

# CSSE 220 Day 28

Data-structure-palooza

**Checkout DataStructures from SVN**

# Questions

# Data Structures

- » Understanding the engineering trade-offs when storing data

# Abstract Data Types

- ▶ Boil down data types (e.g., lists) to their essential operations
  - ▶ Choosing a data structure for a project then becomes:
    - Identify the operations needed
    - Identify the abstract data type that most efficiently supports those operations
  - ▶ Goal: that you understand several basic abstract data types and when to use them
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# Common ADTs

- ▶ Array List
- ▶ Linked List
- ▶ Stack
- ▶ Queue
- ▶ Set
- ▶ Map

Implementations for all of these are provided by the **Java Collections Framework** in the **java.util** package.

# Array Lists and Linked Lists

Operations Provided	Array List Efficiency	Linked List Efficiency
Random access	$O(1)$	$O(n)$
Add/remove item	$O(n)$	$O(1)$

# Stacks

- ▶ A last-in, first-out (LIFO) data structure
- ▶ Real-world stacks
  - Plate dispensers in the cafeteria
  - Pancakes!
- ▶ Some uses:
  - Tracking paths through a maze
  - Providing “unlimited undo” in an application

Operations Provided	Efficiency
Push item	$O(1)$
Pop item	$O(1)$

Implemented by  
**Stack**, **LinkedList**,  
and **ArrayDeque** in  
Java

# Queues

- ▶ A first-in, first-out (FIFO) data structure
- ▶ Real-world queues
  - Waiting line at the BMV
  - Character on Star Trek TNG
- ▶ Some uses:
  - Scheduling access to shared resource (e.g., printer)

Operations Provided	Efficiency
Enqueue item	$O(1)$
Dequeue item	$O(1)$

Implemented by **LinkedList** and **ArrayDeque** in Java

# Sets

- ▶ **Unordered collections without duplicates**
- ▶ Real-world sets
  - Students
  - Collectibles
- ▶ Some uses:
  - Quickly checking if an item is in a collection

Operations	HashSet	TreeSet
Add/remove item	$O(1)$	$O(\lg n)$
Contains?	$O(1)$	$O(\lg n)$

Can hog space

Sorts items!

# Maps

- ▶ Associate **keys** with **values**
- ▶ Real-world “maps”
  - Dictionary
  - Phone book
- ▶ Some uses:
  - Associating student ID with transcript
  - Associating name with high scores

Operations	HashMap	TreeMap
Insert key-value pair	$O(1)$	$O(\lg n)$
Look up value for key	$O(1)$	$O(\lg n)$

Can hog space

Sorts items by key!

# Course Evaluations

- » Your chance to improve instruction, courses, and curricula.

# LodeRunner Work Time