CS773:
Computer Architecture for Performance and Security

Lecture 1: Course Logistics

https://www.cse.iitb.ac.in/~biswa/

Happy, Healthy, and a Calm New Year 2022

About Me: ~~Prof/Dr/Mr.~~ Biswa

Member of faculty at CSE-IITB

Less than one year old at IITB

CASPER group: https://casper-iitb.github.io/

Primary research interests:

Microarchitecture for *performance and security*

Cross systems-stack interactions: *compiler, OS, networks, applied-ML on systems*
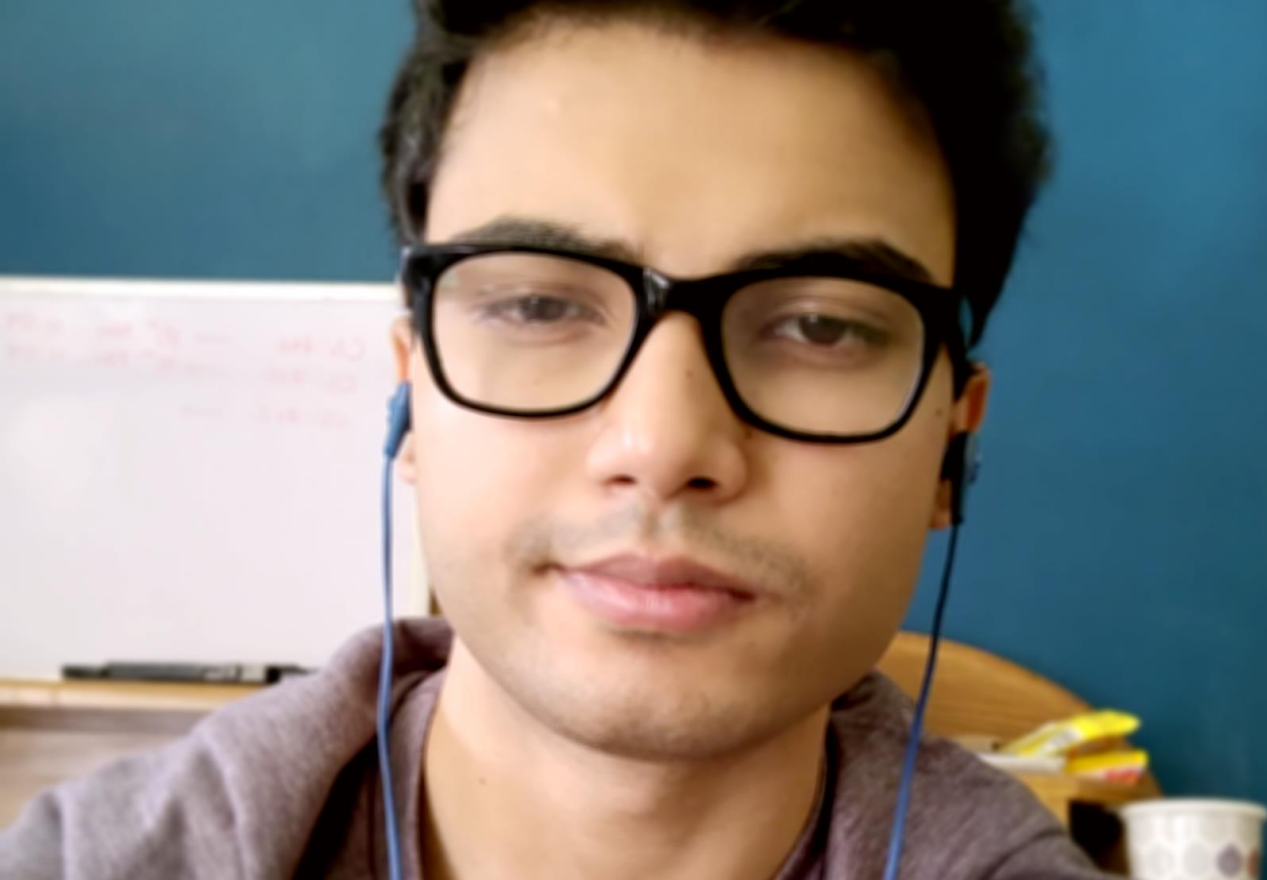
TAs (Debasish and Veerendra)

Introduce Yourself (Maybe Next Monday)

Join Piazza now
Course MS-team channel is up too

Pre-req (Please drop the course if you feel it is not you)

Open mind to learn, debate, discuss, and code in C++/python

Interested in **asking questions** and not only in providing answers ☺

Ready to spend time in **thinking** rather than *ing.

Team player: Trustworthy and professionalism, **respecting others' time/suggestions/ideas**.

Rest I will take care. CS/EE/MECH/…. does not matter.

