

# CSE 201: Data Structures and Algorithms

Lecture 1: Introduction  
Dr. Vidhya Balasubramanian

# Course Overview

- CSE 201: Data Structures
  - Tuesday 2<sup>nd</sup> hour
  - Wednesday 2<sup>nd</sup> hour
  - Thursday 3<sup>rd</sup> hour
  - Friday 5<sup>th</sup> hour
- CSE 281: Data Structures and Algorithms Lab
  - Tuesday – 5,6
- Office Hours:
  - Tuesday – 4-5 pm
  - Friday – 4-5 pm
- Course Website: <https://sites.google.com/site/amritadsaa>
  - Email: **dsdaa.amrita@gmail.com**

# Evaluation Pattern

- Theory
  - Goal: Understand data structures and study the application of data structures in problem solving
  - Midterms – 15+15
  - Tutorials and Assignments : 20
- Lab
  - Implementation and effective use of data structures
  - Periodical labs – 20+20
  - End Semester Lab – 20
  - Continuous Assessment – 40

# Plagiarism/Copying Policy

- Kindly do your own work, it is in your best interest
- Lab exams and theory exams test your understanding of the subject
  - Performance is usually poor if you don't do your own work
- Plagiarism/Copying is strictly forbidden in this course
  - Assignments must be original
  - Lab code must be original
- For every assignment/lab that is copied there will be negative grading.

# Course Outline

- Introduction to Data Structures
- Introduction to Abstract Data Types
- Linear Data Structures
  - Stacks and Recursion
  - Queues
  - Lists
  - Vectors and Iterators
- Non-linear Data Structures
  - Trees, Graphs
- Dictionaries and Hashing

# Text Books and References

- Michael T Goodrich and Roberto Tamassia and Michael H Goldwasser, “Data Structures and Algorithms in Java”, Fifth edition, John Wiley publication, 2010.
- Clifford A. Shaffer, “Data Structures and Algorithm Analysis”, Third Edition, Dover Publications, 2012.
- Goodrich M T, Tamassia R and Michael H. Goldwasser, “Data Structures and Algorithms in Python++”, Wiley publication, 2013.
- Jean –Paul, Tremblay and Paul G. Sorenson, An Introduction to Data Structures with Applications, Tata McGraw-Hill, Second Edition, 2002.

# Lab Outline

- Implementing Data Structures
  - Using Java and its visualization libraries to implement the data structures
- Using Data Structures
  - In Java
  - Usage of in-built libraries in Java
  - Modularity and good programming practices important
- Automated judges like CodeChef for evaluation
  - Evaluated different testcases rather than just whether program works

# Why Data Structures!!!



Huge volumes of data in different formats, need to be organized!!!

# Organization of data



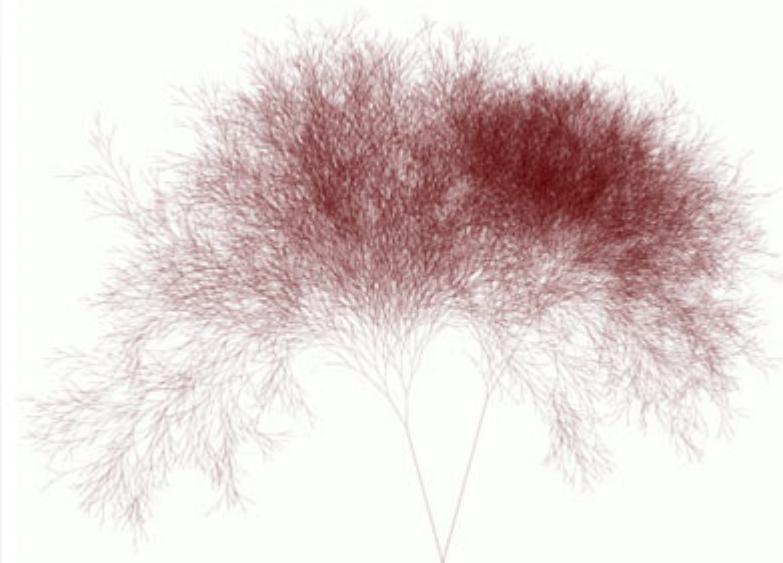
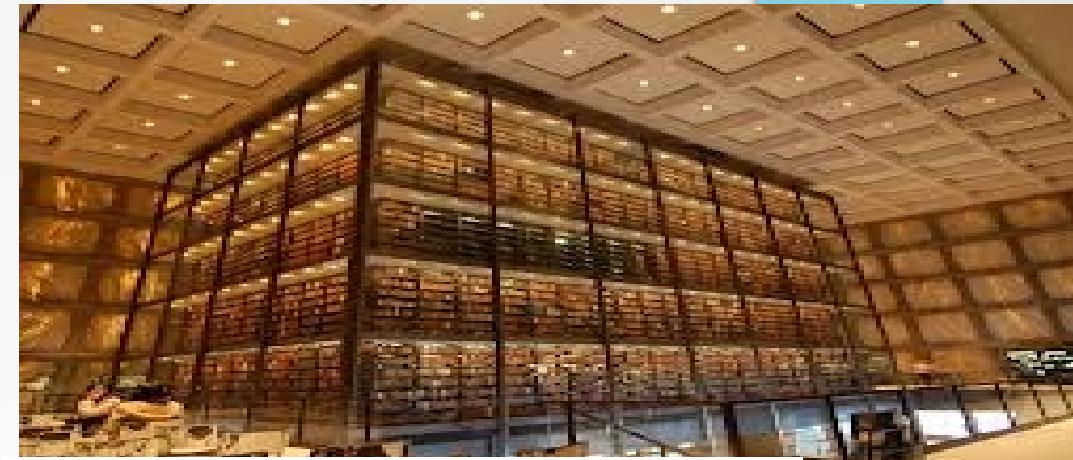
B-Trees  
Arrays  
Dictionaries

