19CSE 212: Data Structures and Algorithms

Lecture 1: Introduction

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Course Overview

- 19CSE 212: Data Structures and Algorithms
  - Tuesday 4th hour (12 to 12.50)
  - Wednesday 1st hour (8.50 to 9.40)
  - Friday 2nd hour (9.50 to 10.40)
  - Lab : Friday – 5,6 (2.00 to 3.50)
- Discussion Hour:
  - Friday – 4-5 pm
- Course Materials: Teams
  - Email: dsdaa.amrita@gmail.com

Course Outcomes

- CO1: Understand the concept and functionalities of Data Structures and be able to implement them efficiently
- CO2: Identify and apply appropriate data structures and their libraries to solve problems and improve their efficiency
- CO3: Analyze the complexity of data structures and associated algorithms
- CO4: Analyze the impact of various implementation and design choices on the data structure performance
- CO5: Conceptualize and build data structures based on application needs

Evaluation Pattern

- Internals - 65
  - Periodicals - 20
  - Quizzes – 10
  - Class participation – 5
  - Lab Evaluations – 15
  - Lab Exams - 15
- End Semester - 35
  - Online Exam : 15
  - Viva : 20
    - Part of the viva will be based on a case study

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 Goldwsasser, “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, Python and or C++ and libraries to implement the data structures
- Using Data Structures
  - In Java, Python, C++
  - Usage of in-built libraries
  - Modularity and good programming practices important
- HPOJ for evaluation
  - Evaluated different testcases rather than just whether program works

Why Data Structures!!!

Searching??????

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

Organization of data

B-Trees
Arrays
Dictionaries

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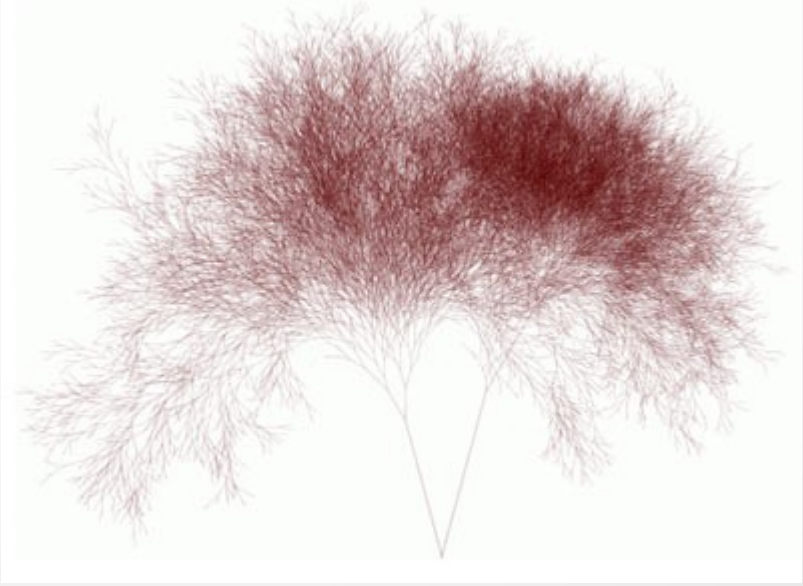
Effective Searching and Retrieval