Technically

A bit of UG Computer Architecture and a half a bit of OS will be helpful.
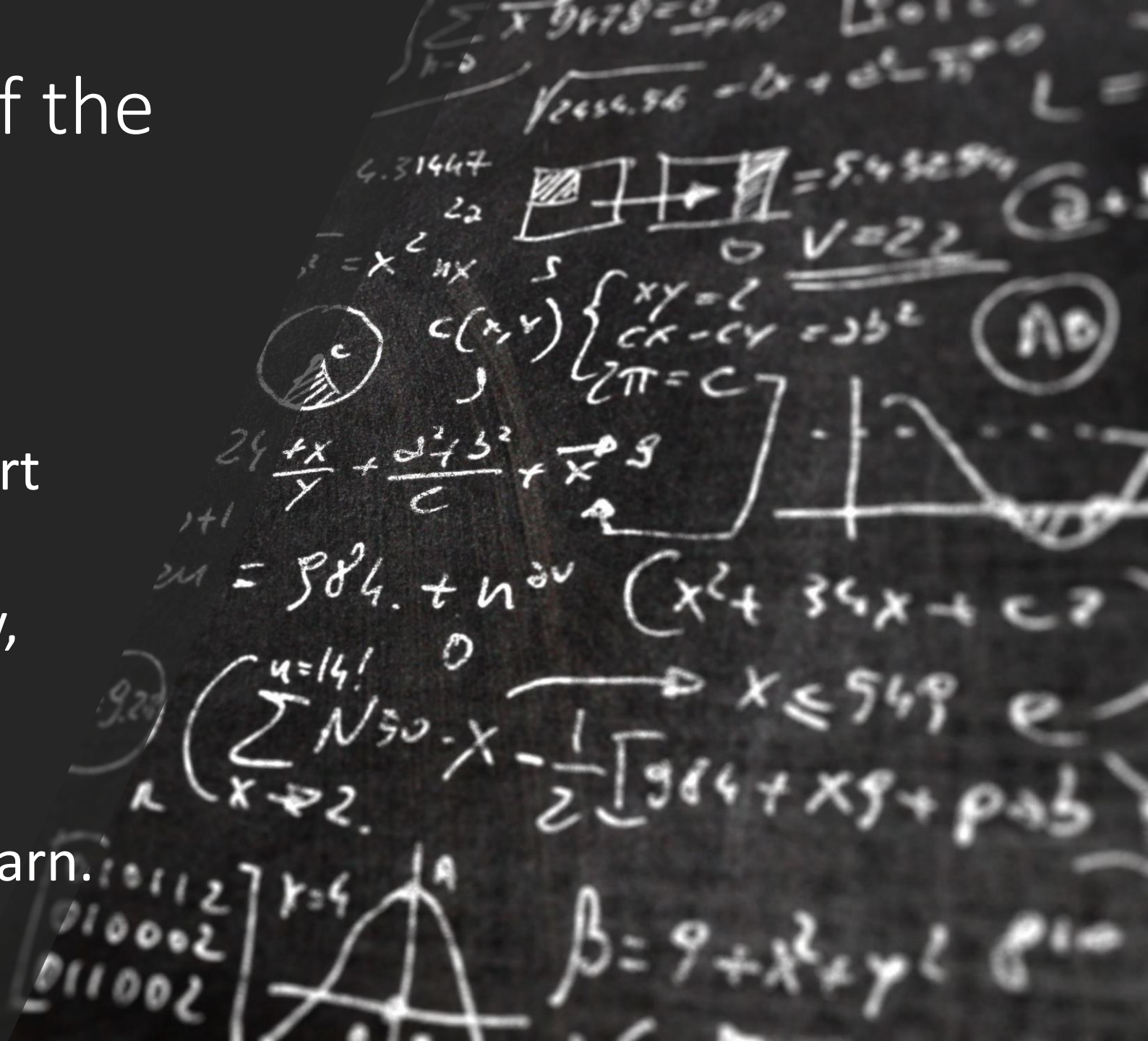
If you know it, it is good

If you do not know it, it is even better.

CS773: Format of the Lectures

1. Basics of Computer Architecture topics

2. Advanced state-of-the-art topics

3. What can be done? Why, how, and many more

I won't teach. We all will learn.

Example

Basics on Cache Hierarchy

Basics on security/performance related to caches

Hands-on on cache attacks (we will provide you the code to play with)

During lecture hours: Ask doubts on the basics stuff and then jump to the state-of-the-art discussion

CS773: The difference

Consumer

- Mugging up, Writing answers!! Grades
- Punished if you fail in exams (F grades)

Producer

- Group-learning and thinking. Asking Qs: Why? Whynot? What if? What may? How? Why not?
- Not believing textbooks. Learning by doing. Multiple answers/ideas/insights

