Garbage Collection

CSCI 201
Principles of Software Development

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Outline

• Garbage Collection
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- Java doesn’t require much memory management
  - C++ has malloc, free, delete

- Since Java does not have these key words, another mechanism was needed to clean up memory after it was used
  - When a memory location is no longer referenced, the Garbage Collector will come around and delete that reference in memory

- Garbage collection looks at memory and identifies which locations are still referenced by variables and which are not
  - An memory location is a candidate for garbage collection when it no longer is referenced by any part of your program
When are the memory locations pointed to by each of the following variables candidates for garbage collection?

```java
public class Garbage {
    private ArrayList num;
    private static String val;
    public Garbage(ArrayList num) {
        this.num = num;
        val = "hello";
    }
    public static void meth() {
        Garbage g = new Garbage(new ArrayList());
        g.num = new ArrayList();
        Garbage.val = "hi";
    }
    public static void main(String [] args) {
        Integer number = new Integer(3);
        for (int i=0; i < number; i++) {
            System.out.print(i);
        }
        meth();
        System.out.println(number);
    }
}
```
Garbage Collection Steps

- **Step 1 – Marking**
  - The garbage collector determines which pieces of memory are in use and which are not

![Marking Diagram](http://www.oracle.com/webfolder/technetwork/tutorials/obe/java/gc01/index.html)

Garbage Collection Steps

- Step 2 – Normal Deletion
  - Garbage collector removes unreferenced objects leaving referenced objects and pointers to free space

Garbage Collection Steps

- Step 2a – Deletion with Compacting
  - Garbage collector deletes unreferenced objects and compacts the remaining referenced objects

Invoking Garbage Collection

- Programmers are not able to explicitly invoke the garbage collector
- We can make a suggestion to the JVM to run the garbage collector with
  \[\text{System.gc();}\]
  - This does not mean that the garbage collector will be run immediately though
- More garbage collection information can be found at
  http://www.oracle.com/webfolder/technetwork/tutorials/obe/java/gc01/index.html