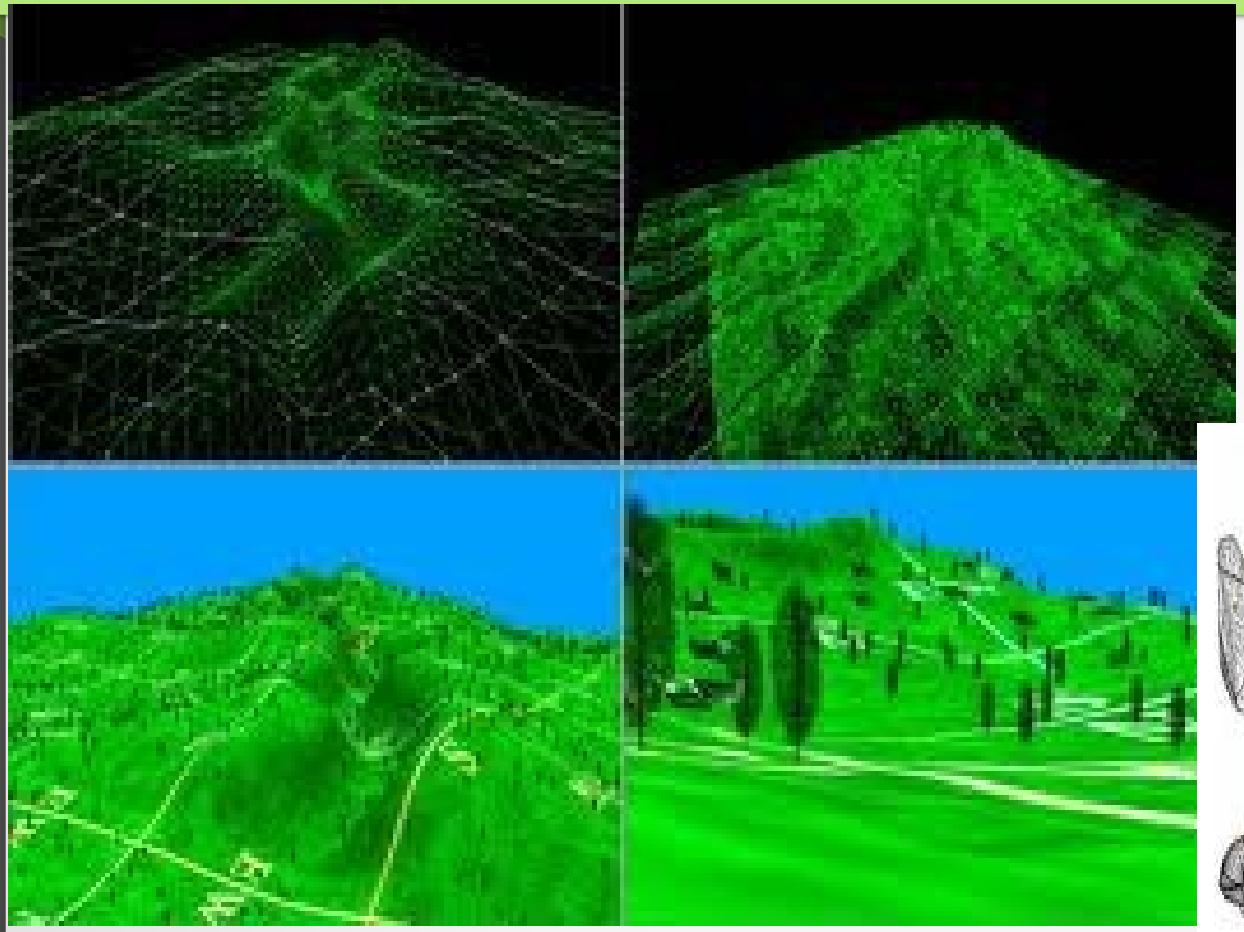
Binary-tree visualization of the Yahoo search engine bot crawling an experimental website