CS773 Composition

Mentoring team: Biswa, Debasish, and Veerendra

CS773 divided into two bins: Bin A and Bin B

Each bin has K (say 4) number of teams

Each team has K (say 3, 4, or 5) number of students
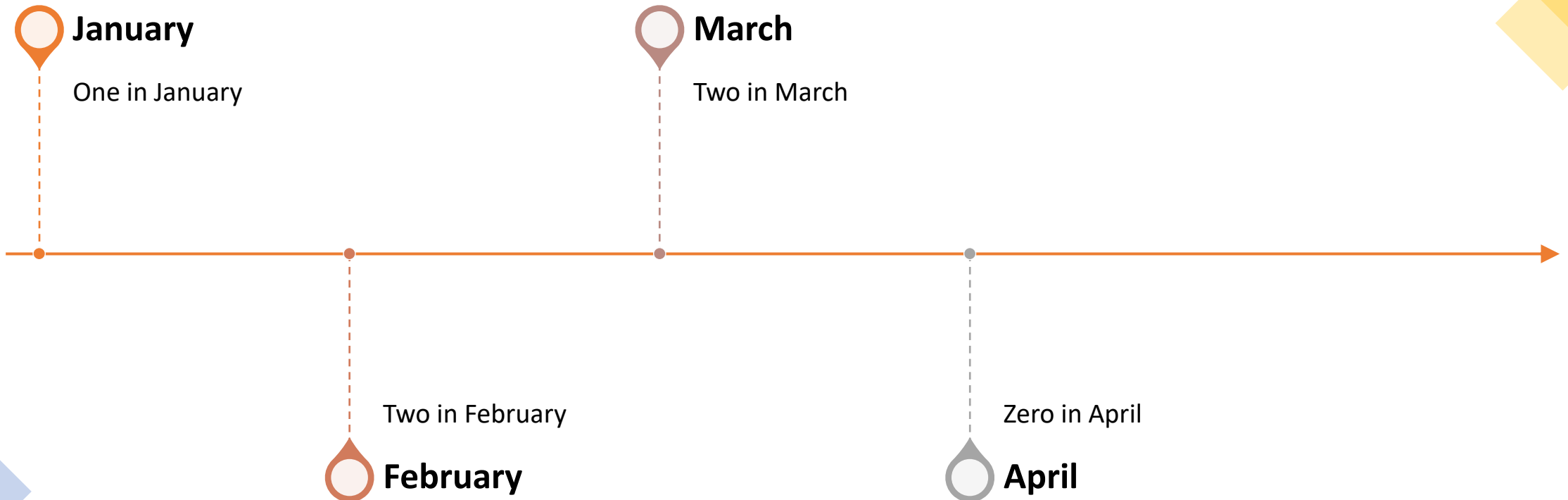
Example of a Bin

Security Bin   Performance Bin

Five Paper Review Assignments
# (Individual submission with team discussion): 20 points

Each team member will submit a review (along with team discussion points) once in two weeks. We will have mock(s) by next week.

January

One in January

March

Two in March

Two in February

February

Zero in April

April

Bonus +4 points for the best review for each review.
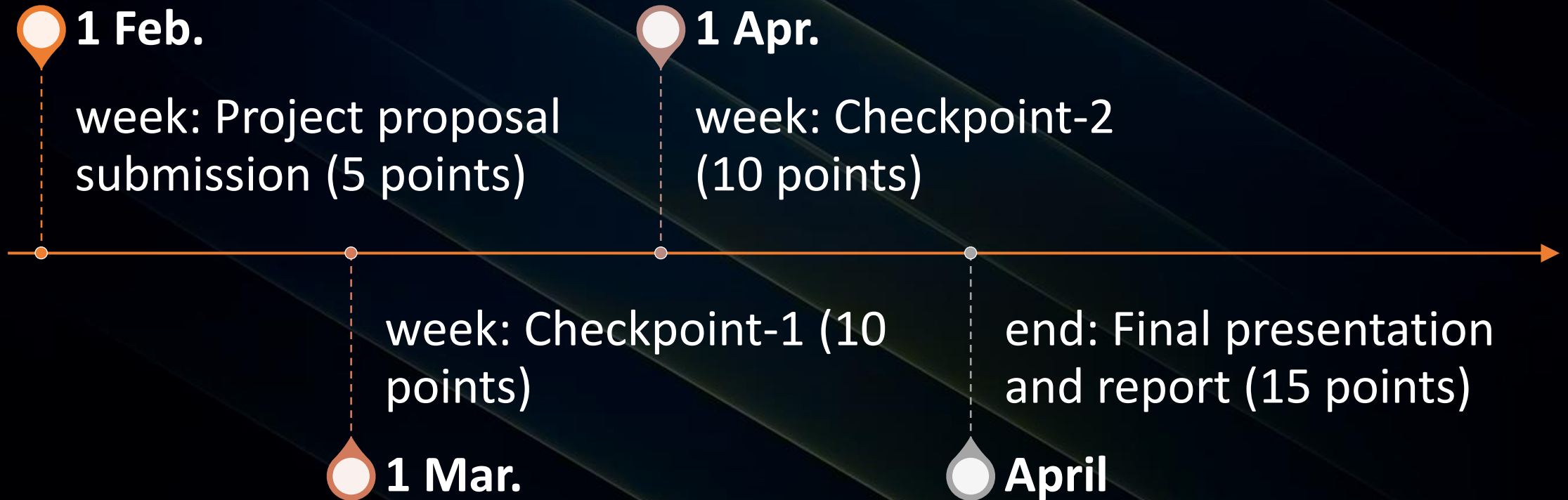*So you can get 40 points if you just concentrate on review only*

Five Paper Presentation Assignments (Team based, one lead presenter): 5X4 (20) points

So, each team will present five times (one per student, with camera ON) in the next four months

