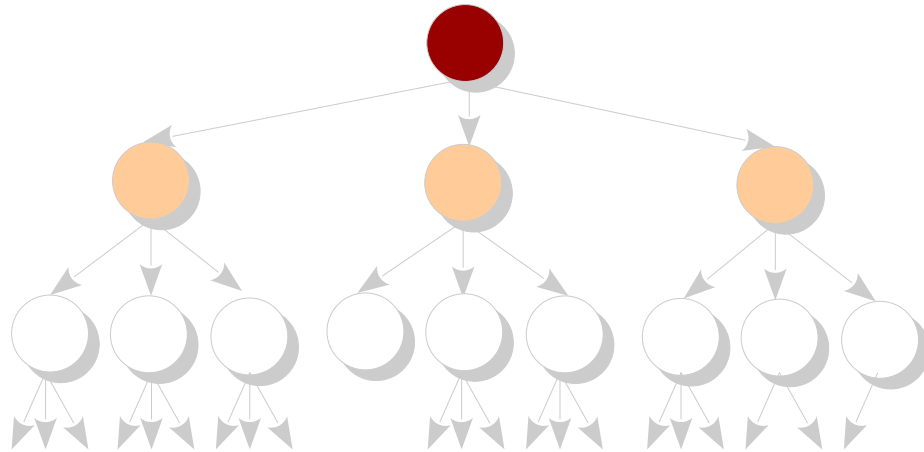


AM5801: Computational Lab



B. S. V. Prasad Patnaik, Rupesh Nasre.

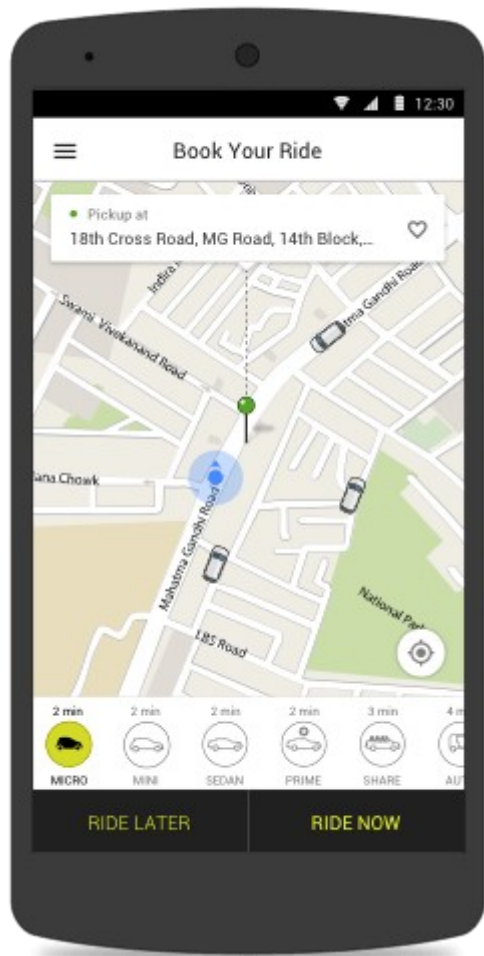
Course webpage: ~rupesh/teaching/clab/jul22

July 2022

Placement in Computer Science

- Coding
- Proofs, Counting
- Computation Theory
- Overview of Digital World
- Hardware
- **Efficient Implementation**
- **Algorithms**
- Ways of Programming
- Translation (Programmer and Machine)
- Resource Management (User and Machine)
- Software Engineering

