

EE 205: Lecture 1, Introduction

Data Structure and Algorithms
for Electrical Engineering

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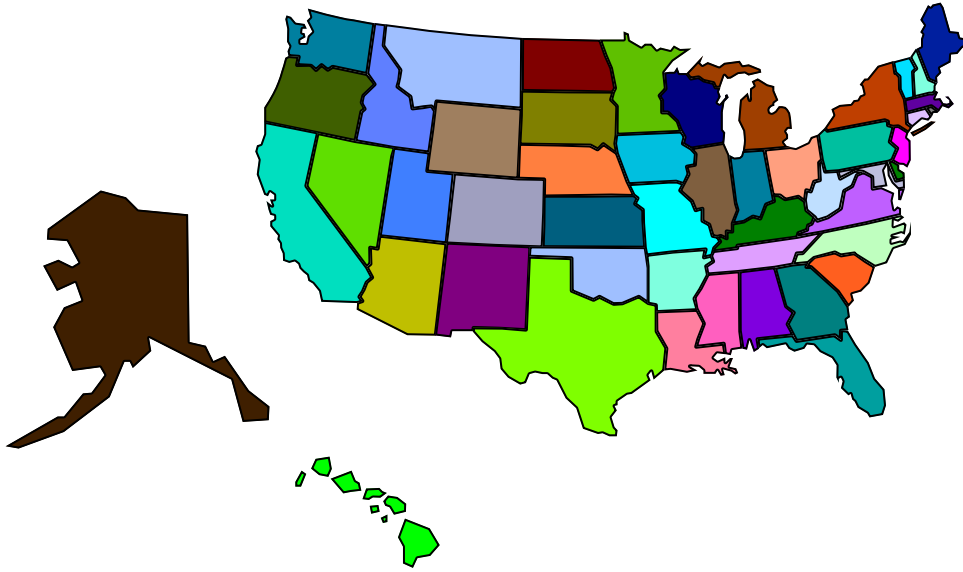
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Data Structures

Definitions

- Ways to organize and store data
 - ✓ Data Storages
- Ways to access and manipulate the stored data.
 - ✓ Methods to access storages

Example (adjacent states)



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Problem

- Definition: *adjacency*: if two states share a boundary, the two states are *adjacent*.
- Given a state X , print a state Z that is not adjacent to X , but is adjacent to a state Y adjacent to X .
 - ✓ for example,
 - ◆ Input: North Carolina
 - ◆ Output: Florida

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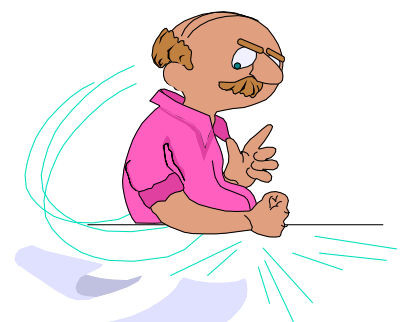
Come up with Data Structures

- Suppose you have only the following information
 - ✓ for each state x , the list of states that are adjacent to state x .
 - ✓ for example,
 - ◆ North Carolina : Georgia, south Carolina, Virginia, Tennessee.
- How are you going to store this adjacency information to solve the problem efficiently?

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Lessons

- Different data structures lead to different ways to solve a given problem. (algorithms).
- Different algorithms may give different efficiency (space and time).



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Course outline

- First Topic: How to measure the efficiency of an algorithm.
 - ✓ Each data structure has a different use and application. So we will also study....
 - ◆ Applications (problems), algorithms.
 - ◆ Their efficiency.

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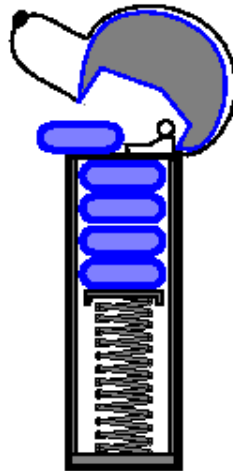
Course outline

- Data Structures
 - ✓ Arrays
 - ✓ Stacks, Queues
 - ✓ List
 - ✓ Priority queues
 - ✓ Search Trees
 - ✓ Graphs
 - ✓ etc ...

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Stack

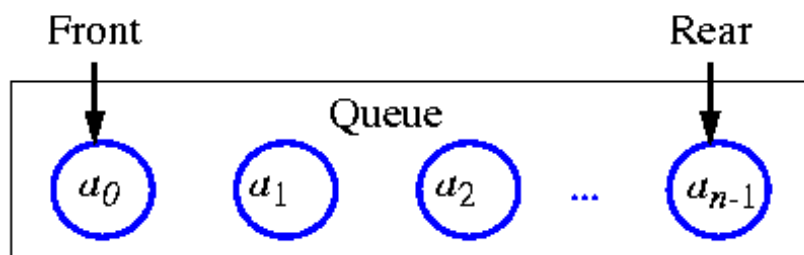
- A container of objects that are inserted and removed according to the last-in-first-out (LIFO) principle.
- Only the last (the most recently inserted) object can be removed.