One in January

Two in March

February

April

January

March

Two in February

Zero in April
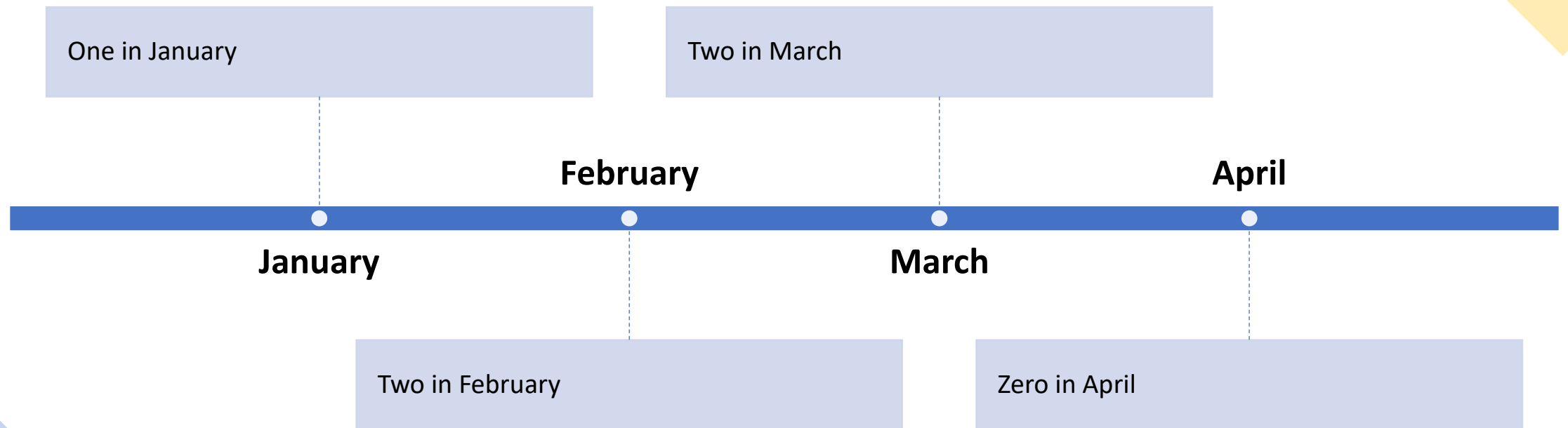
Bonus +4 points for the best group presentation for each presentation.
So, you can get 40 points if you just concentrate on presentation only

15

One Project for Three months: 50 points

1 Feb.

week: Project proposal submission (5 points)

1 Apr.

week: Checkpoint-2 (10 points)

week: Checkpoint-1 (10 points)

end: Final presentation and report (15 points)

1 Mar.

April

Project leading a conference submission: AA grade (irrespective of ...)
Biweekly team meetings: To help you and your team reach the goal.

Discussion Participation: 10 points

10 points for free (2.5 points per month).

If you miss a discussion, then -1 point ☹

If all the member of a team miss a discussion, then

–team_size points to all ☹ ☹

If a team misses a presentation: -team_size points. Inform me/TAs 72 hours before.

All Good. But you do not know…

How to read a top conference paper?

How to review a top conference paper?

How to approach a problem?

How to solve a problem?

How to think, how to question, how to convince, ….

CS773 will take care of that. We will discuss how to about everything ☺ but slowly not today

Evaluation (Your will evaluate your friends)
CASPER has a Hotcrp account ☺

CASPER

biswa@cse.iitb.ac.in   Profile   ·   Help   ·   Sign out

(All) | Search |

Search

| (All) | in | Submitted ▼ | Search |

Reviews

The average PC member has submitted 0.0 reviews.   (details · graphs)

As an administrator, you may review any submitted paper.

Offline reviewing

▶ Recent activity

Submissions

New submission *(No deadline)*

As an administrator, you can start a submission regardless of deadlines and on behalf of others.

The site is not open for submissions at the moment.

Administration

Settings
Users
Assignments
Mail
Action log

Conference information

Deadlines
Program committee

PAUSE (Questions please)

A few more

There won't be any deadlines on Saturday/Sundays.

There won't be any midnight deadlines.

Working on weekend shows – incompetence

CS773 will be an incompetent course

Instructor and the TAs will be incompetent ☺ I will not respond to queries on weekends/holidays.

Learning and Grading

- *Learn at your own speed (no race)*
- *Learn as a team, not as an individual*
- *Learn how to deal with failure and then bounce back*
- *Walk, no need to run* ☺

Rat Race

You?

Still a rat

Forget about Grades
Think about dL/dt

All will get an AA if you do good either presentations/reviews or project.

Computer Architecture

Skills not to have: Intellectual Corruption(theft)