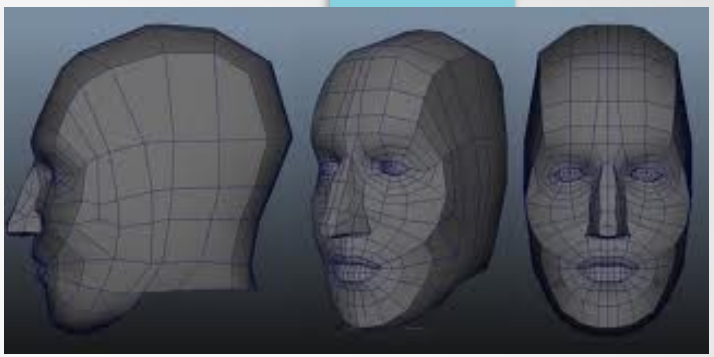
Effectiveness in Modeling

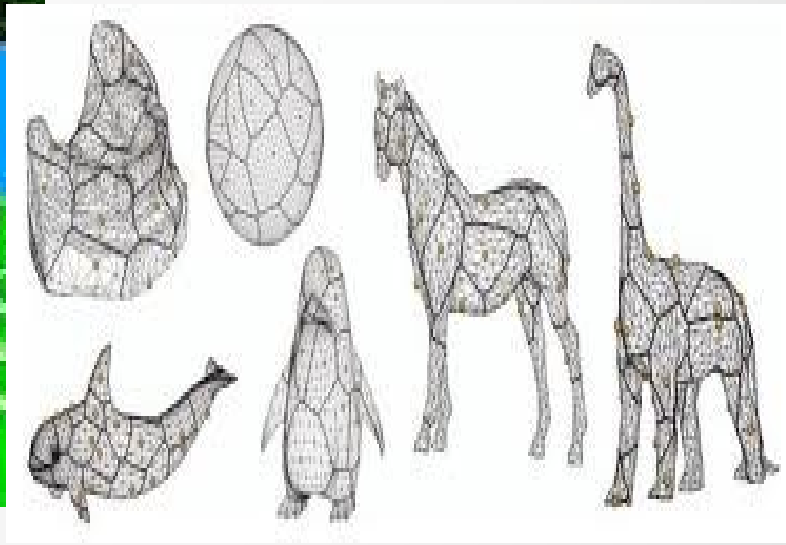
Modeling Processes

Fractal

Modeling Data







Efficiency

