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A Day With Biswa!

Prof. Biswabandan Panda
Computer Architecture for performance and security
CASPER Research Group, CSERL Lab

Research & Labs
I will try to give you a high level, a 10,000 view because otherwise, it will be too technical and boring. So, I work in the field of Computer Architecture, lowest level in the entire computing stack. If you look at all the courses you take during UC, architecture is the bottom of the stack and after that, you start talking to maybe transistor or maybe above that, from proteins, from where physics start coming to picture.

So, I try to work in that interface which deals with improving the performance of modern systems, including desktops, laptops, and mobile phones. I also work on making it secure from last two years. A pretty high level, high school level approach is that I try to make computing devices secure and faster.

I started a group called CASPER. It stands for Computer Architecture for Performance and Security. It is under the umbrella of SYNERGY, which is a bigger lab in terms of systems research. You work with other faculty members who are part of SYNERGY. There is no specific architecture lab per se, but there is a group specifically for the architecture.

Involving Students in Research!
I think in today's world the best thing to do is to email.
On a lighter note, I can also take a call!

On a serious note, you should be aware of what I do. I expect that you have at least gone through my course webpage, lecture videos, and there should be some understanding about what I am doing at a pretty high level. I don't expect experts to join my group; then there is no role of me being here in the department. If all others are experts then there is no need of faculty.

Those are the initial hiccups that usually students have, like what should be your first step, but mostly based on my limited experience, it is not that technically that matters, it is the non-technicality that matters, like how passionate you are about anything. You persevere and persist continuously even if you fail. These are the qualities that I kind of expect, no matter whether you are a UC, PG, CS, non-CS, IITB or IIT-

I usually call it 3P- Passionate about, Persevere and finally, you should be Professional.

At the end of the day, no matter what you do, where do you go, people will expect that you can become professionally. These are the places where you start learning professionalism. As long as you have these 3Ps, you are more than welcome to work with me. I will take care of the rest of the technicalities.

I will give you example. So at IIT-K, I had students from Mechanical and Material Science who have done awesome in research and now they are doing PhD in Georgia Tech in CS/BE. I hope that answers all the questions that you have. It does not matter, at least for my research area. Maybe in other areas, you should be good at doing things, it could be ABCDE but I need these 3Ps that I talked about. As long as you have those 3 Ps, I will take care of this.

But having said that, it is fairly difficult to get folks with 3Ps in today's world.

Getting Started in Computer Architecture
For my field of research- computer systems. It is a bit different from other areas of research in the sense, that no, it is not a sacrosanct research as per say. It is not a pure scientific way of doing research. It is more experimental, you kind of do something, observe it, find out new insights and come up with a new idea. It is kind of iterative process that we try to do in day to day.

A simple example that I usually give to second year undergraduates that you must have gone through simple physics experiment about finding the value of g, that is 9.8. Did you get 9.8 during your experiments?

That is what we do. But if you compare with other areas, you have precise answers. You will have algorithms, there will be lemmas, there will be proofs. Here is not like that. Here the kind of question is like I face some problems, and if something does not go my way. And then you try to find out the answers by experiments. There is no theory. And that is why maybe I kind of enjoy it, not because I don't appreciate logic, but because I use my brain to apply logic, lemm and proofs. If I see things happening, that is all, the best proof.

Ditching the Sir Tag!
The primary reason as I already mentioned that in today's world, we are not the teachers but facilitators, and it is not like only students learn from prof. It is also that prof learn from students.

So it is kind of mutual exchange of ideas, interactions through debates and discussions. And unless you feel free, you won't be able to do that. So unless the way you talk to your seniors, say on WhatsApp, unless you are on track with them, you won't have to spell it out where exactly your issues are, where exactly you are struggling, both academically and non-academically. So that was the primary reason.

However I completely respect the idea behind calling Sir, Madam, or Doctor. I am against them but yes, this was kind of motivation behind encouraging prob to just to use the name. I met at IITK, for one of the courses, I started calling students as dear students, instead of their name. So instead of Parth, I would say, "Dear Student would you mind asking your question?" It went on for 2-3 weeks and they found it really weird. They said that we have a name, I said, "Come, even I have a name. Why are you calling me Sir?"

But yes, at the same time, I completely agree with the other side of the world, where they say, no, no, we should give respect, we should do all the things that we are trained and learned. I completely agree. I am not saying don't do that.

Sharing 2 Cents!
Advice is already there, like the 3Ps advice that I talked about. Basically, try to fail. Fail when you are young so that the consequences are not too high. For example if you fail now, there is nothing to lose. If you fail now, there is a gap of 15 years or so. You fail and learn from those failures and bounce back.