Reason: Comparison with others, desperation

Trying to achieve more with less effort

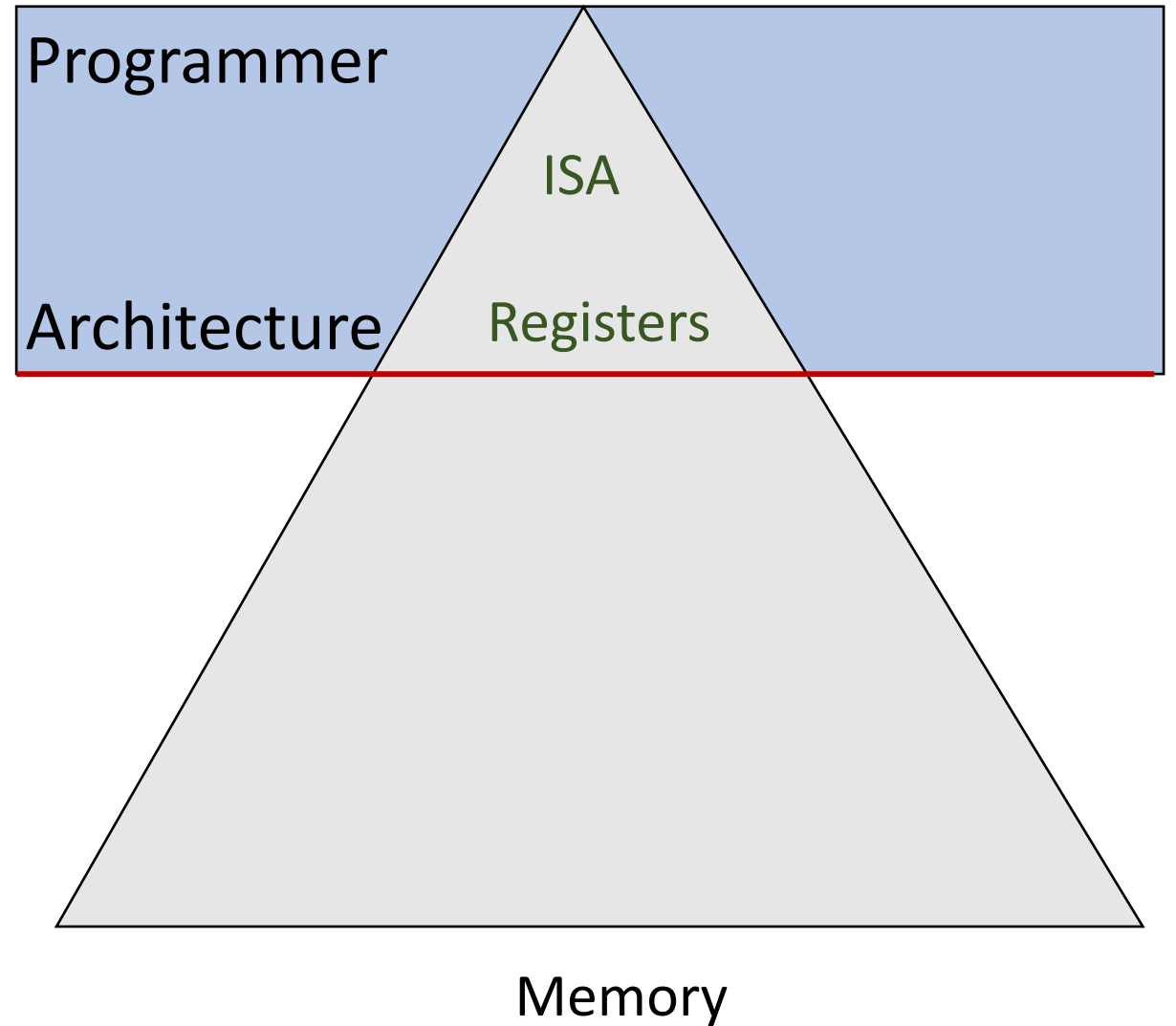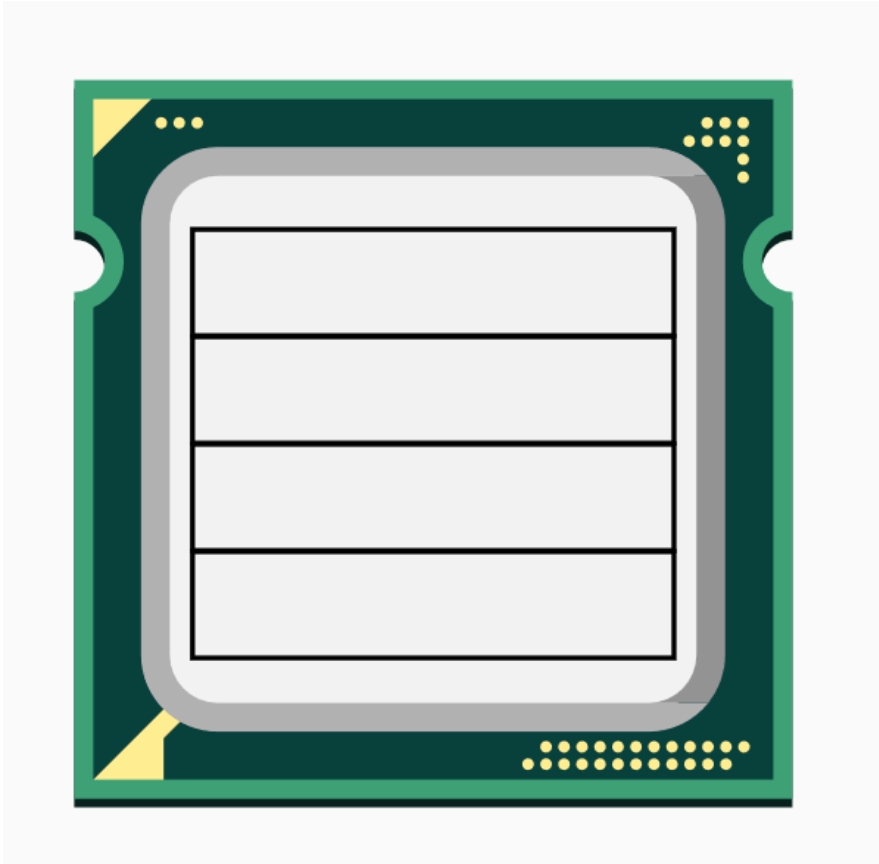*When you can't make it then fake/steal it*

