COL106 - Data Structures and Algorithms

Sem II - 2024-25

Happy new year!

Who are we ?

Srikanta Bedathur & Nikhil Balaji

Along with a number of TAs

- TAs will be assigned to batches - the listing will be up by next week on the course website

What is this course?

Introduces to the idea of building programmatic solutions to problems

- Use of **appropriate** data **abstraction** and **data structures**
- **Algorithms** to solve problems – correctness and efficiency
- Converting algorithms to programs, running them as processes, functional testing and debugging

We **do not** plan on teaching you

a) Java language – besides the basics
b) How to use Chat GPT to solve programming problems

Post by Evening_Action217 on r/ChatGPT on reddit

Details of the course

Please look at https://col106iitd.github.io

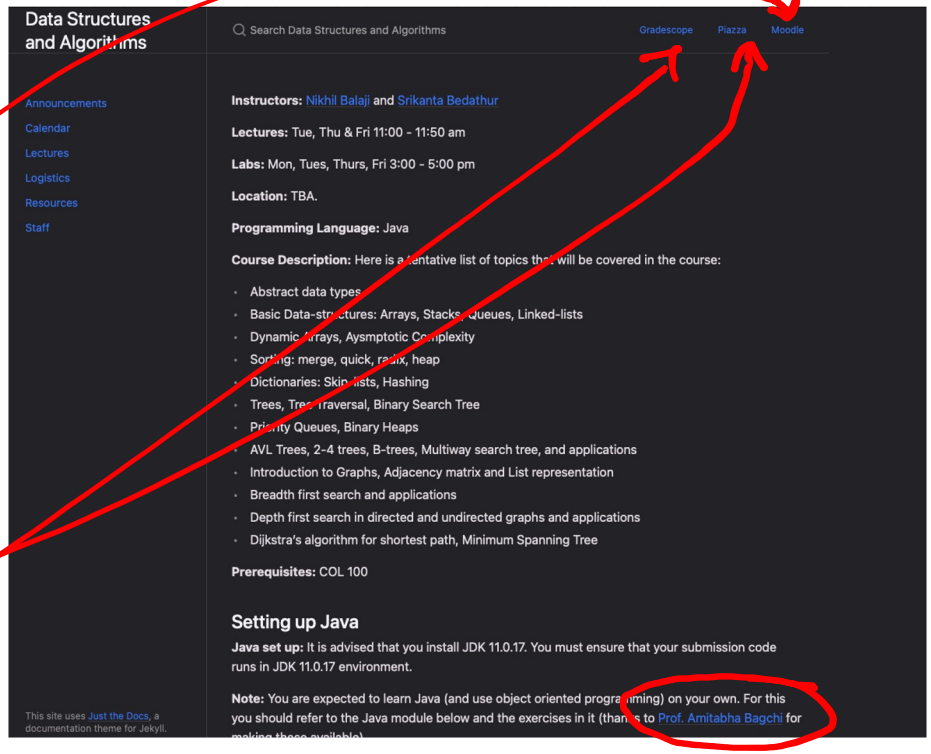
We will use Java language for all programs

- Ensure JDK version > 11

All submissions: moodlenew.iitd.ac.in

All discussions: piazza.com

All evaluations: gradescope.com



Reference textbook: Datastructures and Algorithms in Java (by Goodrich & Tamassia)

Details of the course

Please look at https://col106iitd.github.io

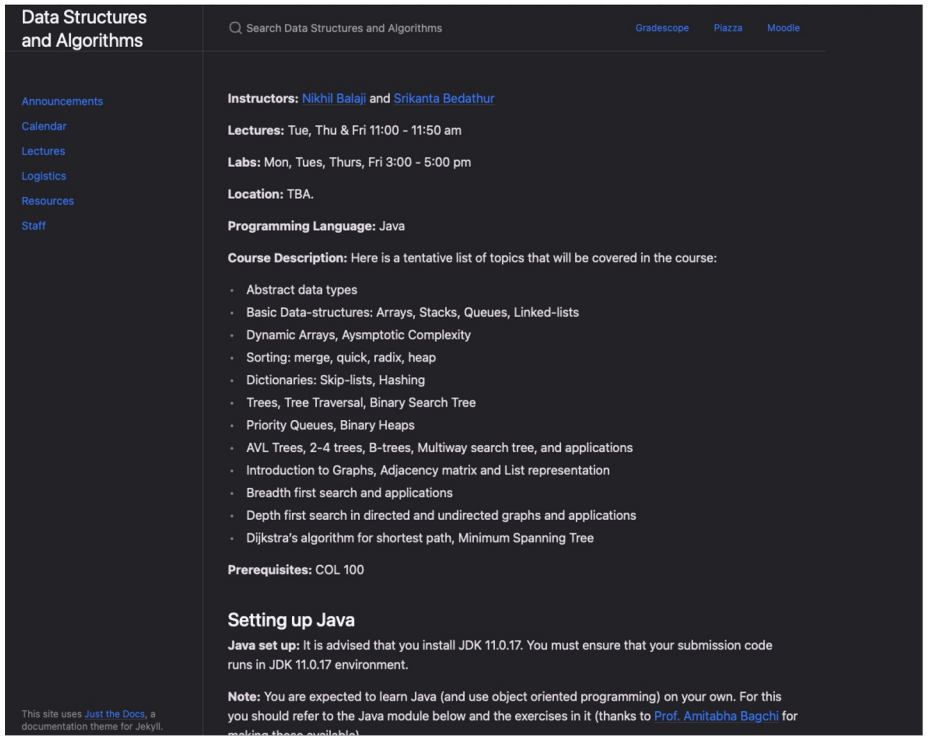
Office hours (instructors)

