

# CSSE 220 Day 28

Data-structure-palooza  
Fixed-length queues

We will continue with the previous session's in-class quiz (Quiz 26).

Checkout DataStructures and FixedLengthQueue projects from SVN

Questions

# Data Structures

- » Understanding the engineering trade-offs when storing data

## Abstract Data Types Recap

- ▶ 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

Q4

## 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

Q5

## 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!

Q6

## 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!

Q7-9

## Fixed-Length Queue

- ▶ `FixedLengthQueue`: a specialized data structure for implementation practice
  - ▶ Problem description is linked from the schedule page (session 28)
  - ▶ Implement FLQ in the next 25 minutes or so
  - ▶ Work with your LodeRunner team, but each person should code and commit it individually
- ▶ If there is time left, work with your team on LodeRunner.

Check out `FixedLengthQueue` project

LodeRunner Work Time