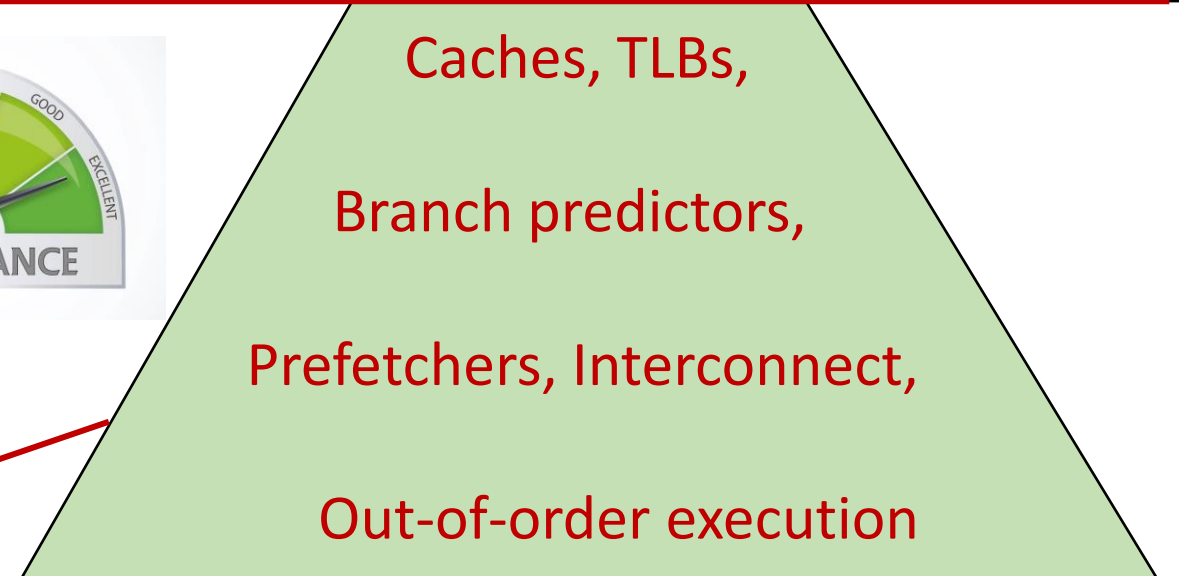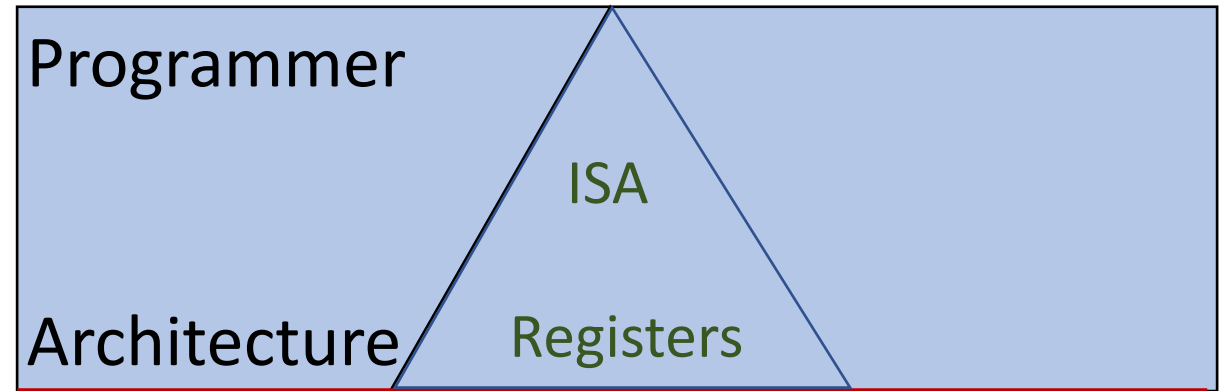*Learn from who knows, ask, how ? Do not cheat/complain*