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# Effective Searching and Retrieval

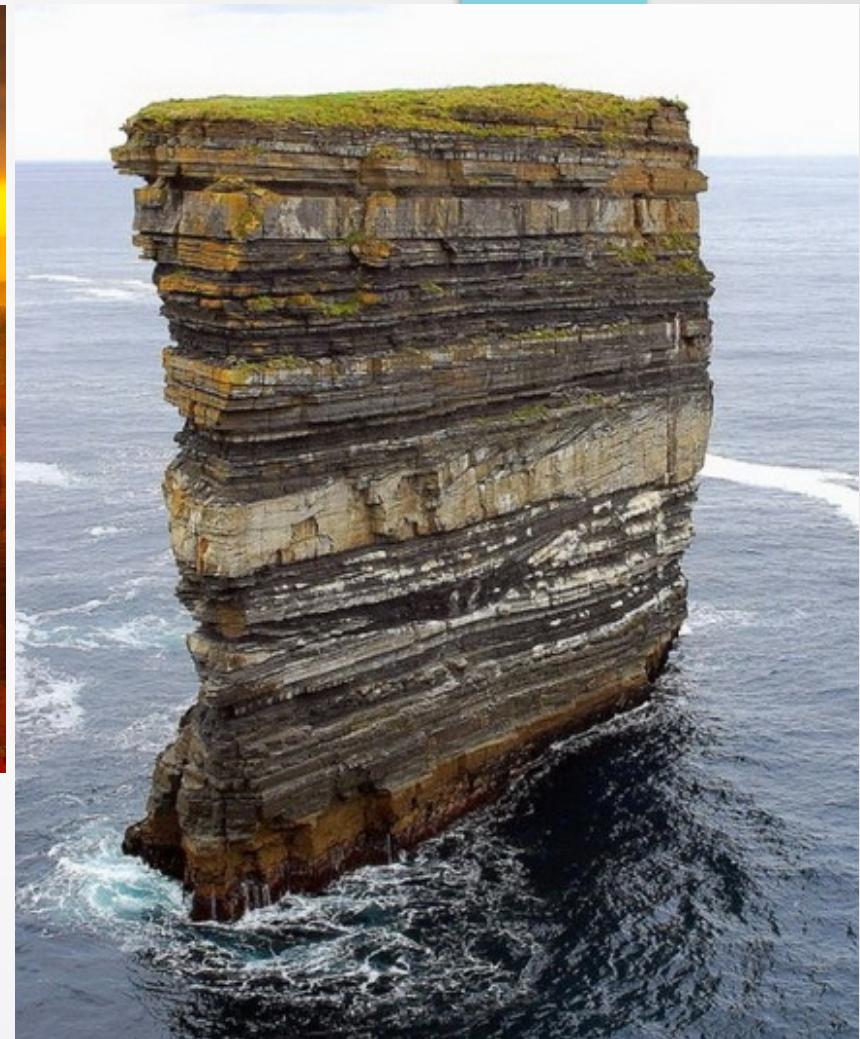


Binary-tree visualization of the Yahoo search engine bot crawling an experimental website

