

CS 251

Intermediate Programming

Intro to Collections and Generics

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Lists

Ordered sequence, similar to an array, but more general.

- `add(item)` Add item to end of list
- `add(index, item)` Add item at specified position in list
- `contains(object)` Returns true if list contains given object
- `get(index)` Get item at specified position
- `remove(item)` Remove item from list
- `remove(index)` Remove item at position from list
- `size()` Get size of list

String List Interface

```
public interface StringList {
    // Add s to end of list.
    void add(String s);

    // Add s at position index
    void add(int index, String s);

    // True if s in list
    boolean contains(String s);

    // Return item at index
    String get(int index);

    // Remove s, return true if successful.
    boolean remove(String s);

    // Remove and return item at index.
    String remove(int index);

    // Return size of list
    int size();
}
```

Abstract Data Types

- List – sequence
- Set – no duplicates
- Queue – First In, First Out (FIFO)
- Stack – Last In, First Out (LIFO)
- Deque – double-ended queue (pronounced “deck”)
- Map – associates keys with values (some languages call it a *dictionary*)

Comparable interface (sort of)

```
public interface Comparable {  
  
    // Compares this with other object  
    // Returns negative, zero, or positive integer when  
    // less than, equal to, or greater than other  
    int compareTo(Comparable o);  
}
```

Using Comparable

```
public static void printGreatest(Comparable a,
                                  Comparable b) {
    if(a.compareTo(b) > 0) {
        System.out.println(a);
    } else {
        System.out.println(b);
    }
}
```

Implementing Comparable

```
public class MyClass implements Comparable {
    // Value used to compare instances
    private int value;

    public MyClass(int value) {
        this.value = value;
    }

    public int compareTo(Comparable o) {
        MyClass other = (MyClass)o;
        return this.value - other.value;
    }
}
```

Comparable interface with generics

```
// T is type of objects that this  
// object may be compared to  
public interface Comparable<T>{  
  
    // Compares this with other object  
    // Returns negative, zero, or positive integer when  
    // less than, equal to, or greater than other  
    int compareTo(T o);  
}
```


Implementing Comparable

```
// Can compare MyClass objs to other MyClass objs
public class MyClass implements Comparable<MyClass> {
    // Value used to compare instances
    private int value;

    public MyClass(int value) {
        this.value = value;
    }

    // Look Ma! No casting!
    public int compareTo(MyClass other) {
        return this.value - other.value;
    }
}
```

Non-generic Box

```
public class Box {  
    private Object object;  
  
    public void set(Object object) {  
        this.object = object;  
    }  
  
    public Object get() {  
        return object;  
    }  
}
```

Could put anything in the box!

Using Box

```
String myString = "Hello!";  
  
Box myBox = new Box();  
myBox.set(myString);  
  
Object obj = myBox.get();  
String str = (String)myBox.get();
```

We've lost our type information!

Generic Box

```
public class Box<T> {  
    private T object;  
  
    public void set(T object) {  
        this.object = object;  
    }  
  
    public T get() {  
        return object;  
    }  
}
```

T is the *type parameter*.

Using Generic Box

```
String myString = "Hello!";  
  
Box<String> myBox = new Box<String>();  
myBox.set(myString);  
  
String str = myBox.get();
```

Specifying a *type argument* of String to say that myBox is a Box of String.

Why Generics?

- Stronger type checks at compile time. It is easier to fix compile-time errors than runtime errors.
- Elimination of casts.
- Enables generic algorithms.
- Collections!

Generic List Interface

```
public interface List<T> {  
    // Add t to end of list.  
    void add(T t);  
  
    // Add t at position index  
    void add(int index, T t);  
  
    // True if t in list  
    boolean contains(T t);  
  
    // Return item at index  
    T get(int index);  
  
    // Remove t, return true if successful.  
    boolean remove(T t);  
  
    // Remove and return item at index.  
    T remove(int index);  
  
    // Return size of list  
    int size();  
}
```