- By appointment over email

Office hours of TAs will be posted on website

Seek help from TAs for

- Coding issues, understanding of specific questions
- DO NOT CALL THEM or HARASS THEM — contact only through Piazza, during Lab sessions, and during their office hours



Logistics

- Lectures are Tue, Thu, Fri – 11:00-12:00
- Lab sessions require mandatory attendance
- **Attendance based on predefined, immutable seating**
  - Next class (tomorrow) you should pick your “favorite” seat and stick with it for the rest of the semester
  - Seating plan will be shared on the course website **early next week.**
  - We will take photos of the class at random instances during the class. You are expected to be in your seat during **all these instances** to be considered to have been present.

You must maintain 75% attendance in Lectures as well as in Labs. Otherwise,

you will be given a grade less, and not allowed to sit in the major exam.

If due to medical reason, you can not maintain the required attendance, you must withdraw from the course.

Marks distribution

3 out of 4 lab quizzes	3 x 10 marks	**30 marks**
3 out of 4 written quizzes	3 x 10 marks	**30 marks**
Midterm exam	1 x 15 marks	**15 marks**
Major exam	1 x 20 marks	**20 marks**
Attendance	3 marks for lectures and 2 marks for labs (linearly scaled)	**5 marks**

Marks in individual quizzes/exams will be linearly scaled to the given weightage

Plagiarism Policy

- Every programming quiz submission goes through plagiarism check
- Written quizzes and exams will be proctored
- All quizzes and exams are to be completed **individually**
  - DO NOT show your work, DO NOT seek other's work
  - DO NOT borrow/copy/steal work from other students
  - Legitimate submissions are thought out, typed and tested by you alone
  - All submissions will be done through Moodle - VPL setup in the lab
- Note that impersonating someone else is considered cheating

Use of unfair means in quizzes and exams will be penalized

1. **First offense, you will be awarded the negative of the marks allocated to that component.**
2. **Second offense, you will be awarded 'D' grade with no remajor/reminor options.**
3. **Next offense, you will be asked to withdraw from the course, and your name will be reported.**

Audit Criteria

- You will be awarded NP if all the following criteria are met:
    - At least “B-” grade equivalent of total marks.
    - At least 50% in lab quizzes OR in written quizzes.
    - At least 75% attendance in lectures and labs.
- In all other cases, you will earn NF grade

No exceptions will be made

Programming Evaluations

- For each unit, we will release a set of programming practice questions
- These are **only for practice**. None of them need to be submitted.
- Model solutions for most questions will be released after one week.
- Some of these questions will be discussed during the lab session, and you are required to implement them, debug, and submit them (but they will not be graded)
- **4 Lab tests**
  - Based on the questions released
  - Will be conducted in labs in the LHC
  - Schedule is already available on the course website
  - No rescheduling due to any reason
  - We will consider the best 3 out of 4 lab tests