That is how things are and then, it is always good to have perspectives from everyone, because at the end of the day, you make your own decision.

You know there is this, I hope you must have seen this movie, "Invincible" which has this famous line.

I am the Master of my fate; I am the Captain of my Soul

Your goal is that movie. That should be part of the curriculum.

I also remember a poem that motivated me to do something different 10-12 years and looking back I strongly feel it correlates with the Indian education!

"A young Apollo, golden-haired, Stands dreaming on the verge of strife. Magnificently unprepared For the long bitterness of life." -Frances Cornford
The way we start with high school, then coaching, then JEE, and keep on doing what the society, or what the rest of the world demands us to do, and then you get lost in the race. Suddenly you realise, Oh where am I?

We are kind of highly intelligent, and we are at the best place, at least in terms of Indian academia, but we are still unprepared for the ‘long littleness’ in life, and once you finish the IITB, and you enter into the real world, suddenly you see that: Oh there are no exams, there are no grades, the world looks different!

That is the main reason behind jumping and doing something different through courses so that we can realise that okay, world is not about the courses and grades. So, do pretty simple things if you can, you know pause a bit and think through it. Otherwise, we are running 24/7, and finally, you may not realise but you are done with your BTech.

In an Online sem, it becomes a little bit difficult but even in Offline sem, you are in for different kinds of things. It is better to pause once in a while, do a little bit of introspection, take a hard break. When I say hard break, I mean completely cut off from Internet, mobile, TV, screen time. That will give you a better perspective. Otherwise, everyone is running through, let’s say, Marina Beach, okay, let us all run through Marina Beach. That is what is the current way of looking at things.

Unorthodox Ways of Conducting Courses

Every year, every semester we have multiple written examinations per course - quizzes, midsems, endsems and what not. Since the beginning of time, this has been the standard way to gauge the students’ understanding of the course. The transition to online teaching meant that professors had to come up with measures in which the exams could be conducted in a malpractice-proof fashion. However, this transition also has led to the birth of creative grading practices which our professors have incorporated into their courses. Let’s first look at some of the courses that employed such creative techniques are:

CS 747 – Foundations of Intelligent and Learning Agents
Prof. Shivaram Kalyanakrishnan

This course did not have any proctored exams and the focus of the professor was on continuous learning via take-home weekly quizzes. Along with that, the application of the methods taught in the lectures was given more importance as assignments were given higher weightage. The professor also wanted to judge the comprehensive understanding of the students about the course and thus, kept a take-home endsem in which students were given 10 days to answer various assignment-centric questions.

CS 771 – Foundations of Verification and Automated Reasoning - Prof. Akshay S

This course did not have any proctored exams and the professor was keen to keep a check on the students’ understanding of the course topics by taking weekly progress quizzes on Moodle. Students were asked to present a research paper of their interest and peer questioning sessions were conducted to grade students’ ability to answer queries related to their topic. This turned out to be a good way to promote peer learning in an online setup. For the Endsem examination, students were given a choice between a take-home exam or a lightweight homework + paper presentation.

CS 760 – Topics in Computational Complexity
Prof. Mrinal Kumar

The intention of the professor for this course was that students learn as many new concepts without worrying much about marks. The course evaluation structure consisted of a couple of homework assignments, a take-home endsem exam, and a course project in which students had to present their analysis of a research paper in some relevant field.

CS 754 – Advanced Image Processing – Prof. Ajit Rajwade

This is one of the courses that adopted an assignment-centric evaluation scheme well before the education moved online. The professor chose the road not taken by balancing the weightage between assignments, exams, and the project. There were assignments for each topic in the course which consisted of both theoretical and programming questions. The midterm and endsem exams were conducted as usual but had lower weightage compared to the typical.

Giving higher importance to assignments motivates students to also focus on applications of the theory that they learn. Given that students do not adopt unfair means, these evaluation techniques are a much better test of students’ understanding of the course content as compared to a time-bound test. In an online setup, that has led to a dearth of in-class or in-hostel interactions among the students, these creative techniques provide an opportunity to encourage peer-to-peer interactions and thus, helped counter this important online setup problem. Reading research papers and presenting your analysis in front of the class develops a students’ critical and independent thinking ability and also boosts their confidence. In contrast, an exam-centric approach often leads to students adopting rote learning as their mode of preparation. Also, our institute encourages students to participate in extracurricular activities, and such courses help students to manage time for other activities alongside their studies.

