Lecture Set #18: Collections

1. New Looping construct
   1. for each loop
2. Collections
   1. Stack
   2. ArrayList

Collections in Java

- Arrays are collections
  - Arrays are objects
  - Arrays are sequences of elements in base type
  - These elements are collected together in one object: the array
- Java includes may other collection mechanisms
  - Arrays good for some applications (fixed-length sequences), not others (varying-length sequences)
  - Other collections tuned for different purposes
  - General observation holds, however:
    - Collections are objects …
    - … that contain other objects in a given type
- We'll study two (more in CMSC132): `Stack, ArrayList`

for … each … in

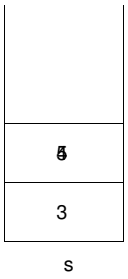
- New construct available in Java 1.5 (not available in older versions of Java)
- Use with arrays
- Use with any iteratable collection
- Limitations:
  - modifications limited
    - can't add items to the list being iterated over
    - can't remove items from the list being iterated over
    - can't replace items in the list being iterated over
  - access only one
    - only a single collection can be traversed at a time
    - can't access the one before or the one after on this iteration
  - limited to forward and one at a time
    - can't traverse the list in the reverse order
    - can't go to every other element or any variation

Stacks in Java

- Recall: a stack is a data structure ("device" for holding values) – FILO (First In, Last Out)
- Typical operations on a stack
  - push: add a new value into the stack
  - pop: remove the most recently added value still in stack
  - top: return the most recently added value in stack
    Note: Java calls this "peek"
  - is empty: returns true if the stack is currently empty or false otherwise

Example of stack concept (not Java specific)

- Stack s
- s.isempty() == ??
  true
- s.push (3);
- s.isempty() == ??
  false
- s.push (4);
- s.peek == ??
  4
- s.pop ();
- s.push (5);
- s.peek == ??
  5



Stacks in Java (cont.)

- Java includes a generic class for stack objects
  - Stack objects contain other objects
  - All objects in stack must have same type
  - Only objects may be stored in stacks (no primitive-type values)
- Syntax: `Stack<E>`
  - `Stack<E>` is a generic class
    - `E` is a class variable representing the base type
    - Replace `E` by a specific type to get a stack of that type of elements
  - Class is in `java.util` package
- Documentation:
  http://java.sun.com/j2se/1.5.0/docs/api/java/util/Stack.html
- See example: `StackExample.java`

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

Creates a stack of strings
  - extend this to be stack of cats
  - extend this to be stack of integer values

ArrayList Collection

- Like arrays … but support for inserting/deleting new elements
  - Sequences of elements
  - All elements must be in same (base) type
- Syntax: `ArrayList<E>`
- Documentation:
  http://java.sun.com/j2se/1.5.0/docs/api/java/util/ArrayList.html
- See example: `ArrayListExample.java`
  - `ArrayList<String> a = new ArrayList<String>();` Creates an ArrayList of strings
  - `Collections.sort` may be used on `ArrayList<String>` objects?
  - Reason
    - `String` implements `Comparable` interface
    - `ArrayList<E>` implements `List<E>` interface

Mutable Strings

- `Strings` are immutable
  - Once a String object is created, it cannot be altered
  - For String objects, reference = shallow = deep copying (why?)
- Sometime mutable strings would be handy
  - Sometimes a small change needs to be made to a string (e.g. misspelled name)
  - Don't want to create a whole new `String` object in this case
- `StringBuffer`: Java's class for mutable `Strings`

StringBuffer Basics

- See documentation at:
http://java.sun.com/j2se/1.5.0/docs/api/java/lang/StringBuffer.html
- Main methods
  - `append`: add characters to end
  - `insert`: add characters in middle
  - `delete`: remove characters
- Note
  - `append`, `insert` return object of type `StringBuffer`
  - This is alias to object that the methods belong to!
- See `StringBufferExample.java`