Data Structures

Elements of Graphics
CS324e
Fall 2017
Student Presentation
Arrays

- Structure that can hold any object of a declared type
  - `int[] values = new int[10];`
- Index accesses data stored within the array
- Length of array has a fixed size upon array creation
  - `values.length;`
Arrays

❖ Structure of mutable length that can hold any object of a declared type
  ❖ `ArrayList<Type> values = new ArrayList<Type>();`
❖ Size of ArrayList adapts as data is added or removed
  ❖ `values.add(object);`
  ❖ `values.remove(index);`
❖ `get(index)` returns the object stored at index
❖ `set(index, object)` sets the value of the object stored at index
❖ `size()` returns the length of the ArrayList
Lists

- ArrayList provides flexibility for object creation at the cost of Array efficiency
- FloatList, IntList and StringList are specialized ArrayLists that are both flexible and efficient
  - Only work with floats, ints and Strings respectively
- append(value) adds value (of given type) to the List
- Other convenience features can be found within Processing website’s Reference
Question

What is the advantage of ArrayLists over arrays?

A. Faster access time
B. Combines array and dictionary functionality
C. Mutable size
D. Holds wider range of object types
Dictionaries

- Provide key-value pairs for efficient lookup
  - Key is a String
  - Value is the data
- FloatDict, IntDict and StringDict provide dictionary lookup for floats, ints and Strings respectively
- `set("key", value)` adds the key-value pair to the dictionary
- `get("key")` retrieves the value assigned to "key"
- `hasKey("key")` returns a boolean whether or not "key" is part of the dictionary
HashMaps

- Provide a more flexible key-value pair than Dicts
- Key and value can be of any type
- Access functionality with `import java.util.Map;`
- Constructor assigns key-value pair upon object creation
  - `HashMap<String, Integer> hm = new HashMap<String, Integer>();`
- `put(key, value)` adds key-value pair to HashMap
- `get(key)` retrieves the value associated with key
HashMap Functionality

- Not native to Processing — built from Java library
- Reference at: http://docs.oracle.com/javase/6/docs/api/java/util/HashMap.html
What are the types of `hm`'s key and value?

```java
HashMap<Integer, String> hm = new HashMap<Integer, String>();
```
Objects

- Also a type of data structure!
- Some objects are defined in Processing (String, PShape, PImage, etc)
- Other objects are defined by the program-specific classes or libraries of classes
- When should you create an Object class versus store object data in one of the pre-existing containers?
Today’s activities:

1. Create an array of colors, so that the background color changes at random on a timer

2. Create an ArrayList of particles, so that the user can add a particle upon clicking the mouse

3. Create a StringDict containing key-value pairs of countries and their capitals, so that the capital displays when the user types in a country