However, the effectiveness of such evaluation methods heavily relies on students maintaining the honour code. Checking for plagiarism in take-home exams which are typically hand-written is another cumbersome challenge. We tend to retain things that we learn for an exam for a longer time. If all the exams are made take-home, the students are not expected to memorize any concept because the course material is available at hand for them to refer to. Hence, the retention of the topics taught in the course could be low. One of the methods to promote peer learning is to incentivize students to take part in discussions on the online forums established for the course. However, this often leads to unwanted spamming as has been observed in the past, defeating the whole purpose of the idea.

These unusual approaches have been the ray of light in the online era where effective teaching has been a very difficult task. Change is an essential step in the path of evolution and these changes have received a unanimous welcome from the students. We thank our professors for coming up with such amazing ideas and hope that by covering this subject we will see a lot of other courses incorporating such innovative techniques in the upcoming semesters.
Cognitive science is the interdisciplinary, scientific study of the mind and its processes with input from linguistics, psychology, neuroscience, philosophy, computer science/artificial intelligence, and anthropology. It examines the nature, the tasks, and the functions of cognition.

34% students interested in the Course!

FINANCIAL MODELLING

Financial modelling is the task of building an abstract representation of a real-world financial situation. This is a mathematical model designed to represent a simplified version of the performance of a financial asset or portfolio of a business, project, or any other investment.

55% students interested in the Course!

GAME THEOREY

Game theory is the study of mathematical models of strategic interactions among rational agents. It has applications in all fields of social science, as well as in logic, systems science, and computer science.

65% students interested in the Course!

GAME DEVELOPMENT

Game Development is the process of creating games and describes the design, development and release of a game. It may involve concept generation, design, build, test and release.

69% students interested in the Course!

ROBOTICS

Robotics is an interdisciplinary branch of computer science and engineering. Robotics involves design, construction, operation, and use of robots. The goal of robotics is to design machines that can help and assist humans.

68% students interested in the Course!

COMPETITIVE PROGRAMMING

Competitive programming is a mind sport usually held over the Internet or a local network, involving participants trying to program according to provided specifications, in order to gauge their logical and mathematical aptitude.

77% students interested in the Course!

COGNITIVE SCIENCE

Cognitive science is the interdisciplinary, scientific study of the mind and its processes with input from linguistics, psychology, neuroscience, philosophy, computer science/artificial intelligence, and anthropology. It examines the nature, the tasks, and the functions of cognition.

34% students interested in the Course!

CYBER SECURITY

Cyber security is the application of technologies, processes and controls to protect systems, networks, programs, devices and data from cyber attacks. It aims to reduce the risk of cyber attacks and protect against the unauthorised exploitation of systems, networks and technologies.

84% students interested in the Course!

BIOMATIC INFORMATICS

Bioinformatics is the application of tools of computation and analysis to the capture and interpretation of biological data. It is an interdisciplinary field, which harnesses computer science, mathematics, physics, and biology.

38% students interested in the Course!

ADDITIONS TO CSE CURRICULUM!

Quantum computing is a type of computation that harnesses the collective properties of quantum states, such as superposition, interference, and entanglement, to perform calculations, which delivers a huge leap forward in computation to solve certain problems.

72% students interested in the Course!

MIT: 6.857 Network and Computer Security
MIT: 6.858 Computer Systems Security

External Link: [MIT CSE Website](https://www.csAIL.mit.edu/)

*For the statistics, a form was shared amongst the students of all batches in the department.*
Questioning the Defined CSE path!

Craxxx bro! Day 1 intern lag gayi, ab toh paisa hi paisa hoga...

You read your friend’s story, and a surge of accomplishment runs through you. A few seconds later, the story changes to an ad for the latest Nike shoes. Will you be able to afford these shoes with your internship stipend? Hmm...

Is the above a glimpse into a moment in the life of an average IITB CSE topper, finest cream of the nation? Perhaps. Is it what one might have expected it to be? Perhaps. The fact remains - at present, the wish to live as many such moments as possible guides the choices that many of these toppers make at college.

Is this wish a good guiding light on the path we walk at IITB? Maybe - or maybe it acts as a bulb that is close to fusing, hanging precariously over the narrow alleyway that we all try to force ourselves to fit into. Fighting like hyenas against each other to get ahead, one misstep and we find ourselves in someone else’s shadow, and end up losing sight of the light altogether and getting trampled under someone else’s new Nike shoes. The problem: the entrance of this alleyway is so deceiving, has so many flashy sign boards surrounding it, that we forget how dark can get for some of us in between. We forget that it is often a wiser choice to step a little to the left of the entrance, and find better lit streets that we can walk more comfortably and confidently on.

We forget that the grass is greener on the other side irrespective of the path we choose (provided of course, that one is willing to work hard for something that they believe in). Then why not choose a path where the light suits us better?