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# Effectiveness in Modeling

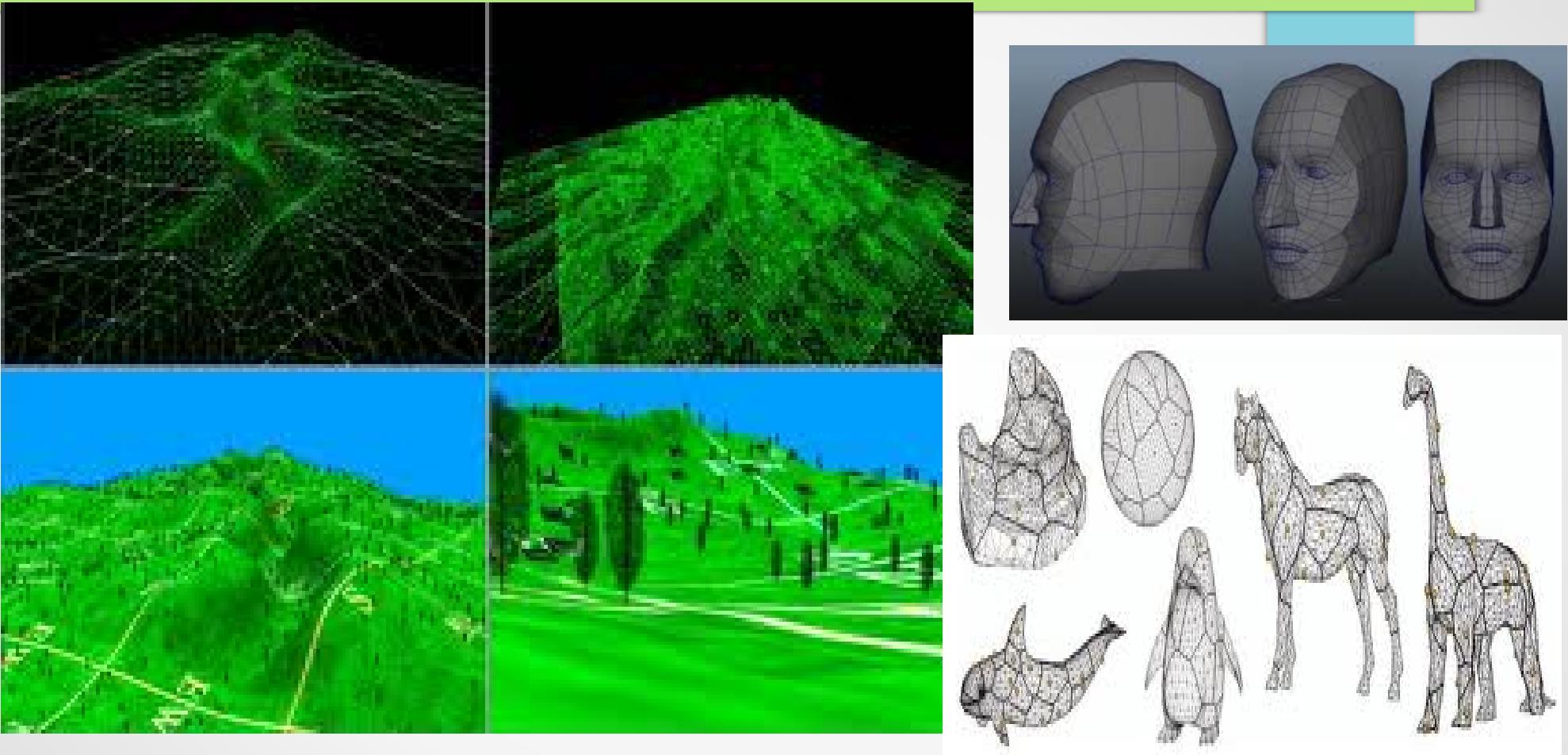


