Lecture Set #15: Collections

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

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 many 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
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](http://java.sun.com/j2se/1.5.0/docs/api/java/util/Stack.html)
- See example: `StackExample.java`
  ```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](http://java.sun.com/j2se/1.5.0/docs/api/java/util/ArrayList.html)
- See example: `ArrayListExample.java`
  ```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
for ... each ... in

- New construct available in Java 1.5 (not available in older versions of Java)
- Use with arrays
- Use with any iterable 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