Respecting that everyone has goals that they want to achieve, and has reasons for the same, we want to ask you - are your goals your own, or has the rush of the madding crowd decided them for you? Because entering the alleyway may seem easy at first - at least you’ll have company - but I think a lot of us who have been in the midst of it and gotten the short end of the straw, know how lonely it can actually be.

The signboards surrounding the other streets maybe aren’t that brightly-colored - but the streets themselves definitely have just as much (if not more) to offer as the alleyway. And the best part is - you can switch from one path to the other even after you have entered. Yes, it may be easier to let the crowd carry you along, but if you find that their goal is theirs and not actually your own, don’t hesitate to take the first exit you see. Walk along the quieter streets, use the peace to reflect.

If you find your way back to the alley out of your own free will, all power to you. But if you think the silence suits you better, don’t be afraid to walk ahead! The path may be lonelier, but you will know it is your own. And who knows, the courage to define your path for yourself may inspire others to branch out from the alley as well.

Several questions and thoughts come to our minds when we think about our careers.

What do I do exactly after college? Should I get a job or pursue higher studies or research? Am I doing what I enjoy? Which fields do I really want to explore? Are these the only things that I can do? Are there more options?

These all questions seem normal but at the same time can be very confusing or even stressful. At times we even doubt ourselves whether we are on the correct path or not. We don’t always know what exactly we want.

These uncertainties can make us cling to the familiar, especially when it comes to our careers. Thus, we tend to follow what most people around us are doing, which feels like a “safe” option to us. Sometimes, we don’t even think of exploring a path we like simply because no one is doing it, or because we don’t have enough information about its future scope.

We need to change our perspective about such situations. Don’t just pursue a thing you don’t like just because most of your friends are running after it. And even more importantly, have faith in yourself and try out what you appreciate, even if you can’t find anyone alongside you. Once you make up your mind you are halfway done. There are countless opportunities out there in any field, you just need to choose the best path for yourself and try it out. If you are unsure about the field or its scope, you can always talk to seniors or alumni that are in the same field. They can help you with any questions and doubts you have in your mind.

There are many new fields and opportunities that most of us don’t even know about. We often hear about placements in the fields of software engineering or in data science or quantitative trading. But there are several other fields as well, like cybersecurity, network engineering, blockchain, quantum computing, cloud computing, and many more. This list is not at all exhaustive. You can pursue either research or jobs in any of these fields. Even if you are unsure about trying out what you like, you can just give it a shot and see what happens. There is no rule that you cannot change your field once you enter it. In fact, it can be easy to change fields in many cases. Also, at the initial stages of your career, it is normal to try out various fields and select what suits you the most.

Always keep in your mind that you can do anything you desire. It is your choice what you want to pursue in your life. Just have faith in yourself and don’t be afraid to try things that you like.

As a closing note we quote the poem “The Road not Taken” by Rober Frost which perfectly sums up our thoughts!

“Two roads diverged in a wood, and I—
I took the one less traveled by,
And that has made all the difference.”
Let’s start with a brief introduction about this domain, can you please explain what Quantum Computing & Information Theory is all about?

Quantum computation and information theory (QIT for short) is about what happens to classical computation in the presence of quantum mechanics. I urge you to recall that the behaviour of the “software” of the universe is governed by the rules of computer science whereas the rules of the “hardware” are governed by physics. For example, if you think of a black hole as a computer which accepts matter as input and outputs radiation, this changes your perspective on what that object is, bringing ideas from computer science to pollinate our point of view of physical systems. Likewise, if I think of software as a physical process happening on a machine, ideas such as Landéurs erasure limit appear. So this cross-pollination between hardware and software is quite fruitful.

Within this context, QIT is an attempt first and foremost to understand what a computer will do if it could access its on quantum mechanical nature. This means one has to understand computer science where the physical model underneath of the physical device that the computation is being performed on is quantum. So this is one explanation of the field of quantum computation. This can of course be extended to ask questions about other technologies. For instance you can ask if sensors made to detect electric fields, magnetic fields and so forth would benefit from being able to access their own quantum nature. Would that be better for the outcomes of the sensor in your phone or smartwatch? Or would that be worse? The answer in general is that it would of course be better, but to understand this you need to understand the theory of quantum computation.

Is Quantum computing an emerging field these days? What makes it exciting?

