

CS 2700 Programming and Data Structures.

Slot C (Mon 10.00am, Tues 9.00am, Wed 8.00am, Fri 12.00pm)

Instructor: Meghana Nasre (meghana@cse.iitm.ac.in)

Some Logistics First..

- Pre-requisites: CS11XX and CS1200 (Discrete Math or equiv)
- Students are expected to credit both CS2700 and CS2710.
- CS2700 Theory : 10 credits (C slot)
- CS2710 Lab : 6 credits (R slot)
- Text Book: Data Structures and Algorithms Analysis – by Mark Weiss.
- **Non-CS student:** B slot course (without lab) best suited.

CS Curriculum (cores)

First Year

- CS1111 (Problem Solving using Computers)
- CS1200 (Discrete Maths)

Second Year

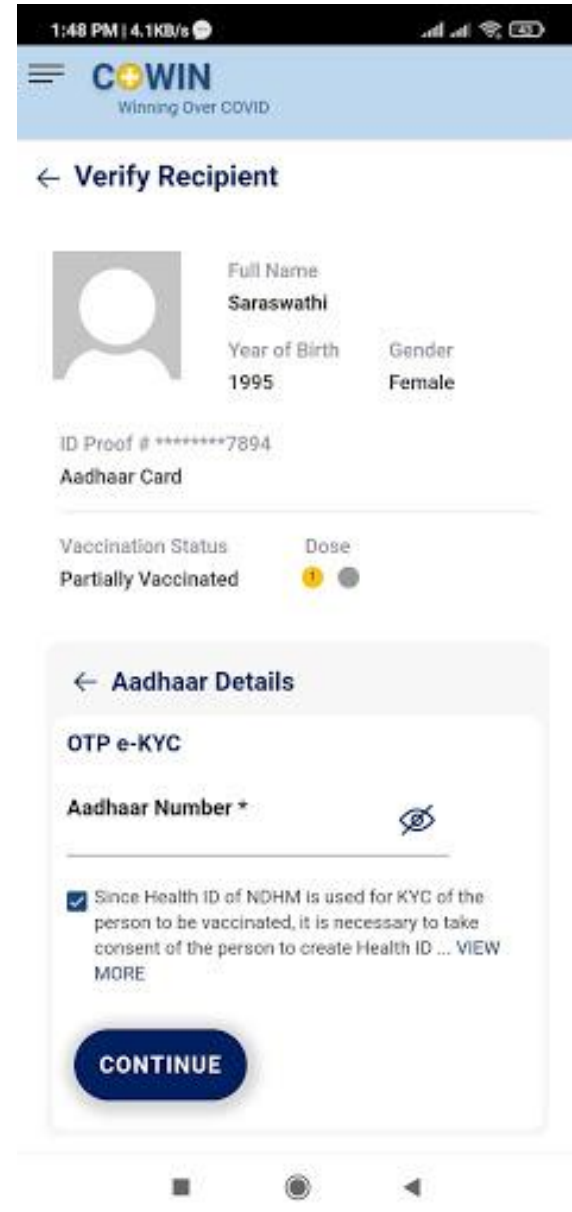
- **CS27X0 (Programming and Data Structures)**
- CS23X0 (Foundations of Computer Systems Design)
- CS2200 (Theory of Computation)
- CS28X0 (Algorithms + OO Concepts)
- CS2600 (Computer Architecture)

Third Year

- CS3100 (Paradigms of Programming)
- CS3300 (Compiler Design)
- CS3500 (Operating Systems)

An application

- **DM** : How many centers are within 5 km radius of my house?
- **ToC** : Can *this* be computed by a smart phone / computer?
- **CO** : Hardware needed to build the smartphone.
- **PDS** : How to store slots during online bookings?
- **Algo** : How to resolve conflicts with multiple requests for same slot?
- **OS** : How to prioritize an incoming phone call?
- **Compilers** : Convert the code into machine understandable code.
- **Networks** : How does phone connect to the network?
- **Databases** : How to store data to answer several queries?



Main takeaway: Do not view these courses in isolation.

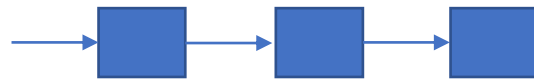
What is the course about?

- **Data structures** is about organizing data such that its storage and retrieval improve the efficiency of the algorithm using it.
- A data structure may be used by multiple algorithms.
- An algorithm may use multiple data structures.

