CLASSES, OBJECTS AND PACKAGES

15TH LECTURE

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Outline

- **Classes**
  - Creating New Data Types: class
  - Methods, Arguments and Return Values

- **Objects**
  - You Manipulate Objects Using References
  - Primitives
  - You Never Destroy Objects

- **Packages**
  - Using Other Components
Creating New Data Types: class

• Class keyword defines new data type

```java
class ATypeName { /* class body goes here */ }
ATypeName a = new ATypeName();
```

• Fields

```java
class DataOnly {
    int i;
    float f;
    boolean b;
}
```

• Each instance of `DataOnly` gets its own copy of the fields
• In a class, primitives get default values
Methods, Arguments and Return Values

• Methods: how you get things done in an object
• Traditionally called “functions”
• Can only be defined inside classes

```java
ReturnType methodName(/* Argument list */) {
    // Method body
}
```

• Example method call:

```java
int x = a.f(); // For object a
```
String s; // Reference only
// Normal object creation:
String s = new String("asdf");
// Special string initialization:
String s = "asdf";
Primitives

• Built-in types: *not* object references, but variables on the stack like C.
  – `boolean`, `char` (Unicode), `byte`, `short`, `int`, `long`, `float`, `double`
• Same operations as C/C++, same syntax
• Size of each data type is machine independent!
• Portability & performance implications
• To create objects, wrapper classes are provided:
  – `Boolean`, `Character`, `Byte`, `Short`, `Integer`, `Long`, `Float`, `Double`.

```java
char ch = 'x';
Character c = new Character(ch);
Or
Character c = new Character('x');
```
## Primitives Cont’d

<table>
<thead>
<tr>
<th>Primitive type</th>
<th>Size</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Wrapper type</th>
</tr>
</thead>
<tbody>
<tr>
<td>boolean</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Boolean</td>
</tr>
<tr>
<td>char</td>
<td>16-bit</td>
<td>Unicode 0</td>
<td>Unicode $2^{16}$ - 1</td>
<td>Character</td>
</tr>
<tr>
<td>byte</td>
<td>8-bit</td>
<td>-128</td>
<td>+127</td>
<td>Byte</td>
</tr>
<tr>
<td>short</td>
<td>16-bit</td>
<td>$-2^{15}$</td>
<td>$2^{15} - 1$</td>
<td>Short</td>
</tr>
<tr>
<td>int</td>
<td>32-bit</td>
<td>$-2^{31}$</td>
<td>$2^{31} - 1$</td>
<td>Integer</td>
</tr>
<tr>
<td>long</td>
<td>64-bit</td>
<td>$-2^{63}$</td>
<td>$2^{63} - 1$</td>
<td>Long</td>
</tr>
<tr>
<td>float</td>
<td>32-bit</td>
<td>IEEE754</td>
<td>IEEE754</td>
<td>Float</td>
</tr>
<tr>
<td>double</td>
<td>64-bit</td>
<td>IEEE754</td>
<td>IEEE754</td>
<td>Double</td>
</tr>
<tr>
<td>void</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Void</td>
</tr>
</tbody>
</table>
You Never Destroy Objects

• Scope of objects

```java
{ // ← Beginning of scope
String s = new String("a string");
} // ← End of scope
// Reference has gone "out of scope"
// but the object itself still exists
```
static Data ("class data")

• Normally each object gets its own data
• What if you want only one piece of data shared between all objects of a class?

class WithStaticData {
    static int x;
    int y;
}
WithStaticData
a = new WithStaticData(),
b = new WithStaticData(),
c = new WithStaticData();
Using Other Components

• Bring in a library of components using `import` keyword

• To specify particular element in library:
  – `import com.bruceeckel.utility.MyClass;`

• To specify entire library:
  – `import java.util.*;`
Package: the Library Unit

• Managing “name spaces”
  – Class members are already hidden inside class
  – Class names could clash
  – Need completely unique name even over the Internet

• Compilation units (.java files)
  – Name of .java file == name of single public class
  – Other non-public classes: not visible
  – Each class in file gets its own .class file
  – Program is a bunch of .class files (no .obj or .lib)
Creating a Library of Classes

• `package mypackage;`
  – `public` class is under the umbrella `mypackage`
  – Client programmer must `import mypackage.*`;

• Creating unique package names
  – Location on disk encoded into package name
  – Convention: first part of package name is Internet
  – domain name of class creator (reversed)
  – Java interpreter uses CLASSPATH environment
  – variable as starting point for search