# Modeling Processes



Fractal

# Modeling Data



# Efficiency



# Efficiency



# Efficiency



# Efficiency

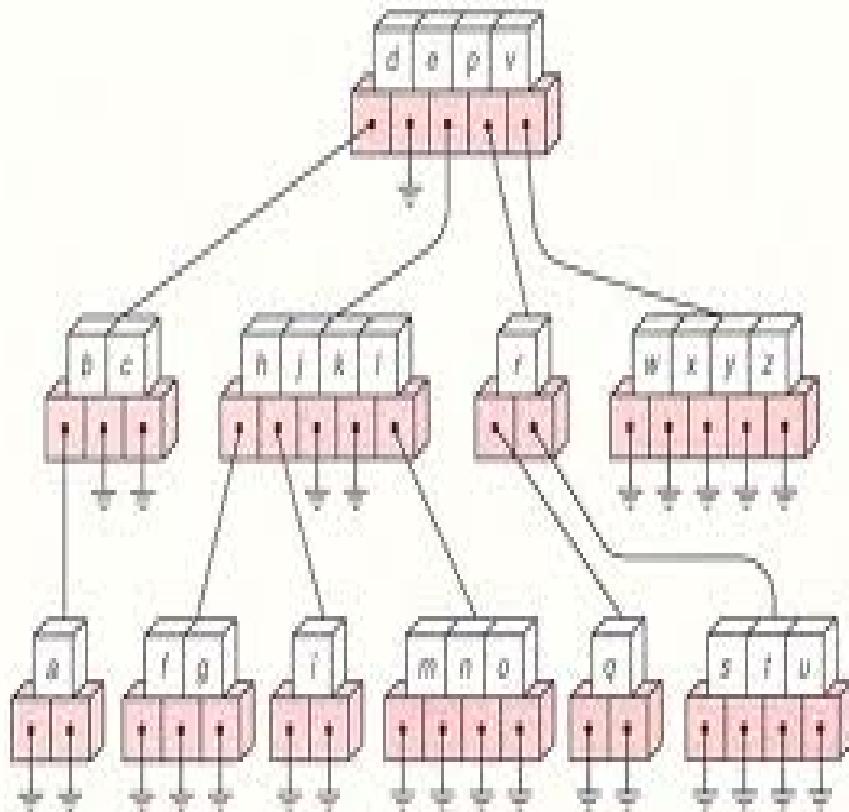
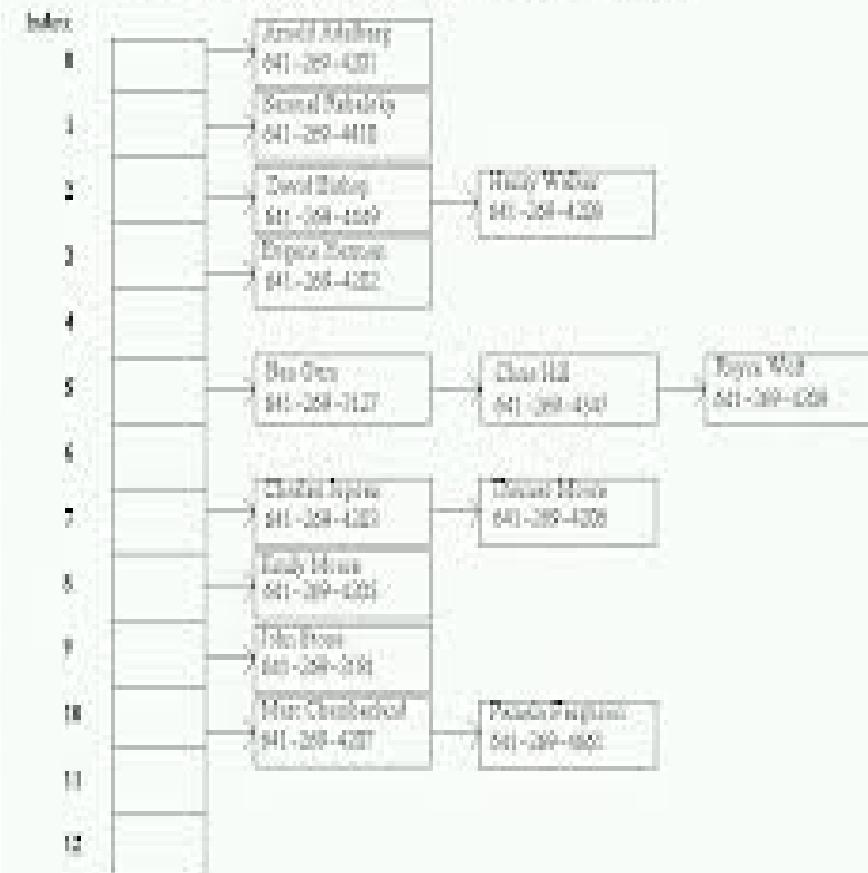
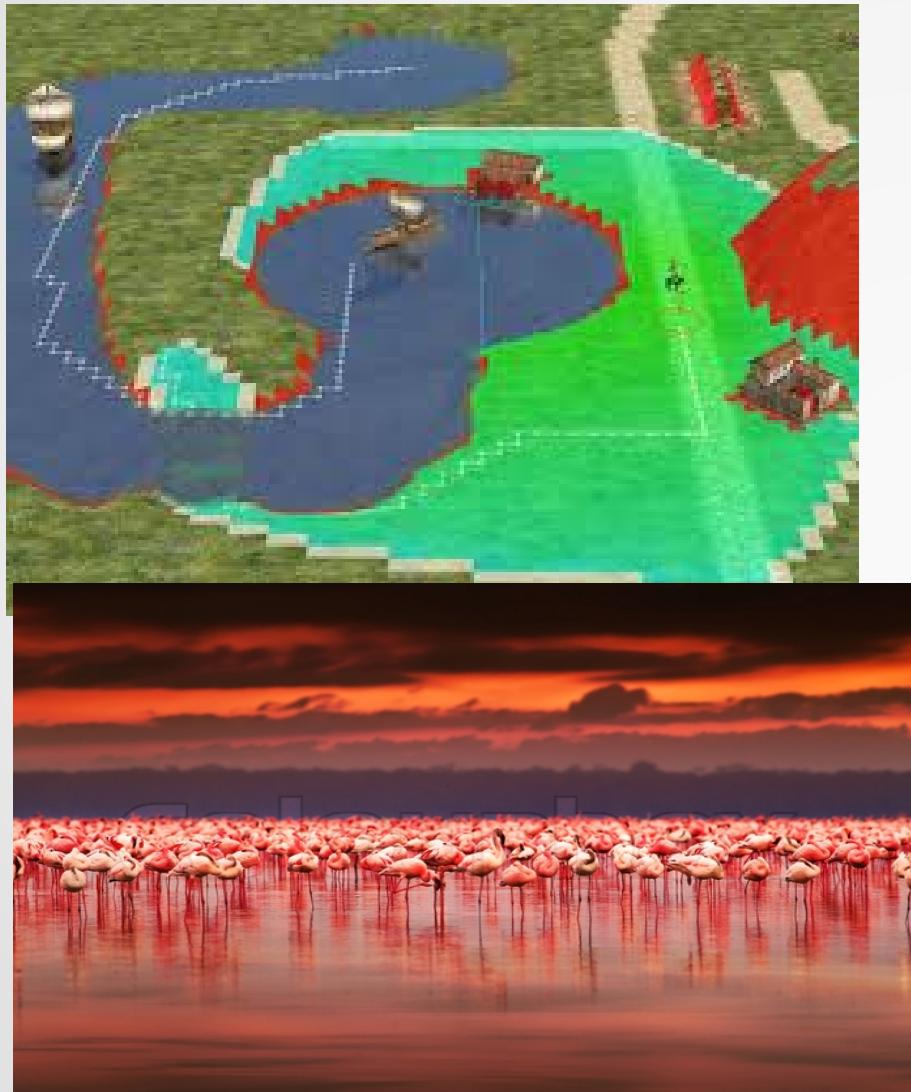