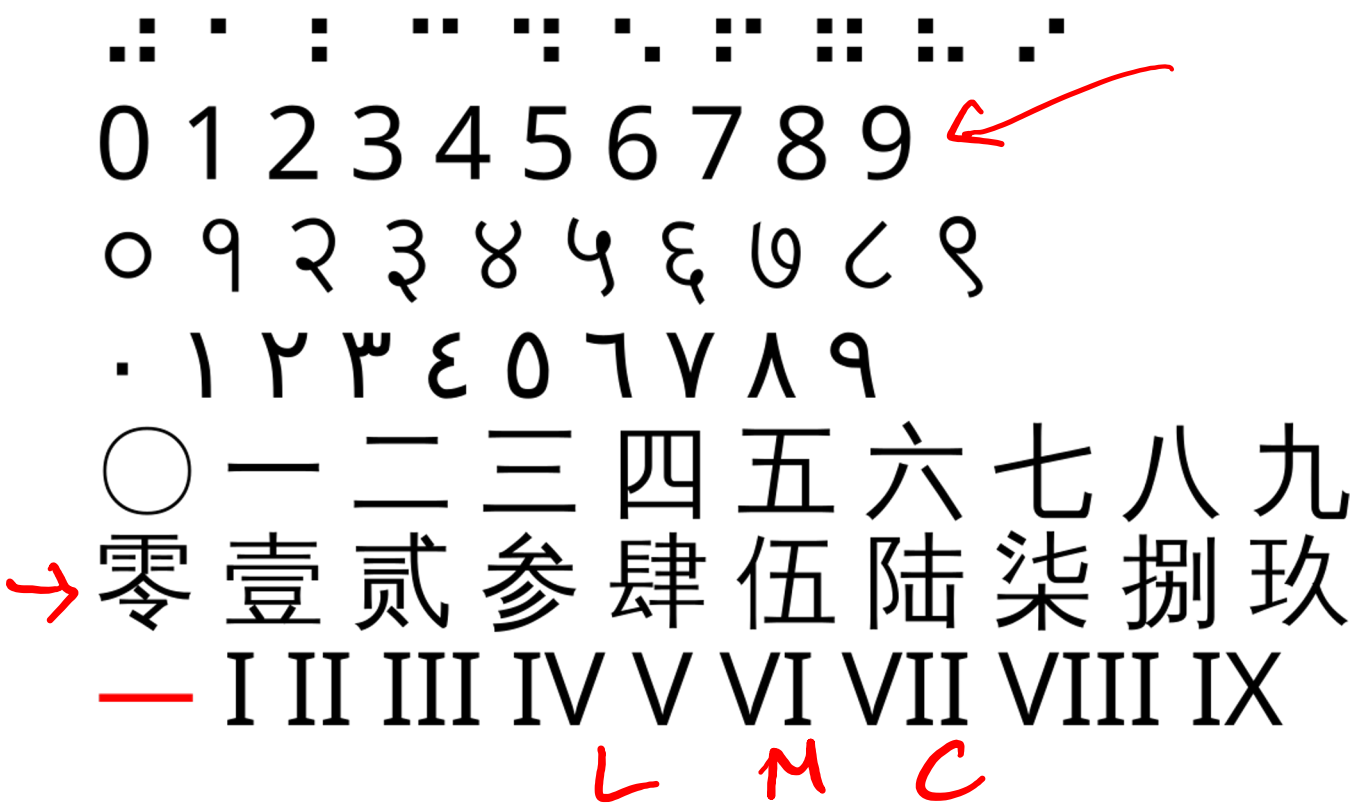
Written Quizzes

- There are **4 written in-classroom quizzes**
- To be completed individually (plagiarism rules apply)
- The schedule of written quizzes is on the course website (click on “Weekly Schedule” on the left)
- How to prepare for written quizzes?
  - Please read the textbook, and solve the textbook questions
  - Attend the lectures and make sure you clear your doubts as lectures progress

Programs = Data Structures + Algorithms
Processes are “Programs in Motion”

Representations Matter!

Consider Numeral System



Revolutionary concepts in number representation

1. Introduction of zero (well before 7th century in India)
2. Positional notation of numbers (possibly 2000 BC in Babylonia)

Number and its position together determine the value

From Individual to **Collections**

Programs rarely work with individual numbers, instead on collections of them.

A collection could be a

- **Set** : holds unique values, with no specific order.
  membership
  union / ... - -
  add/delete
- **List** : maintains some form of linear ordering of values it holds.

Set of Numbers

- **Set** : holds unique values, with no specific order.

Representing related data: Representing Students in COL106

Each student is unique and inimitable

- Each student consists of nearly infinite “characteristics”

Thank God - we do not need all characteristics for every task!

In a class roster, we just need the following for each student:

- Official name - a string
- Entry number - a string
- Batch number - a number between 1-4

How do we represent this?