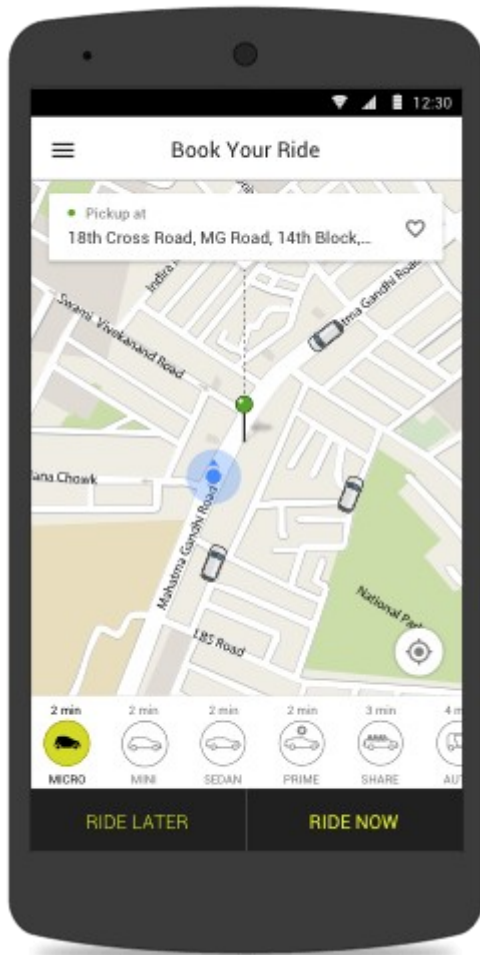
Relevance, with an example



- DM: How many ways can you go from IIT to Central?
- LMC: Can you compute *blah* using a smartphone?
- CO/CA: How to build a smartphone hardware?
- **PDS: How to keep track of cabs such that a passenger can query the nearest cabs efficiently?**
- **Algo: How to compute the shortest path from IITM to Central?**
- OS: How to give a higher priority to an incoming call?
- Compilers: Translating an app or OS to machine code
- Networks: How does a phone call work?
- DBMS: How to store and retrieve world-map data relevant to the user?

Do not decouple these subjects (especially Algorithms and Data Structures). They go hand-in-hand.

More Examples



- How to keep track of cabs such that a passenger can query the nearest cabs efficiently?
- How should I store addresses such that I can show suggestions as user types a destination address?
- How should I categorize cabs such that the passenger is able to view Micro, Mini, Prime, Sharing options quickly?
- I should be able to identify quickly if there are multiple sharers nearby.
- How to find a route that is the shortest / fastest / with fewest traffic signals?
- How should I store previous rides such that I am able to find an approximate cost for this journey prior to booking?

Algorithms and Data structures get more important when there is more data,
... and more types of data.

Misconceptions

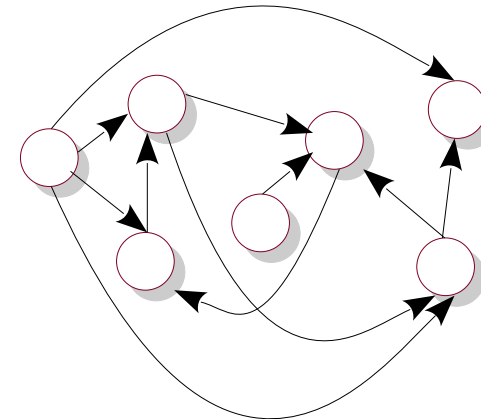
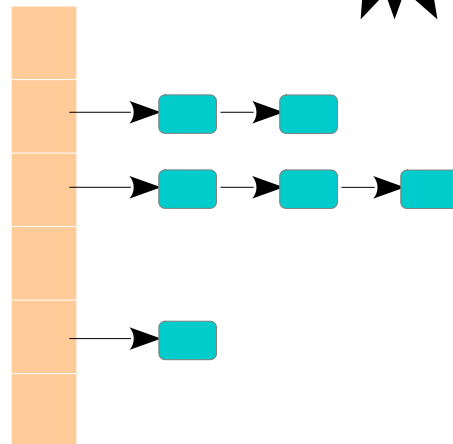
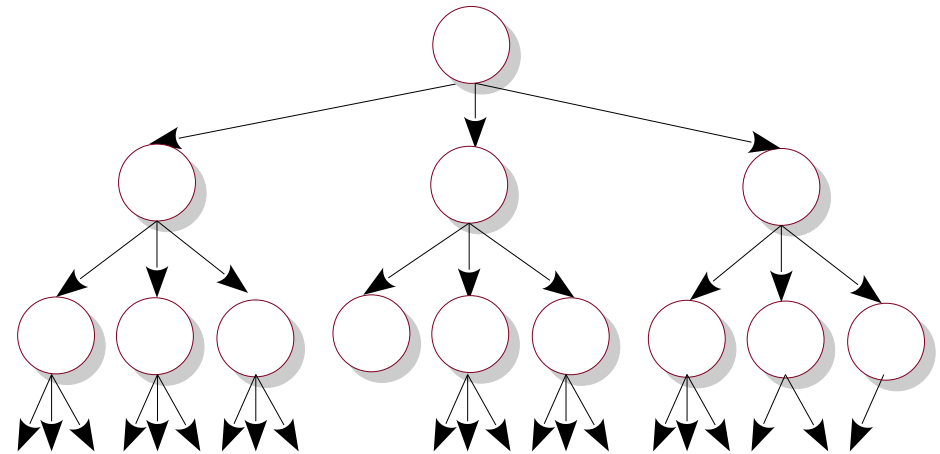
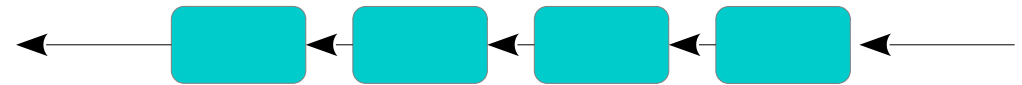
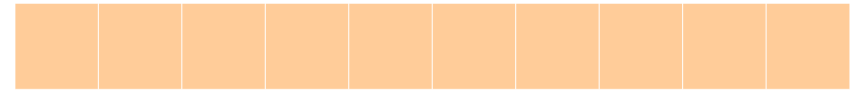
- Data structures get created when we use **struct**.
- Data structures need pointers.
- An algorithm must use a specific data structure.
- C++ has more data structures than C.
- There are in total seven data structures.
- Union-Find is the best data structure.