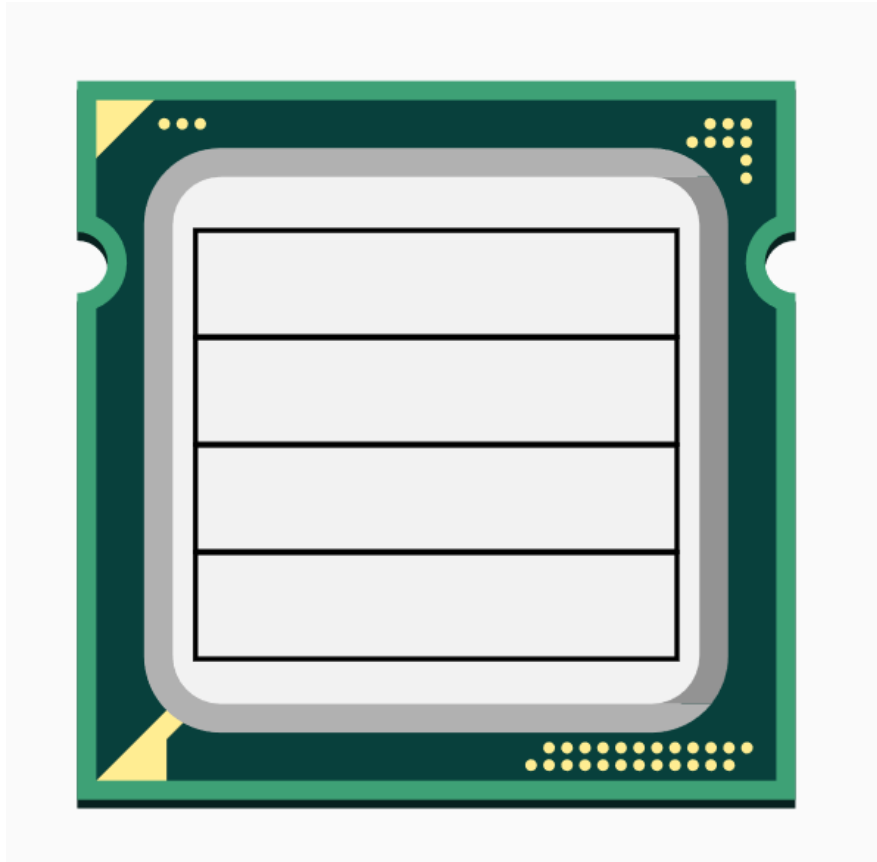# CS773:101

Programmer

ISA

Architecture

Registers

Memory

CS773:101

Programmer

Architecture

ISA

Registers

Caches, TLBs,

Branch predictors,

Prefetchers, Interconnect,

Out-of-order execution

Not exposed to programmer

Memory

Performance (faster the better): 100K Feet View

Better Cache Hierarchy

Better Processors for AI/ML

Better OS-architecture interaction

Better Network-architecture interaction

Better compiler-architecture interaction

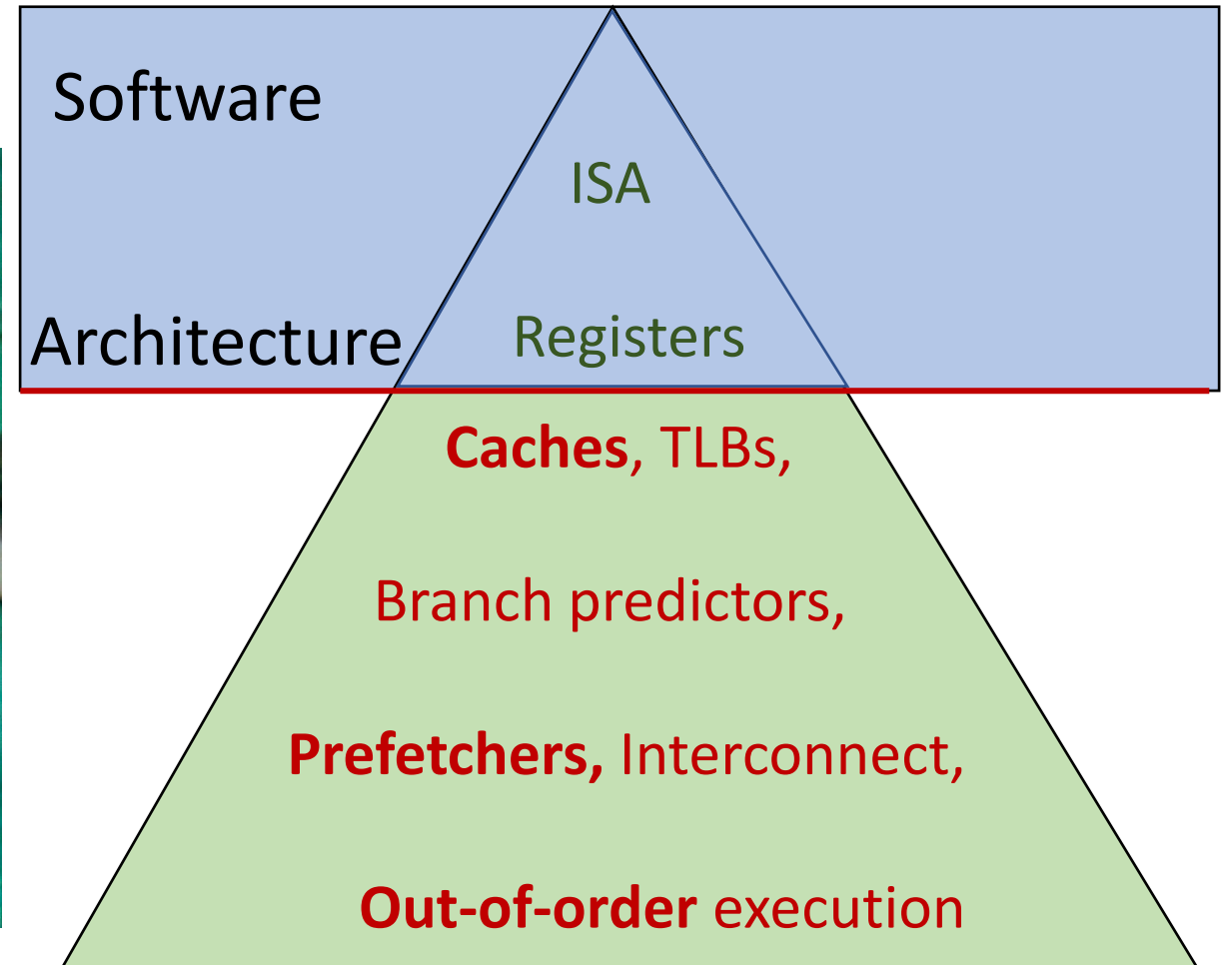Microarchitecture for cloud, servers, virtualized environments

