CS 367 - Introduction to Data Structures  
Tuesday, February 23, 2016

Midterm Exam 1
- Tuesday, March 1, 5:00 pm – 7:00 pm
- Lec 1: room 3650 of Mosse Humanities Building
- Lec 2: room 1351 of Chemistry Building
- Lec 3: room 6210 of Social Sciences Building
- UW ID required
- See posted exam information

Homework 5 due 10 pm Friday, February 26th
Program 2 due 10 pm Sunday, March 6th - GET STARTED NOW!

Last Time
Complexity
- best/worst cases
- analyzing Java code (from last time)
- practice analyzing Java code (from last time)
- significance of scaling
Comparing ArrayList vs LinkedList

Today
Complexity Caveats (from last time)
Comparing ArrayList vs LinkedList (from last time)
Shadow Array - improving array resizing
Stack ADT
- concept
- array implementations
- chain of nodes implementations
Queue ADT
- concept
- chain of nodes implementations

Next Time
Read: finish Stacks and Queues, Trees Intro., start Priority Queues
Circular Array Data Structure
Tree Terms
Priority Queue ADT
- concept
- operations
- implementation options
Returning N Papers to N Students

problem size (N) =
dominant operation =

→ What is the complexity of each algorithm below?

Algorithm 1:
call out each name,
have student come forward & pick up

best-case:

worst-case:

Algorithm 2:
hand pile to first student,
student linearly searches through papers & takes hers/his,
pass pile to next student who does likewise

best-case:

worst-case:

Algorithm 3:
sort the papers alphabetically,
hand pile to first student who does binary search,
pass to next student who does likewise
Shadow Array – Improving Array Resizing

"Naïve" Approach

```
items
  2
numItems
```

```
A B
```

```

```

"Shadow Array" Improvement

```
items
  
shadow

numItems
```

```

```

Stack ADT

Concept

Operations

Implementing using an Array

[Diagram of an array with an arrow pointing to the left]

→ Where should the top be located in the array?

Implementing using a Chain of Nodes

[Diagram of a chain of nodes with an arrow pointing to the left]

→ Where should the top be located in the chain of nodes?

Complexities
Queue ADT

Concept

Operations

Implementing a Queue using a Chain of Nodes

→ Is one option better than the other?

Option 1: front of queue is at head, rear of queue is at tail

```
    ┌─┐
    │ │
    └─┘
```

Option 2: front of queue is at tail, rear of queue is at head

```
    ┌─┐
    │ │
    └─┘
```
Implementing a Queue ADT using an Array

Assume a shadow array is used so that expand is $O(1)$.

**Option 1:** front of queue is at ________________, rear of queue is at ________________

```
  ______
 |     |
 |     |
 |     |
```

**Option 2:** front of queue is at ________________, rear of queue is at ________________

```
  ______
 |     |
 |     |
 |     |
```

**Option 3:** front of queue is at ________________, rear of queue is at ________________

```
  ______
 |     |
 |     |
 |     |
```