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

Q1

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)

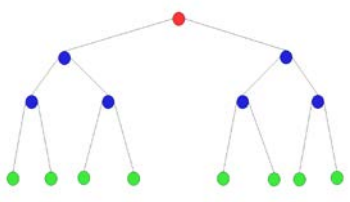
Operations Provided	Efficiency
Add (enqueue, offer) item	O(1)
Remove (dequeue, poll) item	O(1)

Implemented by *LinkedList* and *ArrayDeque* in Java

Q2

When using a set or map, you choose the implementation:

- Use if you need the items to be **sorted**
- Log(n) height of tree



Binary Tree

- Uses “hash code”
- O(1) to lookup, add or remove

Hash Table

Sets

- Collections **without duplicates**
- Real-world sets
  - Students
  - Collectibles
- Some uses:
  - Quickly checking if an item is in a collection
- Sorted? Depends on implementation!

Operations	HashSet	TreeSet
Add/remove item	O(1)	O(log n)
Contains?	O(1)	O(log n)

Can hog space

Sorts items!

Q3

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)

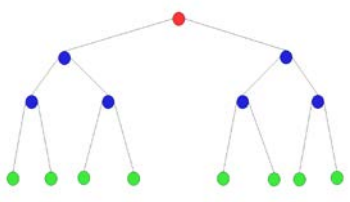
Can hog space

Sorts items by key!

Q4

When using a set or map, you choose the implementation:

- Use if you need the items to be **sorted**
- Log(n) height of tree



Binary Tree

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Hash Table

Course Evaluations

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

LodeRunner Work Time

Q5 – 6