Efficiency

Efficiency

Efficiency

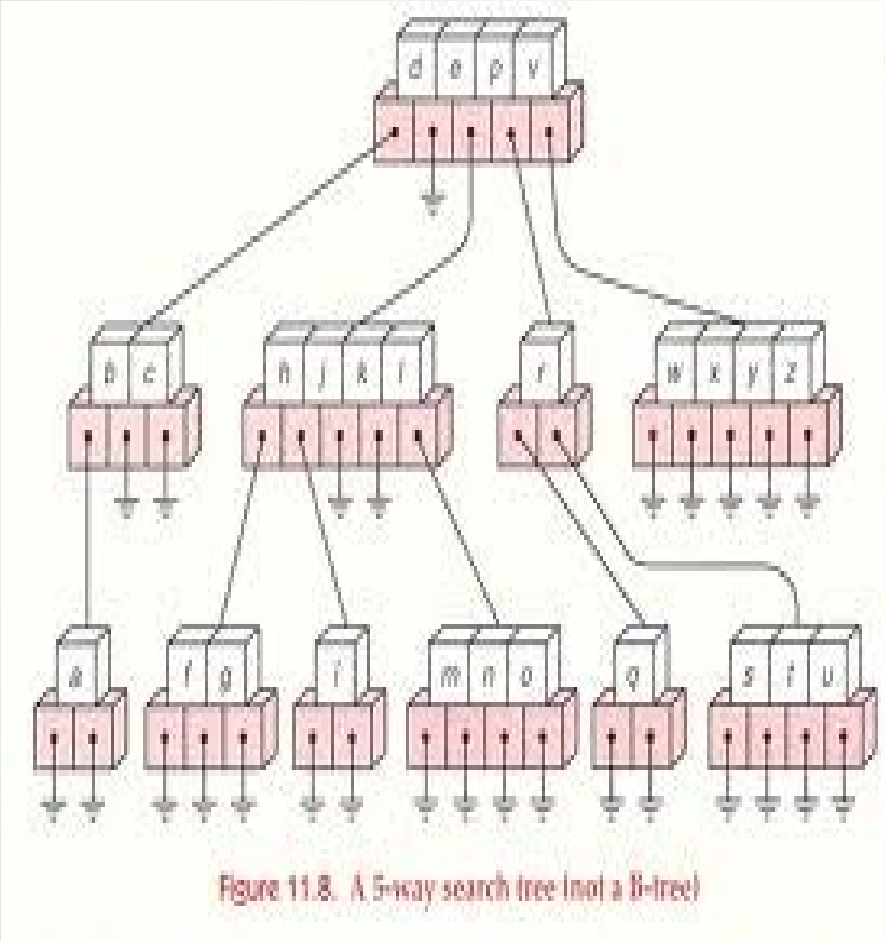
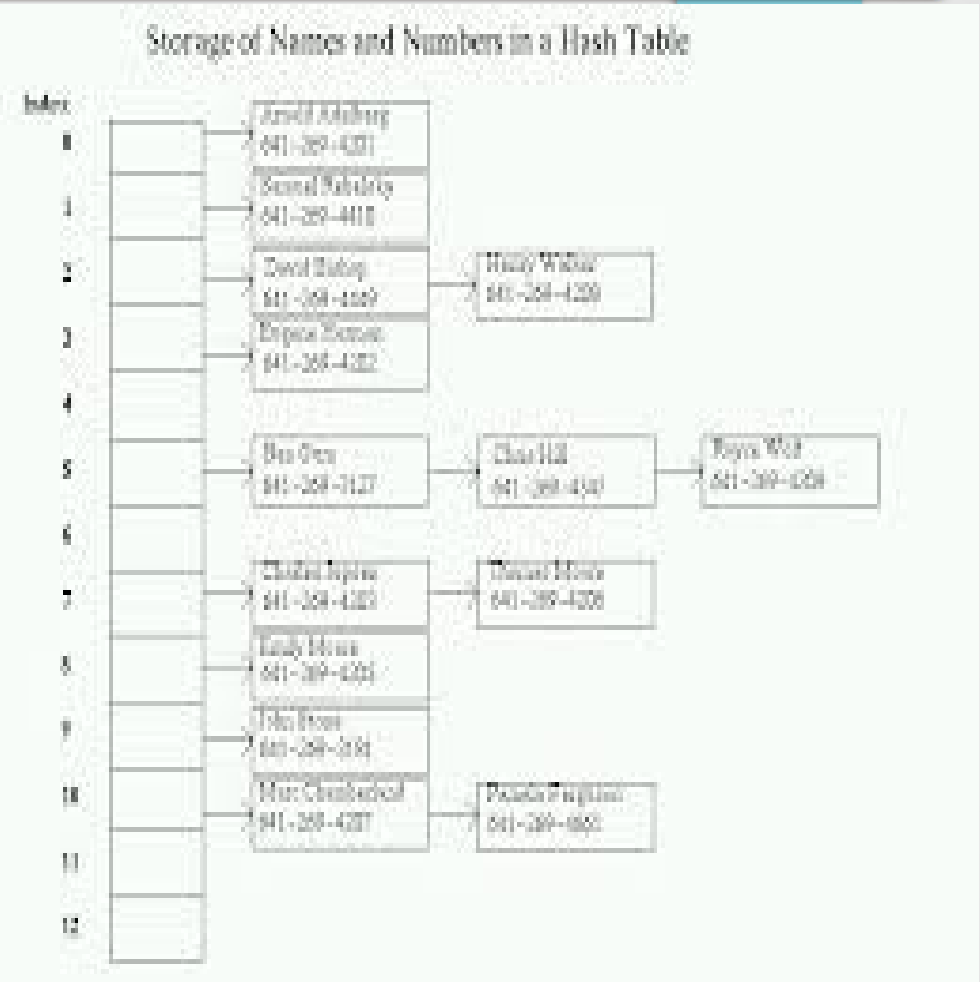
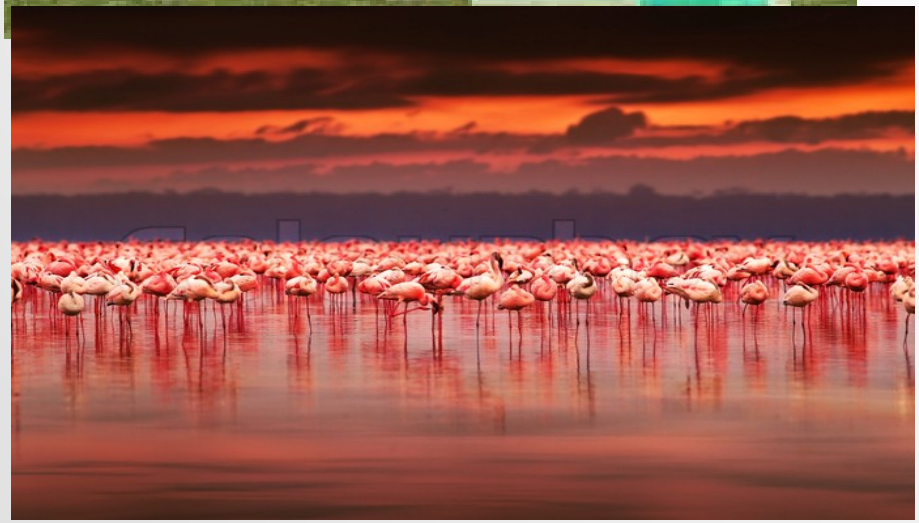