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Queue

- Differs from a stack in that its insertion and removal follows the first-in-first-out (FIFO) principle.
- The element which has been in the queue the longest may be removed.



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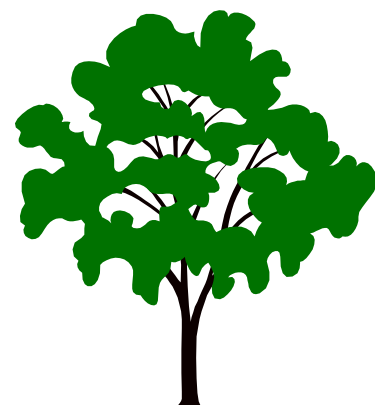
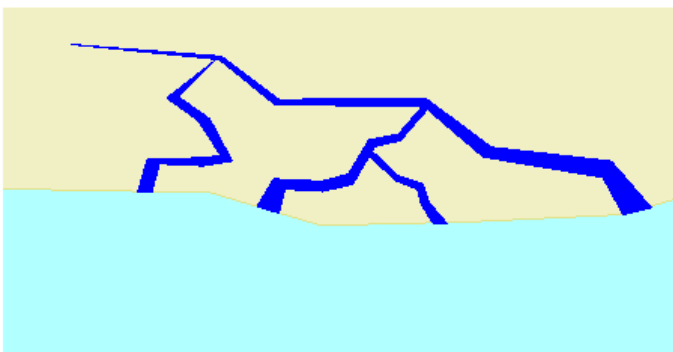
List

- A collection of linearly arranged element (a linear order).
- Provides methods for accessing, inserting, and removing arbitrary elements.
- Notion of position, before and after.
 - Stacks and queues are a restricted form of a sequence.
 - Example,
 - ✓ A,B,C,D,E,F
 - ✓ a₁, a₂, a₃,...

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Tree

- A collection of objects arranged in a hierarchical fashion.
- E.g., organization of a corporation, a table of content, dos/unix file systems, family tree.
- Notion of parents and children, root and leaves.



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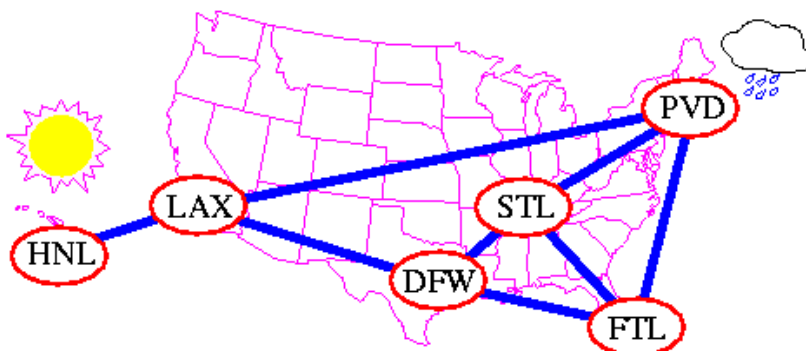
Priority queue

- An abstract type for storing a collection of prioritized elements that supports arbitrary element insertion but support removal of elements only in order of priority.
- Examples.....

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Graphs

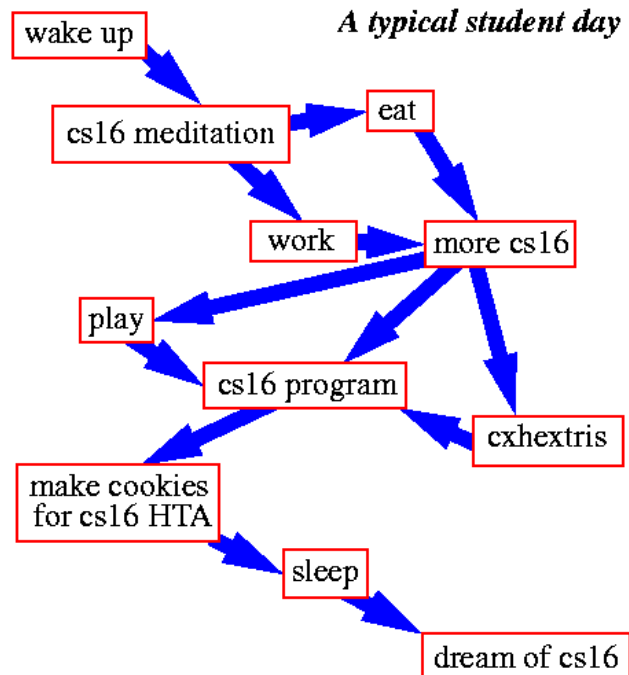
- Representing a way of connections or relationships between pairs of objects.



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Graphs

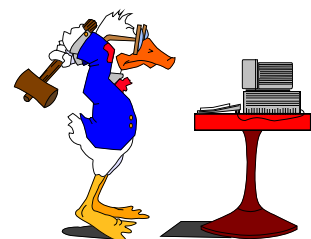
- Not only physical connectivity, but also logical relationship.



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Algorithms and Applications

- Every computer software uses some collections of data structures.
- We will study **algorithms** to efficiently solve problems using various data structures.
- **Proof techniques** for correctness or efficiency.



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Questions?