Memory hierarchy for persistent memory

Performance/Power tradeoffs

We won't cover all. Depending on your interests, we will jump into these topics, again slowly

From Performance to Security

Software

ISA

Architecture   Registers

Caches, TLBs,

Branch predictors,

Prefetchers, Interconnect,

Out-of-order execution

Security

Confidentiality	*You do not **see (READ)** what you are not supposed to see*
Integrity	*You do not **change (WRITE)** what you are not supposed to see*
Availability	*You do not **affect (DELAY)** others (un)intentionally*

Intel Inside; NO; attacks inside ☺

Security: 100K Feet View

Secure Cache Hierarchy

Secure Processors

Secure OS-architecture interaction

Microarchitecture for security and performance

Offensive side: More attacks

Defensive side: More mitigations

We won't cover all. Depending on your interests, we will jump into these topics, again slowly

Projects

PERFORMANCE

SECURITY

PERFORMANCE AND SECURITY

On real systems, simulators, other tools. We will go through it slowly.
No need to learn all. Depending on your interests, you should learn one (not all)

More Projects (ISCA Championships)
Only Indian group in ISCA-2018/19/20, 2021: I moved to IITB
Only Indian institute to win THE ISCA championship
Can I see IITB in 2022?
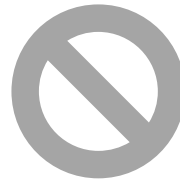
Theory vs Practice

It is not a theory course

- While(1)
- {
- Read,
- code,
- experiment,
- read again,
- code again,
- experiment again
- }

Interested in Auditing (but why? Just sit maybe)

Participate

You must participate in all the discussions (reviews and presentations)

No

No need of the project

Make

Make sure to create a team of students who are auditing

Team Size for projects and Grading

I am ok with team size of one to five. Grading will be weighted.

Make sure you have a trustworthy/professional team member(s).

Choose your partner wisely ☺

Projects will be graded/team. Wont be rigid.

PAUSE

Questions please

Hopefully, some course drops too ☺

Tentative topics

Google sheet:
https://docs.google.com/spreadsheets/d/1L_67f8uQl1Y3D0n4HV71ch5jtNs_GlByLhbFMhJ2xBo/edit#gid=0

OMICRON Effect

We will change the logistics based on the uncertainties. Do not overthink. Do speak up if you struggle.

What Can you Expect from Me?

- I will be there to help you and facilitate your learning.
- I will make sure you go through the process of
  - Finding a problem
  - Solving a problem
  - Communicating your findings, precisely.
  - I do not care about result. I do care about insights and effort.

Drop the Course

(Hard Deadline
January 17, 1 PM, Why?
This is an elective course, and all
assignments are group based. If you drop
the course later, it will disrupt the course)

It is not a core course. So, no compulsion.

Lesser the number of the students the better.

So, please drop ASAP

Assignment-0
(First filter)

Submit a 250-word review on one of these movies:	Submission Deadline: January 10th, 1 PM IST
• Million Dollar Baby • Cast Away • Dead Poets Society	• Link: Please refer Piazza after January 6th

Fill the Form so that we will know you better

(https://docs.google.com/forms/d/e/1FAIpQLSdRIq15cFwy4jbo8asQTcbExeHMT8iqZ9N7hMxFLDb_plOK5w/viewform)

Feel free to speak now so that we can make the course better.

One of the primary goal of this course: "To communicate"

If You want to get started

Caches/Cache Hierarchy:
https://www.cse.iitb.ac.in/~biswa/courses/CS305/lectures/L30.pdf
https://www.cse.iitb.ac.in/~biswa/courses/CS305/lectures/L31.pdf
https://www.cse.iitb.ac.in/~biswa/courses/CS305/lectures/L32.pdf
https://www.cse.iitb.ac.in/~biswa/courses/CS305/lectures/L33.pdf
OR
Lecture videos (short ones): Lecture 30 to 33
(https://www.youtube.com/playlist?list=PLw6vmiIQrilTWa5twNV8opVJ3ge_kEfsM)
OR
One hour lecture if you like long videos:
https://www.youtube.com/watch?v=fEd-7hA5Pq0

Thanks
(Feel free to talk to me for any…)
Let's Talk now