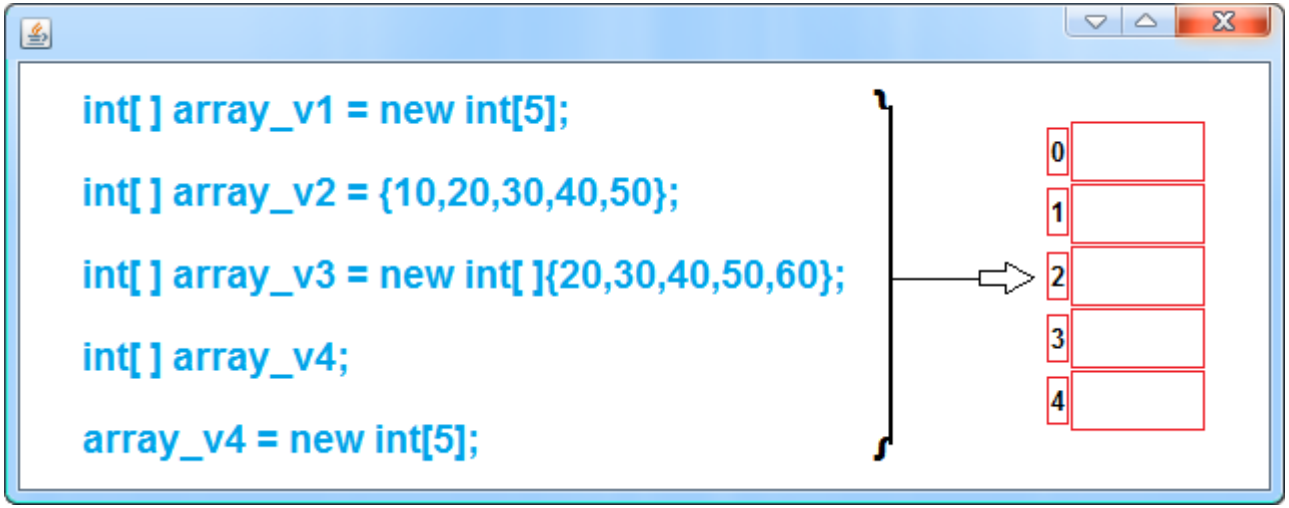


Objectives

- Students should be able to identify from syntax what variables are arrays and what are Lists

ArrayListToArray.java | ArrayListToArrayMutableObjects.java | ArrayListToArrayDeepCopy.java

```
1  import java.util.ArrayList;
2  import java.util.Arrays;
3  import java.util.List;
4
5  public class ArrayListToArray {
6
7      public static void main(String[] args) {
8          List<String> strList = new ArrayList<String>();
9          strList.add("1");
10         strList.add("2");
11         strList.add("3");
12
```



Let’s code!