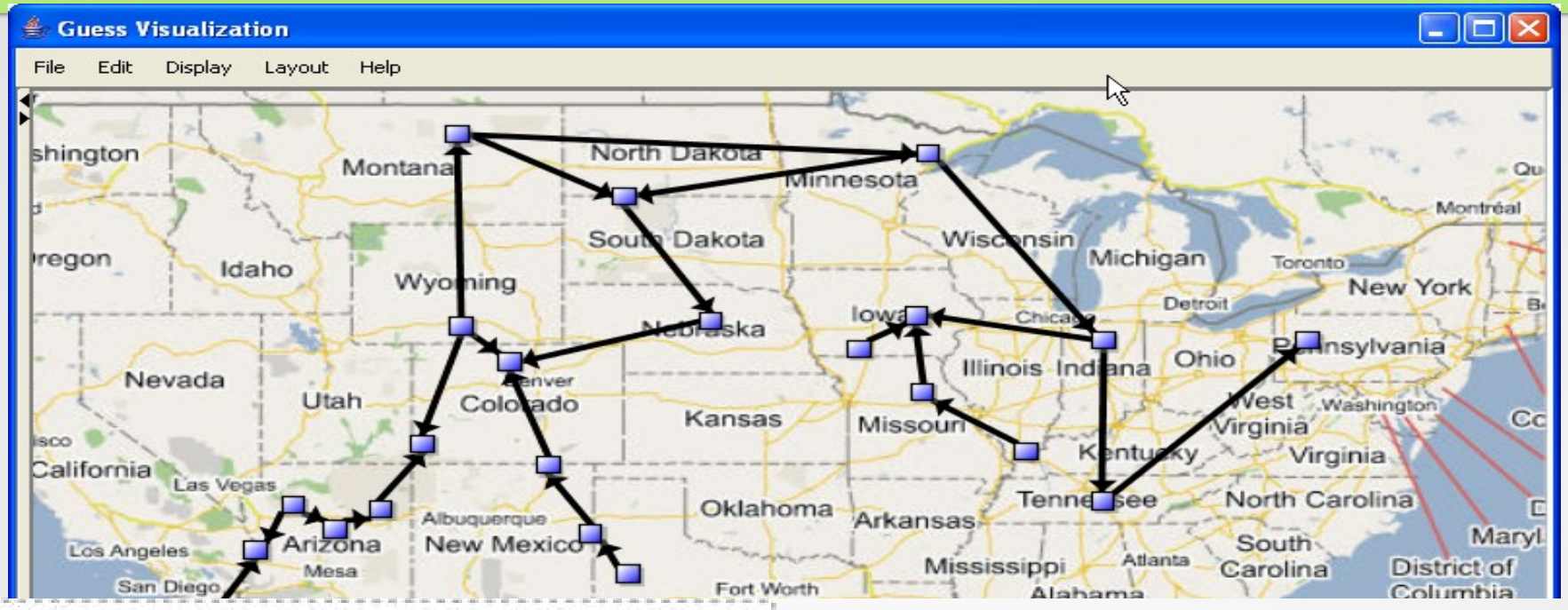
Figure 11.8. A 5-way search tree (not a B-tree)