Yes, it is an emerging field these days. Though the seed of the idea has been with us since Feynman in the early 80s, Shor in the mid-90s showed that QIT has implications on security. This and other results by Grover, Simon, Vazirani etc. This is because we can detect fields, magnetic fields and so forth would benefit from being able to access their own quantum nature. Would that be better for the outcomes of the sensor in your phone or smartwatch? Or would that be worse? The answer in general is that it would of course be better, but to understand this you need to understand the theory of quantum computation. Within this context, QIT is an attempt first and foremost to understand what a computer will do if it could access its own quantum mechanical nature. This means one has to understand computer science where the physical model underneath of the physical device that the computation is being performed on is quantum. So this is one explanation of the field of quantum computation. This can of course be extended to ask questions about other technologies. For instance you can ask if sensors made to detect electric fields, magnetic fields and so forth would benefit from being able to access their own quantum nature. Would that be better for the outcomes of the sensor in your phone or smartwatch? Or would that be worse? The answer in general is that it would be better, but to understand this you need to understand the theory of quantum computation.

What kind of opportunities does this field offer in terms of career growth and development? Can we expect more job opportunities in this domain in the future?

The old saying goes that you should never predict the future, but yes, the trend seems to be that for a while now, the demand for a skilled quantum workforce will far outstrip the supply of qualified and mature scientists and engineers, who are being trained in our very institutes.

As I mentioned, there are large companies investing in everything from hardware to algorithm development, so there are bound to be jobs for folks with a variety of interests. Furthermore, there are several startup companies that hope to provide quantum computing services to solve complex tasks in pharma companies, drug design, operations research etc. It’s a good time to do quantum computing.

What courses do you offer in QIT at IITB lab. Can you please tell us more about it? What kind of research work does the group do? And what are you working on currently?

My group works on three themes. The first is quantum information theory persay. Let me give you an example or two of projects I have worked on in this area. With colleague Carlos Perez Delgado at University of Kent in the UK, I coauthored a paper on the implementation of quantum computers on universal classical computation. On a different note, with dual degree EP student Policherla, I coauthored a paper on how noisy quantum computers (so-called NISQ devices) can be engineered to perform quantum control. This was a theoretical proposal for “device engineering” combined with theoretical tricks to implement control.

The second topic I work on is quantum control theory. This topic involves solving important problems to control quantum systems to come up with either experimental designs or control protocols (or both) to engineer outcomes desirable to the quantum computing community. I note that since machine learning, optimization and control are closely related areas, I also work on machine learning of quantum systems. The aforementioned paper on quantum information is actually about performing control algorithms on NISQ devices using techniques from the quantum machine learning community. On a sidenote, let me highlight Prof. Navin Khaneja who is a real expert on this topic and works in the Systems and Control department.

The third topic I am interested in is non-equilibrium quantum thermodynamics. This is a vast topic with decades of work, so I am by no means the expert. Having said this, my recent interest in this has been in the field of optimal engines and refrigerators in the quantum regime. This alongside some of the work we have done with Prof. Bhaskaran’s group has been about contributing realistic quantum technologies beyond computers. For example, with students Adil Khan, Anuraman Das, Parvinder Solanki, and coauthors who passed through IITB. Prof. Bhaskaran and I worked on an “engine” whose output is not mechanical work, but entanglement. This weird device can with modifications be implemented in quantum dot architecture like the one in prof.Mahapatra’s lab and can serve as a tiny engine that emits entanglement on demand. This preprint can be seen here.

How can interested students get involved in the research work under your guidance? Do you have any advice for those who want to get started in this domain.

I encourage folks to come in via an SLP route and transition to a BTP/DDP. This is because learning the ropes of this new and exciting field already takes about a year, and hence real progress takes about two years to achieve. Just come chat with me and also talk to my group members to get a good sense of what we do. I recommend take quantum mechanics course beyond 107 (something with bra-ket notation) followed by the quantum information theory course. After this, come talk to the various faculty members I have mentioned to find mutual interests.
**SPIDER-MAN**

Peter Parker is a brilliant young student eager to explore the Insti culture. During the weekends, Peter often visits Sameer Hill. He wishes to become just like his ISMP Mentor - Tony Stark, and taking inspiration, he has been dedicated to academics from the get-go!

**MS MARVEL**

Kamala Khan is the most cheerful and enthusiastic person one could meet! She loves exploring new domains and meeting new people. With eyes beaming, Kamala screamed with excitement when she met her idol alumni Carol Danvers, a.k.a Captain Marvel, last week!

**THIRDIES**

**MR FANTASTIC**

Meet Reed Richards, a.k.a. Mr Fantastic! Often seen in the reading halls of the Central Library, Reed loves working on research projects, tackling difficult problems and expanding upon a perfect solution. With his scientific brilliance and a perfect academic score, Mr Fantastic looks forward to making a career in the field of computer science research!

**BLACK WIDOW**

Having taken the Cryptography elective, Natasha Romanoff has developed an interest in the subject. She is a member of the Cybersecurity Club and often participates in different events and competitions related to cybersecurity and ethical hacking. She loves to roam around the whole campus and the city of Mumbai with her best friend, Clint Barton, a.k.a Hawkeye!