Commonly used DS

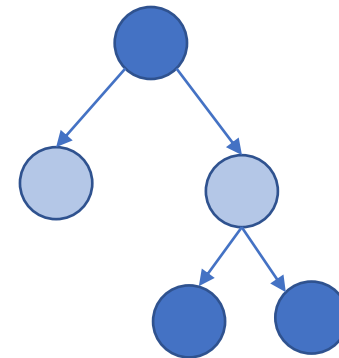


arrays

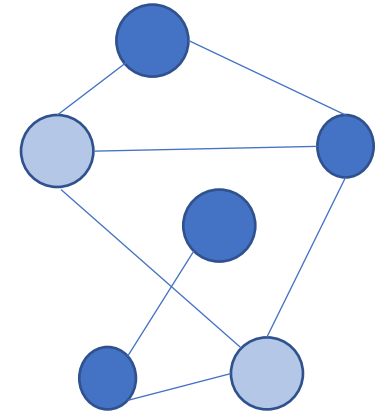


linked list

S
T
A
C
K
&
Q

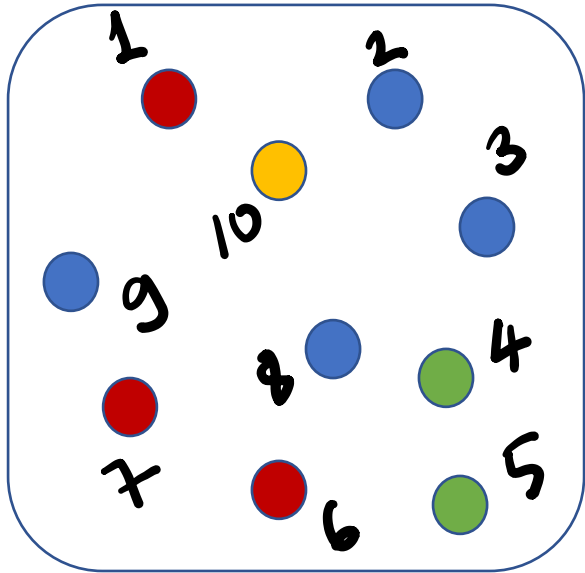


trees



graphs

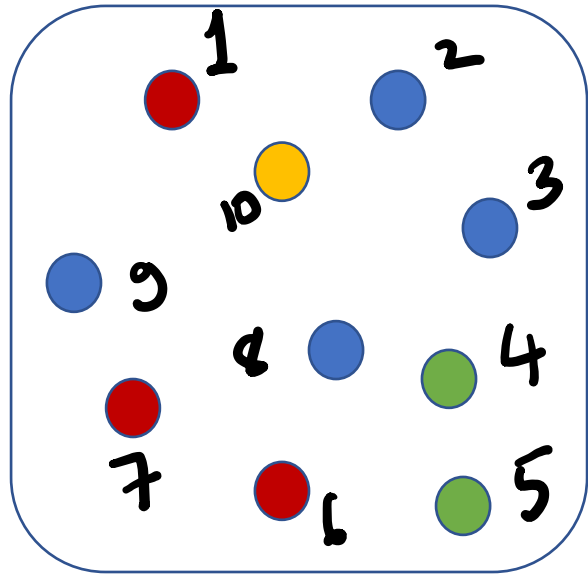
A sample data structures question..



**n people grouped
into k groups.**

- Each person belongs to exactly one group.
- Groups can merge over time – when two people of different groups decide to do that.
- Given two people, are they a part of same group?
- How do you store this information? What operations do you provide?

Lets work out a solution...



n people grouped
into k groups.

APPROACH PROPOSED:

1) MAINTAIN AN ARRAY OF SIZE n

$A[i]$ = group that i belongs to

2) CHECK GROUP $i, j \cong A[i] = A[j]$

3) MERGE GROUP i, j

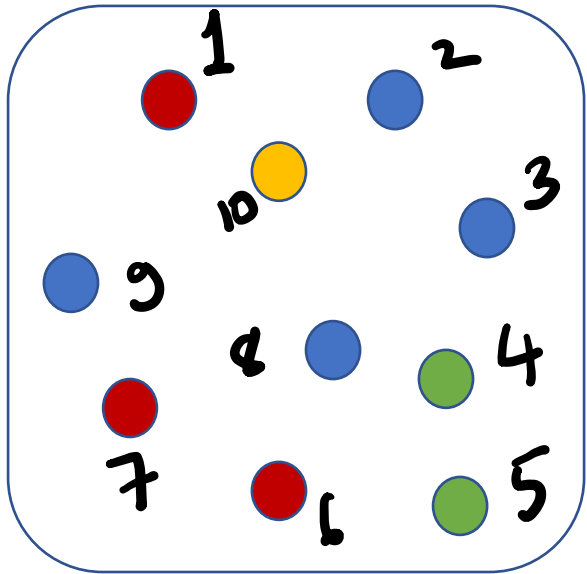
MODIFY ALL ENTRIES IN A

WHICH CONTAIN $A[i]$ to $A[j]$

OR VICE VERSA

NEEDS A LINEAR PASS FOR (3).

Lets work out a solution...



n people grouped
into k groups.

KEY TAKEAWAYS:

- 1) ANALYZE A SOLUTION WITHOUT
CODING IT.
- 2) OPTIMIZE BASED ON
APPLICATION.

Learning Outcomes

- Select the appropriate data structure for the problem to be solved.
 - Different data structures and their “interfaces”
- Design correct programs to solve problems.
 - Test and debug.
 - Testing is necessary, but not sufficient.
 - Argue that the program is correct.
- Design efficient programs to solve problems.
 - Code up a first solution, try out on test instances.
 - Design a better solution, try on larger instances.
 - Design a solution and analyze it **without coding** the same.

Some more logistics..

Quiz 1	25 %	Sept 4 (10.00am)
Quiz 2	25 %	Oct 9 (10.00am)
End Sem	25 %	Nov 21 (10.00am)

Tut1	5%	Aug 13
Tut2	5%	Aug 27
Tut3	5%	Sept 17
Tut4	5%	Oct 1
Tut5	5%	Oct 22
Tut6	5%	Nov 5

The Quizzes and Endsem are NOT on calendar days ([Saturday / Sunday](#))
All Tutorials are on [Fridays](#). Best 5 out of 6. No makeup for tutorials.
If objections, get back latest by [Aug 4](#).

Logistics continued..

- Each student has a Theory TA and a Lab TA assigned.
- Lab TA should have already contacted you. Please respond to him / her.
- Course Homepage: www.cse.iitm.ac.in/~meghana/CS27X0-AN21/
- Each one of you should register on moodle for theory and lab.
- Repeat: All students are expected to take theory and lab both.
- Repeat: Pre-reqs CS11XX and CS1200.

TA Introduction, questions
and discussion