

CMSC 132:

OBJECT-ORIENTED PROGRAMMING II



Java Language Constructs I

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About Style/Code

- Let's use Eclipse's
 - Edit→Select All
 - Source→Format Element
- No need for { } for single statements
- Use Eclipse's "Quick Fix"
- Use Eclipse's source generation tools
 - Not for equals and hashCode methods
- About Eclipse Errors/Warnings
 - <http://www.cs.umd.edu/eclipse/other.html#errors-warnings>

Iterator Interface

- Interface

```
public interface Iterator<E> {  
    boolean hasNext( );  
    E next( );  
    void remove( );  
}
```

- Example usage

```
ArrayList<String> L = new ArrayList<String>();  
L.add("Mary");  
L.add("Pete");  
Iterator<String> i = L.iterator();  
while (i.hasNext())  
    System.out.println(i.next());
```

Enhanced For Loop

- Works for arrays and any class that implements the **Iterable** interface, including all collections
 - <http://docs.oracle.com/javase/6/docs/api/java/lang/Iterable.html>
 - Has method `iterator()` returns `Iterator<T>` object
- For loop handles `Iterator` automatically
 - Test `hasNext()`, then invoke `next()`
- **/* Iterating over a String array */**

```
String[ ] roster = {"John", "Mary", "Alice", "Mark"};
```

```
for (String student : roster)
```

```
    System.out.println(student);
```

Enhanced For Loop

```
ArrayList<String> roster = new ArrayList<String>( );
roster.add("John");
roster.add("Mary");
/* Using an iterator */
for (Iterator<String> it = roster.iterator( ); it.hasNext( ); )
    System.out.println(it.next( ));
/* Using for loop */
for (String student : roster)
    System.out.println(student);
```

Generics (Motivating Example)

- Problem

- Utility classes handle arguments as Objects
- Objects must be cast back to actual class
- Casting can only be checked at runtime

- Example

```
class A { ... }
```

```
class B { ... }
```

```
List myL = new List();
```

```
myL.add(new A());    // Add an object of type A
```

```
...
```

```
B b = (B) myL.get(0); // throws runtime exception  
                      // java.lang.ClassCastException
```

Solution (Generic Types)

- Generic types
 - Provides abstraction over types
 - Can parameterize classes, interfaces, methods
 - Parameters defined using `<X>` notation
- Examples
 - `public class foo<X, Y, Z> { ... }`
 - `List<String> myNames = ...`
- Improves
 - Readability & robustness
- Used in Java Collections Framework

Generics (Usage)

- Using generic types
 - Specify <type parameter> for utility class
 - Automatically performs casts
 - Can check class at compile time

- Example

```
class A { ... }
```

```
class B { ... }
```

```
List<A> myL = new List<A>( );
```

```
myL.add(new A( ));    // Add an object of type A
```

```
A a = myL.get(0);     // myL element ⇒ class A
```

```
...
```

```
B b = (B) myL.get(0); // causes compile time error
```

Autoboxing & Unboxing

- Automatically convert primitive data types
 - Data value $\Leftrightarrow$ Object (of matching class)
 - Data types & classes converted
 - Boolean, Byte, Double, Short, Integer, Long, Float

- Example

```
ArrayList<Integer> myL = new ArrayList<Integer>();  
myL.add(1); // previously myL.add(new Integer(1));  
int y = mL.getFirst();  
//previously int y = mL.getFirst().intValue();
```

- Example: SortValues.java

Enumerated Types

- New type of variable with set of fixed values
 - Establishes all possible values by listing them
 - Supports values(), valueOf(), name(), compareTo()...
 - Can add fields and methods to enums
- **Example:** Color.java
- In Eclipse we define them as we defined classes
- When to use enums
 - Natural enumerated types – days of week, phases of the moon, seasons
 - Sets where you know all possible values
- **Example:** Deck.java
- **Example:** BoardCell.java