Other functionalities



Examples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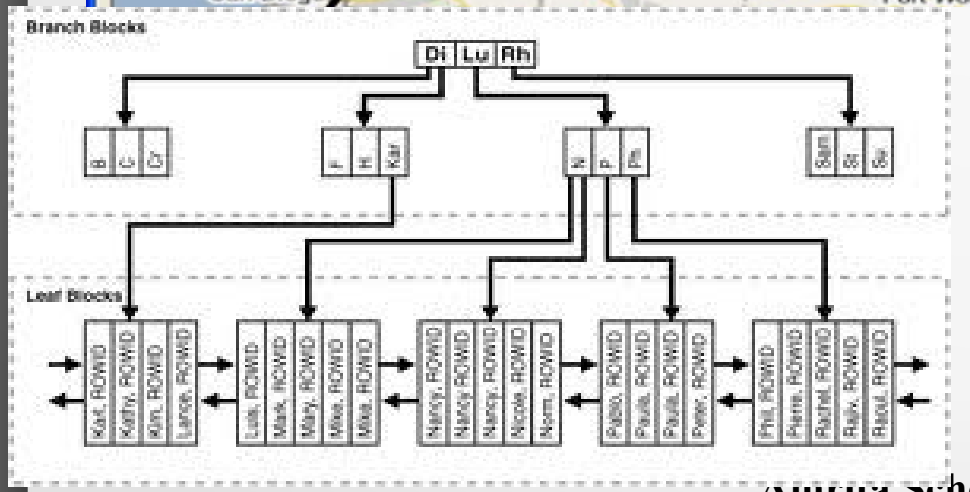
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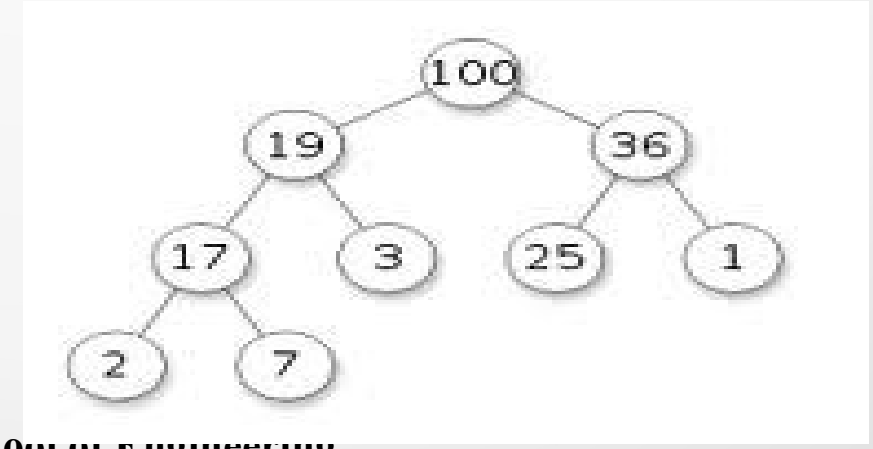
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Philosophy of Data Structures

- 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