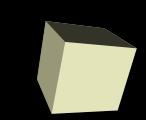
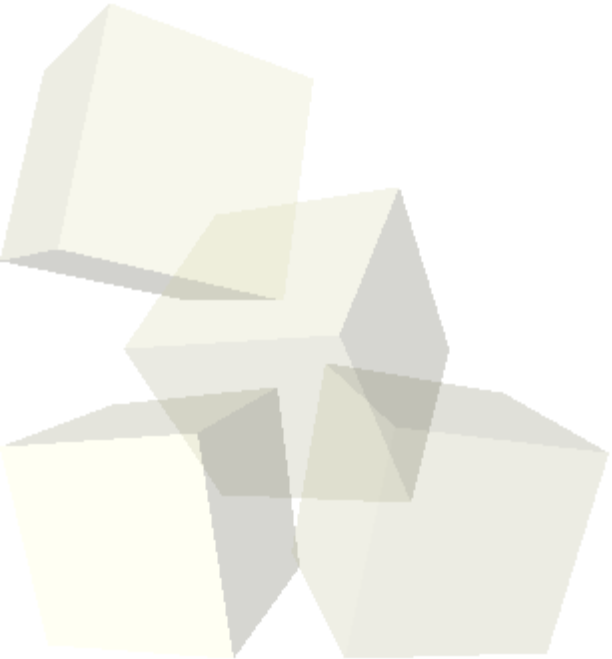
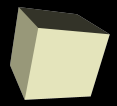


# Linked Lists

2/15/2007



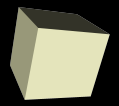


# Opening Discussion

- Do you have any questions about the assignment?
- What is a list?  What are the things that you can do with a list?
- What are the advantages and disadvantages of implementing a list with an array?
- What is a linked list?  What are their strengths and their weaknesses?

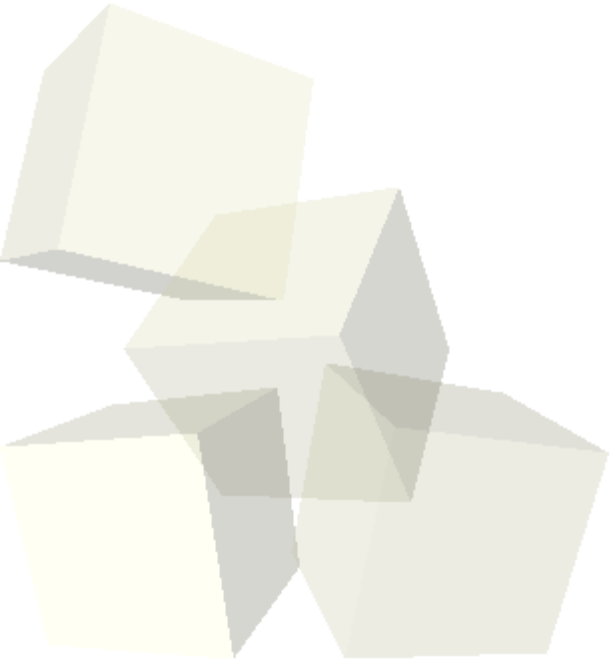
# Types of Linked Lists

- Linked lists can be implemented in many ways. The basic characteristic is that we only keep a reference to one node and nodes then link to one another.
- The linking can be single or double. A doubly linked list has nodes that know about both the next and the previous elements.
- Linked lists can also be circular. In a circular linked list, the first element links around to the back one.
- For optimization purposes, lists can keep track of a head and a tail, but that isn't required.



# Implementing a Singly Linked List

- Let's work together to build an implementation of a singly linked list.
- We will implement the java.util.List interface, but we won't have time to implement all of the methods.

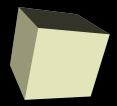


# Sentinels

- Your book refers to an extra node placed at the beginning of a linked list as a dummy node. These are also called sentinels and your book understates how much they can improve your life. They also don't do them quite right.
- A sentinel is an extra node in the list the represents the “end” of the list and doesn't store data. The purpose of the sentinel is to remove special cases. The next of the sentinel is what we have called head.

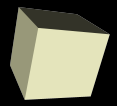
# Implementing a Doubly Linked List

- Now let's implement java.util.List with a doubly linked list with a sentinel. The list will also be circular.
- You should notice that this implementation never has to check for null because no references in the list should ever be null. This simplifies the code significantly. We also implicitly get a head and a tail with no extra work. If you don't have a sentinel you will write a lot of extra checks for nulls and even more to include a tail.



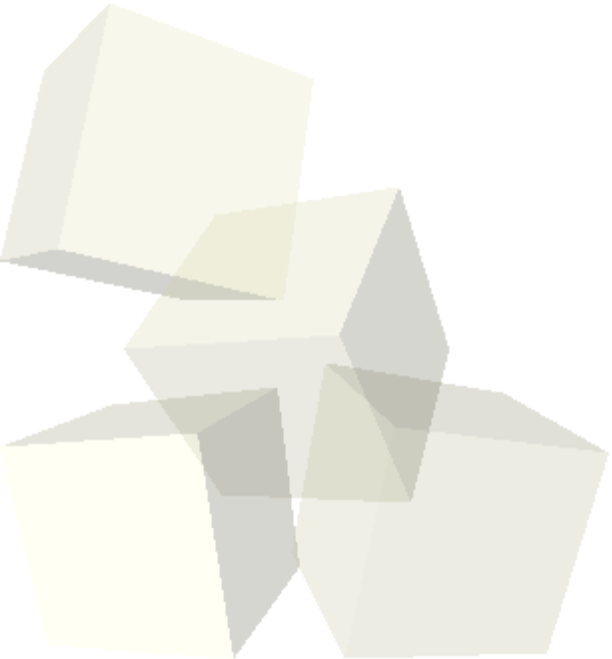
# Iterators

- We've already discussed that direct access on linked lists is very inefficient. How then should we walk through a list with outside code? Remember that the outside code doesn't have access to the nodes so it can't use the style of loop we have been doing internally.
- The concept of an Iterator is something that abstracts the process of walking through all of the elements in a container. Iterators can not only be efficient, they also make code more flexible because they don't depend on the implementation details of the containers.



# Iterating Lists

- An iterator basically needs to encapsulate the information and functionality we would put into a standard method of going through a container.
- With this in mind, what do we need to put in an iterator for an array based list?
- What would we put in an iterator for a linked list?



# Minute Essay

- For one of your future assignments you will be forced to write your own linked list. What type of linked list do you think you will write?
- Remember that the design for assignment #3 is due on Tuesday.