**FIFTHIES**

**THOR**

No one knows how long Thor Odinson has been in Insti, but rumour has it that he is much older than he looks! Could be ten, hundred or a fifteen hundred years! What we do know is that he misses his roommate Loki often, who graduated a few years back. Thor loves his Electric Guitar “Mjolnir”. You should have had a glimpse of him playing “Thunder” last year!

**PROFESSORS**

**THANOS**

Thanos teaches an elective course on Computer-Resource Optimization. His courses are considered the most dreadful across the Department because he likes to pass only half of the students that register. “Perfectly balanced, as all things should be!” Thanos smiles as he snaps away the CPI’s of all the students.

**NICK FURY**

Nick Fury teaches the Department Introductory Course, or as he likes to call it - “The Department Initiative”. He looks forward to training this year’s batch of talented and enthusiastic cadets, such as Peter Parker, Kamala Khan and Groot.
The initial problems with setting up anything is always getting the momentum. Akash Aum Naik, Founder of CSE, Batch of 2019, had to start from the beginning and started convincing people that there were problems with CSE. Nalin Shah, another member of the very first WnCC, demonstrated how a WnCC could work if it were established properly. With the momentum, the club was established with a great enthusiasm in the freshers’ batch of 2020. The club was initially small, but we are proud of how much we have grown and contributed to the community. We have organized various events and workshops that have helped many students and motivated them to pursue their goals. As we celebrate the first generation of CSE members, we continue to strive for excellence and grow as a community. We encourage everyone to join us and be a part of the journey. We are looking forward to the future and what it holds for us.
MANAGERIAL RACE AND DARK YEARS

Then came my third year and talk of succession to manager position were just around the corner. By this time, Rupesh, Yash and Aryan had left the club and had started working full fledged on Machine Learning problems exclusively and Ashish had started the process of slowly drifting away along with them. The only candidates for the manager position were Rishabh and I. I barely knew anything about security except a bit of reverse engineering and binary exploitation. I deeply respected and wanted Rishabh to become the manager owning to his perfect balance of people skills and web exploitation knowledge despite his disinterest. In fact, he also managed to discover a vulnerability in the placement portal (which probably isn’t fixed yet, I hope) and that lent even more credence to my choice of him as the manager.

After that, I helped organize a few talks on prof. Vinay Rebete and a few from other students in the institute. Eventually, due to certain circumstances, I was away from the institute for the entirety of my 6th semester and cannot give a proper account of what happened during that time. But to my delight, Rishabh took the reins of the club. Unfortunately, the club was mostly stagnant online during majority of this period, with barely any events.

ACtivities - Of the jEdi Council

A NEW HOPE

Enter Himanshu and Lakshya (B.Tech CSE, batch of 2020). These guys singlehandedly revived the club from a state of neglect and popularized various events of the club throughout the institute. Himanshu went on to specialize in cryptology and also bagged some medals from NSU Crypto International Cryptography Olympiad and joined the widely acclaimed CTF team, ZNF0. Following in his footsteps came Sahil, he buttered up Himanshu and developed a deep bond with him over the course of solving problems and CTFs with him. I was not much associated with the club during this time.

RETURN OF THE JEDI

After a long break from club activities, graduation and an internship later, I decided to reconnect with the club having gained some more security knowledge. This brings us to the activities that our club conducts and how can one join in. The club is very open and aims to expand our influence far beyond the limited scope of CSE branch, since security is pervasive. To that end, we also have 3 conveners from Mechanical Department too. As a result, joining the club is a very simple affair. We have a very active discord group with a plethora of resources to suit all your needs. All discussions pertaining to CTF participation and hobby project happen there.

We also have a WhatsApp group, whose membership is a bit exclusive to active members, although we shun the idea of exclusivity it is due to the participant cap on WhatsApp groups; however, we ensure that all important information is circulated promptly on discord. So, joining the club is basically equivalent to hopping on the discord server and introducing yourself. As for activities, we participate in CTF competitions that are organized by various bodies whenever we find ourselves free. We don’t have any flagship event per se. But there are some basic events which you may consider as flagship events namely - Intro to CTF, Insti CTF and the latest addition to the roster is a semester long student run security education course dubbed Year of Security (YoST). Apart from that, we recently held sessions on Linux, Python and CTF for incoming froshie batch and have also taken sessions on various topics which can be found on Teams Hope to see you there, soon.

