CS 367 - Introduction to Data Structures
Thursday, February 18, 2016

Homework 4 due 10 pm tomorrow, February 19th
Homework 5 assigned by Monday, February 22nd
Program 2 due 10 pm Sunday, March 6th - GET STARTED NOW!

Last Time

Iterable and For-Each Loops
More Linked List Variations
- double linking
- circular linking

Complexity
- concept
- big-O notation
- analyzing algorithms practice

Today

Complexity
- best/worst cases
- analyzing Java code (from last time)
- practice analyzing Java code (from last time)
- significance of scaling
- caveats

Comparing ArrayList vs LinkedList

Next Time

Read: start *Stacks and Queues*
Shadow Array - improving array resizing
Stack ADT
- concept
- array implementations
- chain of nodes implementations

Queue ADT
- concept
- chain of nodes implementations

Number Guessing Game

Picker picks a number (positive integer)
Repeat until number is guessed:
  Guesser guesses a number
  Picker answers "correct", "higher", or "lower"

problem size:
dominant operation:

→ **What is the complexity of each algorithm below** that the guesser uses to decide the sequence of numbers to give as guesses?

Algorithm 1:

```
guess = 1
repeat
  If guess incorrect, increment guess by 1
until correct
```

Algorithm 2:

```
guess =   /2
step  =   /4
repeat
  If guess is too small, increase guess by step
  otherwise decrease guess by step
  step = step/2 (alternate rounding up/down)
until correct
```

The Significance of Scaling

N	N log(N)	N^2	2^N	N!
2	2.0	4	4	2
4	8.0	16	16	24
6	15.5	36	64	720
8	24.0	64	256	
10	33.2	100	1024	
15	58.6	225		
20	86.4	400		
100	664.4	10,000		
1000	9965.8	1,000,000		

Complexity Caveats

Small Problem Size

Same Complexity

Comparing `ListADT` Implementations

Time Requirements
Problem size N is number of items

	construct or	add (E) "at end"	add (int,E) "at pos"	contains (E)	size	IsEmpty	get (int)	remove (int)
Array								
Singly-Linked List (SLL)								
Circular SLL								
Doubly-LL								
CircularDLL								

Comparing `ListADT` Implementations

Space Requirements

→ Problem size N is?

Array:

Singly-Linked List:

Circular Singly-Linked List:

Doubly-Linked List:

Circular Doubly-Linked List:

Comparing `ListADT` Implementations

Ease of Implementation

Array:

Singly-Linked List:

Circular Singly-Linked List:

Doubly-Linked List:

Circular Doubly-Linked List: