CSSE 220

Linked List Implementation

Checkout *LinkedListSimple* project from SVN

Quiz

- Get into pairs
- Look at/run the code in LinkedList.java main
- Draw a box-and-pointer diagram of what's happening in the main code.
- To figure it out, you'll have to look at the LinkedList constructor and addAtBeginning.
- If you've forgotten how to do box-and-pointer diagrams, checkout the handout on Day 5 of the schedule

Solve the Other Problems in LinkedListSimple

- Look at toString to get an idea of how to do size, then go from there
- They are in approximate difficulty order
- Get help if you get stuck!

Understanding the engineering trade-offs when storing data

DATA STRUCTURES

Data Structures

- Efficient ways to store data **based on how we'll use it**

- The main theme for the rest of the course

- So far we've seen `ArrayLists`
  - Fast addition **to end of list**
  - Fast access to any existing position
  - Slow inserts to and deletes from middle of list

Big-O Notation

- Describes the limiting behavior
  - How slow it can possibly run?
  - Describes the worst case
- Used for Classifying Algorithm Efficiency
- “O” for “Order”
  - O(n) → said as “Order n”
  - O(n^2) → said as “Order n-squared”

Big-O Notation (continued)

- Don’t Care About Constants
  - O(2n + 7) → O(n)
- Don’t Care About Smaller Powers
  - O(6n^2 + 7n) →O(n^2)
  - Algorithm grows asymptotically no faster than n^2
- If constant value, we say O(1) → “Order 1”
  - O(48) → O(1)

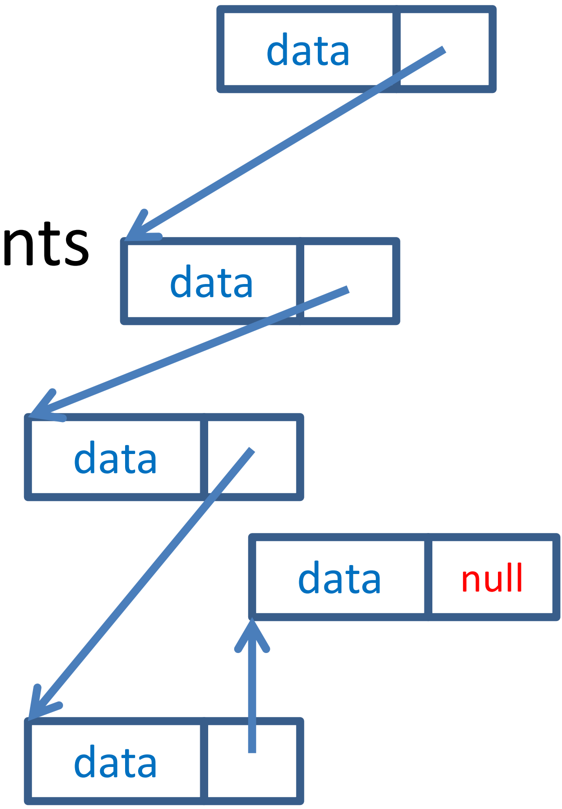
ArrayList Performance (Revisited)

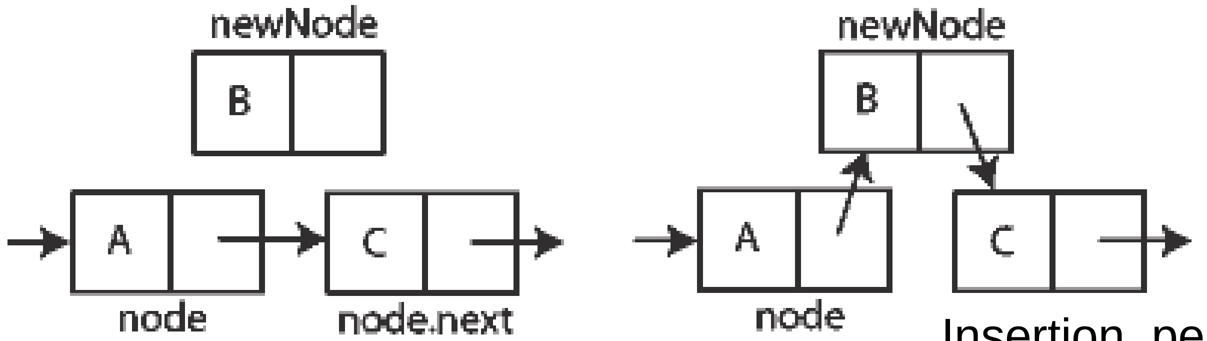
- Fast addition to **end of list**:
  - Fast access to any existing position – O(1) (like array)
  - Keep extra *capacity* for list growth
    - Fast access includes items in capacity not yet filled – O(1)
  - Capacity management is best left for CSSE230
- Slow inserts to and deletes from middle of list
  - Can get to insert/delete location quickly
  - For insert, shift all items right to accommodate -O(n)
  - For delete, shift all items left to fill gap – O(n)

Q2

Another List Data Structure

- What if we have to add/remove data from a list frequently?
- `LinkedLists` support this:
  - Fast insertion and removal of elements
    - Once we know where they go
  - Slow access to arbitrary elements





Insertion, per Wikipedia

Q3-4

`LinkedList<E>` Methods

- **`void addFirst(E element)`**
- **`void addLast(E element)`**
- **`E getFirst()`**
- **`E getLast()`**
- **`E removeFirst()`**
- **`E removeLast()`**

- What about accessing the middle of the list?
  - **`LinkedList<E> implements Iterable<E>`**

TEAM PROJECT WORK TIME