MIRAI - THE FUTURE

CSEC - THE NEXT GENERATIONS

I am personally very happy the way the club is functioning. The conveners are working day and night (and somehow joking about not working for even longer durations of time. I don’t know how they manage that). But going forward there are many things the club wants to accomplish. Obviously, knowledge transfer and blessing everyone with a good time are hallmarks of the club but going forward we want to inspire and keep the club a very inclusive one. Organize sessions on interesting topics to facilitate knowledge transfer, improve our publicity and gather likeminded people.

We also want to appoint a professor as a faculty mentor like a lot of other clubs from other institutes, in order to gain credibility and funding. Eventually, use that funding to establish a CSEC room in CSE department and creating environment for hardware reverse engineering and hacking to pique interest of people from other departments too. The list of ambitions is going to expand with time and I’m happy that we have really able juniors who can entrust the torch to.

"WE ARE CURRENTLY COLLABORATING WITH OTHER CYBERSECURITY CLUBS (AND TECHNOLOGY CLUBS IN INSTITUTE TOO) IN THE COUNTRY AND ABROAD, LIKE IIT KANPUR AND NYU.

HACK THE PLANET!"
Following WHO guidelines to tackle Coronavirus many institutions were closed and all the students were asked to vacate their hostel rooms, in order to avoid spread of the dreaded COVID-virus which had resulted in pandemic, and that too on a hysterical level. Eventually government notice came out that dictated that all the colleges be shut and the classes be conducted 'online'.

And since then it has been more than a year and a half of Online Semester. During this period, online exams with multiple devices, homes transforming into classrooms, workplace and offices. Hostel common rooms replaced with WhatsApp chat groups and Discord servers, events burnt down to series of Instagram, Facebook stories, posts and google meetings, fests into classrooms, workplace and offices. Hostel common rooms more, and some never got to say goodbye to the insti the way they had planned.

But as they say, “Worst experiences teach the best lessons”. The online semesters definitely came with some of their own learnings apart from what we could grasp academically. The biggest of them all being time-management and the wonders that it does to make our life more efficient and days more fruitful. How can we utilise the time we save because of not dressing up every morning? How do we choose to handle Discord gaming sessions with Zoom meetings? This newfound free time (and the lack thereof) allowed us to introspect and change aspects of our lifestyle. Previously, those who were too tired to hit the gyms after class found an opportunity to try home workouts. Those who never entered the kitchen were suddenly after the chance to try home workouts. Those who never watched movies discovered the joys of anime. Honestly, not everyone is grasper academically. The biggest of them all being time-management and the wonders that it does to make us efficient and days more fruitful.

Discussion amongst friends and acquaintances dropped drastically, Online classes were not as engaging as offline classes and of course rampant cheating and unfair attitude towards honest students.

- a Fourthie

The business side of 100s of aspects I learnt at home (from my father), is something that was more worthwhile than just studying in my department (which I was able to comfortably do at home).

- Pranav Goyal (another Fourthie)

Online semester, through its classes, meetings and virtual collaborations taught us how to work synchronously over the internet remotely, interact and collectively work towards goals without even seeing each other in real life. In today’s globalized economy, WiFi, remote jobs and projects are widely prevalent and we can thank the online semester for training us to handle the same.

But above all, we will probably agree on the fact that the online semester taught us the significance of face to face interaction and how offline interactions can’t be replaced by the online regime. Seeing a loved one over Zoom can never replace the joy of giving them a tight hug in real life. It taught us the importance of friends, who in times like these, kept us motivated through late-night VO's, sharing reels with “this reminded me of you” and having random chats over the phone.

On a lighter note, the online semester gave us a huge amount of texting slang ranging from lol, lmao, to a host of newer terms like afak, afar, ik. Not to mention the countless WA stickers it gave us XD. In some sense this became the unofficial insti lingos. Nothing to be proud of, but something that can indeed be cherished as a memory.

It gave us flexibility. A person can literally attend lectures from wherever he wants: bedroom, balcony. In the car, you name it. Recordings of these lectures gave us the flexibility to watch it at our own speed (2x huh?), whenever we want. In an offline setting this is hardly possible especially because lectures may or may not be recorded.

The professors became more approachable. Now contacting/discussing something with the professor is as simple as dropping him an e-mail or a MS Teams message. No need to take appointments or wait for the office hours.

Online semester gave us a chance to accommodate our academics in a way that allowed us to explore more and take up more credits. More credits meant more load but online semesters helped us manage them efficiently.

Good thing is we had the opportunity to spend time with family.

- Thirdie

Apart from that, owing to the various problems: network connectivity, power outage, medical emergency or any other such issues, the deadline for assignments and labs were softened. We got more time to complete our labs which did become tiring but at the end of the day, it helped us submit efficient solutions with proper learning.

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EXPLORING C-MINDS DEPT.