Figure 11.8. A 5-way search tree (not a B-tree)

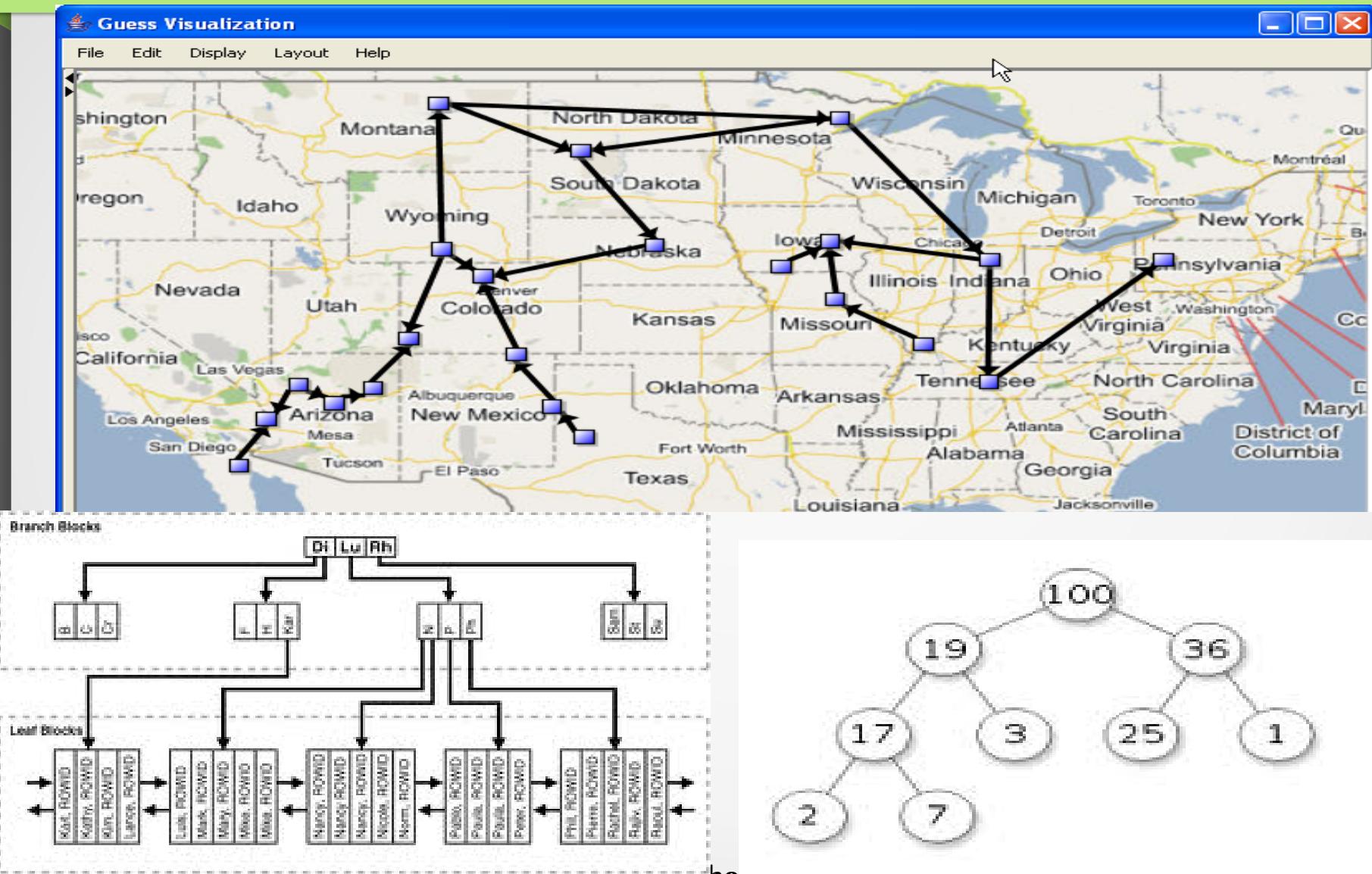
Storage of Names and Numbers in a Hash Table



# Other functionalities



# Examples



# Philosophy of Data Structures

- Applications getting more complex
  - Need for more efficiency
- What is a Data Structure?
  - is any data representation and its associated operations
  - Used for organizing or structuring a collection of data items
- Need
  - Chosen data structure impacts the running time of program

# Efficiency

- A solution is efficient if it solves the problem within the specified constraints
  - Available space
  - Time taken
- Choice of Data Structure depends on the following
  - Are all data items inserted into the data structure at the beginning, or are other operations interspersed with insertions ?
  - Can data items be deleted, and how often are they deleted?
    - Does frequent deletion require reorganizing the data structure
  - Are all data items processed in some well-defined order, or is search for specific data items allowed?

# Choice of Data Structure

- Depends on application/modeling requirement
  - Stacks most suitable for recursion
- Space vs time considerations
  - Hash tables are fast but occupy more memory
  - Arrays are not dynamic
- Suitability for disk based access
  - For large volumes of data, the data structure will not fit main memory
  - Is the data structure suitable for disk based storage and access