

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

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!

LodeRunner Work Time