This Week

Lab: Debugging with Debugger

Lecture:

- Static memory area
- Object-Oriented Programming
- ArrayList
- Wrapper Classes

Thursday: Gary Dahl
What is the value of num?

class Stuff {
    final static int MAX_VALUE = 10; //allowed P2
    static int num = 6; //NOT allowed in P2
    static void change( int n) {
        num = n + 1;
    }
    public static void main( String [] args) {
        int num = MAX_VALUE;
        change( num);
        System.out.println("num:" + num);
        System.out.println("Stuff.num:" + Stuff.num);
    }
}

<table>
<thead>
<tr>
<th>num</th>
<th>Stuff.num</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>error</td>
<td></td>
</tr>
</tbody>
</table>
What are values of x and y?

static int x;
static int y = 2;
static int methodA( int y) {
    x = y + 1;
    return x + y;
}

public static void main(String []args) {
    int x = 5;
    y = methodA( x);
    System.out.println("x=\"+x+ " y=\"+y);
}
Instance vs. Class (static) Methods

Class (static) Methods
- method definition has “static” modifier
- use name of class when calling
  
  ```java
  Math.max( 10, 20);
  ```

Instance (non-static) Methods
- method definition does Not have “static” modifier
- use instance of class when calling
  
  ```java
  Random randGen = new Random();
  randGen.nextInt( 5);
  ```
What is the answer?

String s1 = "An important programming tool.";
String s2 = s1.substring( 9, 10);
String s4 = new String( "?");  
if ( s1.contains( "gram")) {
    s4 = s1.substring( 2, 4).trim();
}
char c3 = s1.charAt( s1.indexOf('g') -3);
String answer = (s2 + c3 + s4).toUpperCase();
Object-Oriented Programming

ArrayLists - specific example of use

Concepts - Big Picture

- Grouping related data and methods
- User Defined Data Type (class)
- Creating Instances from a Class

Creating a Class
Arrays

- fixed number of same data type (contiguous in memory)
- What would we like to do with arrays?
  - Add elements, remove elements...
How many elements in an Array vs ArrayList?

```java
static void methodA(int [] arr) {
    //how to find length of array?
}

static void methodB(ArrayList list) {
    //how to find length of list?
}
```

<table>
<thead>
<tr>
<th>Array Method</th>
<th>List Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>arr.length</td>
<td>list.size()</td>
</tr>
<tr>
<td>arr.length</td>
<td>list.length()</td>
</tr>
<tr>
<td>arr.size</td>
<td>list.size()</td>
</tr>
</tbody>
</table>
What happens when you try to add more elements than will fit into an array?

- Array grows automatically
- Array index out of bounds
- Error
- Who knows?
What happens when you try to add more elements than will fit into an ArrayList?

- ArrayList grows automatically
- ArrayList index out of bounds
- Error
- Who knows?
What happens when you want to insert an element in an array at a specific index?

You have to make sure there is enough room and move all the elements down and then insert it.

Insertion is handled automatically.
What happens when you want to insert an element in an ArrayList at a specific index?

Insertion is handled automatically.

You have to make sure there is enough room and move all the elements down and then insert it.
Data members

Instance data members (variables) should be ______ unless there is a very good reason.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>private</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>public</td>
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<td>protected</td>
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<tr>
<td>static</td>
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</table>
Data members

Instance methods should be _______.

- private
- public
- depends
- static
Can primitive values be stored in an ArrayList?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>If they are wrapped</td>
<td>int yes, char no</td>
</tr>
</tbody>
</table>

**ArrayList**
Will this work?

Integer i = 10;

| yes   |
| no    |
| sometimes |
| error |
Will this work?

Double d = new Double(10);
double d2 = d;

<table>
<thead>
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<td>sometimes</td>
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<tr>
<td>error</td>
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</table>
Is result true or false?

Integer m = 5;
Integer n = 5;
boolean result = m == n;

true
false
error

Creating a Class

Pizza Order

Bugs