Representing a Collection of Students of COL106

- **Approach 1:**

Names = [“Veeru”, “Basanti”, “Jai”]

Batch= [1, 4, 3]

Entrynumber = [001, 004, 002]

Typical operations:

Adding a new student, deregistering Basanti from the course, …

Representing a Collection of Students of COL106

- **Approach 2:**

Student1 = { Name : ”Veeru”, Batch : 1, Entrynumber : “001”}
Student2 = { Name : ”Basanti”, Batch : 4, Entrynumber : “004”}
Student3 = { Name : ”Jai”, Batch : 3, Entrynumber : “002”}

Related values are together.

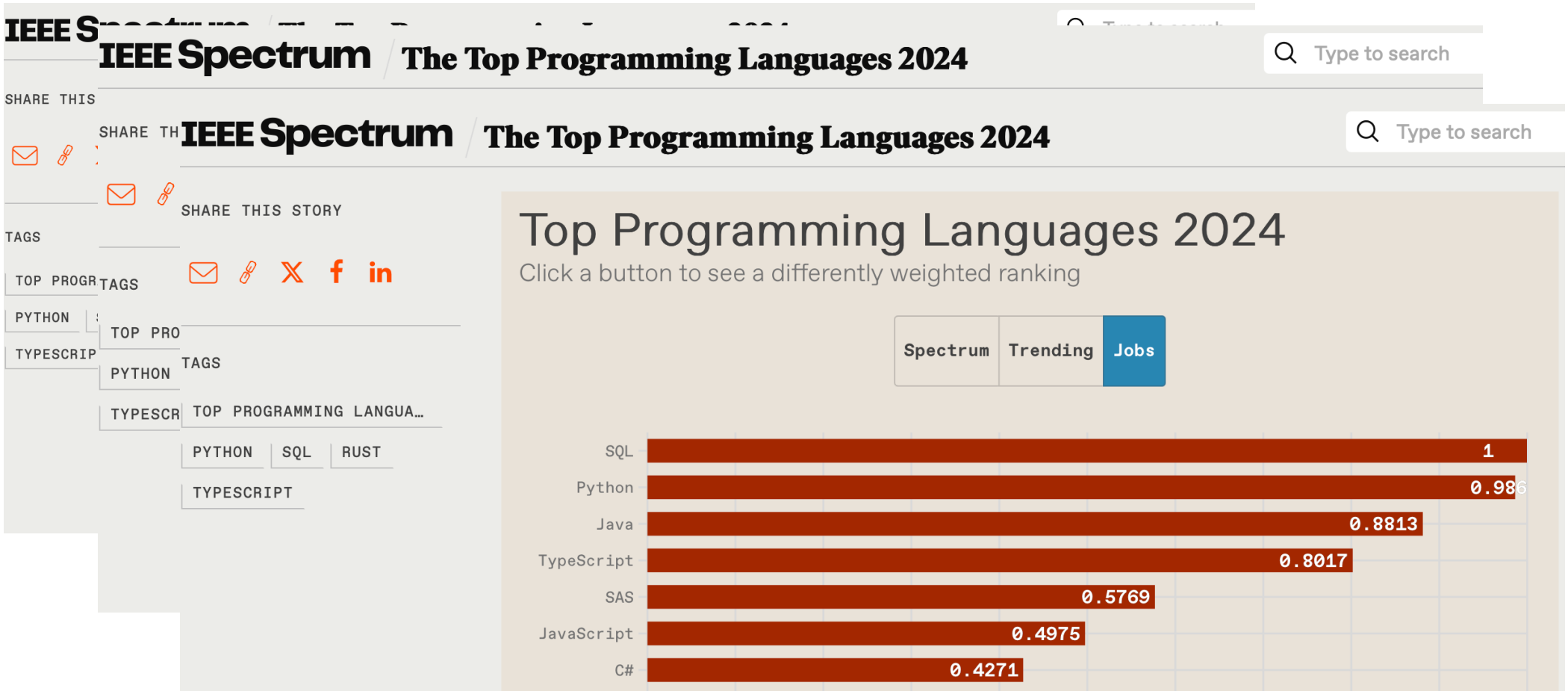
Course roster = {Student1, Student2, Studen3}

Typical operations:
Adding a new student, deregistering Basanti from the course, …

Object Orientation

- Every Object contains
  - A set of value(s) related to the object
  - A set of behaviors that can be applied to the object's value (e.g., correct the name, update the batch)
- Class
  - A "template" for objects – values identifiers, methods that define the behavior of the object
- Instantiate Objects from Class

Java Programming Language



Java Programming Language

- An object-oriented, high-level language with automatic garbage collection that follows “Write-Once Run Anywhere” (WORA) paradigm
  - It is not an interpreted language, but is compiled into an intermediate byte-code – **javac**
  - Executed over a “virtual machine” that mediates with the underlying hardware and the byte-code – **java**