What is it?

- An **Algorithm** is a precise sequence of steps to solve a problem.
- **Data Structures** is about organizing data such that its storage and retrieval improve the efficiency of the algorithms using it.
- A data structure may be used by multiple algorithms.
- An algorithm may use multiple data structures simultaneously.
- An algorithm may use different data structures and achieve the same computation.

Core and Standard

- Array
- Linked List
 - Stack
 - Queue
- Tree
 - Binary Tree
 - Binary Search Tree
 - Heap
 - ...
- Hash Table
- Graph



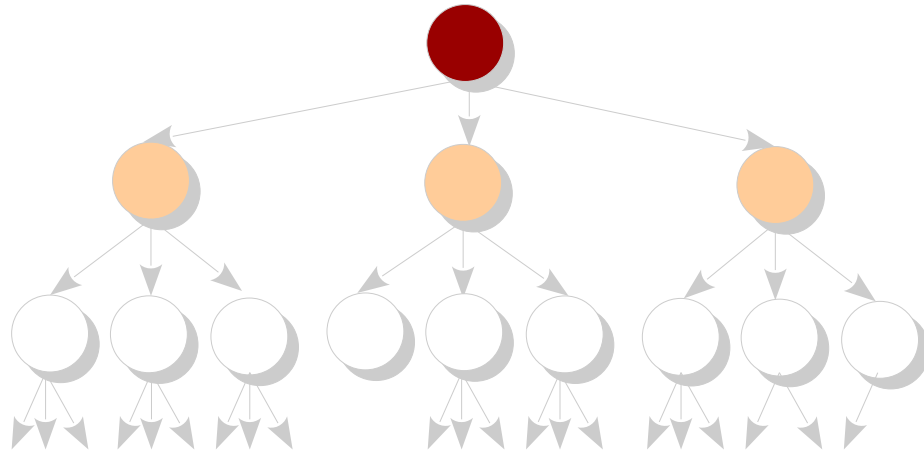
Logistics

- Lectures:
 - [Join here](#) for now. In FMCR in a few weeks.
 - R slot (Wednesday 14:00)
 - Discussions on moodle
- Assignments
 - Problems on [Moodle](#) / Hackerrank
 - Mostly C (a little bit of C++)
 - Plagiarism checker will be used

To get the MOST out of this course

- Keep hands away from mouse, keyboard, and whatsapp.
- Solve questions during classwork.
 - Keep a copy with you. Take notes.
- Ask questions (others also haven't understood).
 - Do not let a few dominate the discussion.

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