## INSTRUCTOR WEBPAGE

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

## COURSE WEBSITE

https://www.minds.iitb.ac.in/index.php/academics#minor

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**Prof. Sunita Sarawagi**

"I am a faculty member at Computer Science and Engineering department of IIT Bombay. Since March 2020, I am also the Professor in charge of CMInDS. My area of research is Machine Learning, data analysis, and data bases."

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The C-MInDS department was set up last year and since then has been one of the most popular Minor among students. It'll be great to know from one of the founding professors the motivation behind starting the C-MInDS department?

Students at IIT Bombay, across all departments, are eager to learn about AI/ML and Data Science. We believe that students across the board should learn more, not just to satisfy a demand from the industry, but because of the importance of these areas in R&D across every branch of knowledge. Today, multiple departments offer courses in these areas. There is an opportunity for better coordination between and structuring of these multiple offerings keeping in mind the needs of the bulk of our students. Industry is keenly looking to hire students trained in AI/ML and we as a country are lagging behind in AI/ML research. A formal minor in AI and Data Science is a small step that IITB is taking to address these needs.

There are already courses in Machine Learning, AI and Data Science being offered within the CSE Department. So what makes the C-MInDS department unique? And were there any academic challenges faced in starting this initiative?

The interdisciplinary nature of the curriculum and the opportunities to interact with experts in the application domain spread across various engineering disciplines of IIT is what makes the center different from CS. The major challenge is to handle the huge demand for the two core courses that are part of the CMInDS minor (DS 203 & DS 303). Also, design of curriculum to make it appealing to students of all departments was a challenge.

What was your personal motivation to join the department? What are some of the research fields that you're working on related to C-MInDS?

First, let me clarify that this is a three year position, and I continue to be a CSE faculty. I was asked to serve as Professor-in-charge of the center based on my seniority and relevant experience in the area. The center offers opportunities to interact with faculty and students across other departments at IITB, and AI organizations who wish to collaborate with us. My research has not changed much as a result of this position. I continue to work in machine learning topics spanning structured predictions in NLP, domain adaptation and generalization, low resource adaptation for Indian language and speech tasks, and data analytics. However, I have greater appreciation of other application in other engineering disciplines.

What are the practical applications of this minor and which domain of Computer Science research/field does this train a student for?

The minor comprises two core courses: DS 303 focused on providing the foundations of machine learning and DS 203 on covering the programming aspects of data science and machine learning. Thereafter there are a large number of electives spanning greater mathematical concepts, core A/I/ML, and applications of A/I/ML across various disciplines.

Data Science is a buzzword these days and the number of career opportunities in this field are growing at a fast rate. How does the C-MInDS minor prepare the students for this increasing demand?

Several large companies in India and worldwide are hiring engineering graduates with AI and Data science expertise. Further, some students may use the minor to decide on further studies and/or a research career in AI/ML. Even though many CS students are already taking several AI/ML courses, the minor in CMInDS allows them to explore courses that stress.

Apart from the minor and courses, what are some of the research opportunities that the department offers?

The center facilitates tie with AI/ML industry and government organization. This provides opportunities to explore interesting and relevant research projects. Announcements about such projects are circulated with CMInDS associated faculty periodically. Interested faculty may in turn engage students as appropriate. CMInDS runs an AI/ML seminar series that seeks to foster inter-department collaboration.

Are there any opportunities that the department offers for the post-graduate students?

CMInDS already has an IDDDP program and plans to start a MS by Research and PhD program in Fall 2022. We hope to find projects for these students that are developed in close collaboration with companies. Also, we are exploring sponsorship, internship, and fellowship models with industry. We also plan to have a visiting student/exchange program whereby our students can spend time working in other academic institutions or companies worldwide.

What are the future plans for C-MInDS? Are there any new initiatives that the students should look forward to?

CMInDS will grow to be like a normal department in IIT Bombay. Starting Fall 2022, we plan to offer a MS by Research and PhD degree in AI and DS. Eventually, the center builds up its own core faculty strength and with the partnership of existing departments in IITB, CMInDS will also offer an undergraduate degree in AI/DS.
WHAT WAS YOUR MOTIVATION BEHIND CHOOSING A HIGHER STUDY OR PHD? WHAT IS YOUR ADVICE ABOUT DECIDING THE FIELD?

During my undergraduate years, I tried experimenting with different domains, like ML, ML, and ML. I want to highlight that Indian societies are pretty much based on comparison and competition. This decision should be based on what you really enjoy & what you really dislike. You should be well aware of your own scenario currently and how you project your future trajectory. The key is that you create around yourself, free from others, so that you make your confident but with realism.

WHAT SHOULD STUDENTS LOOK OUT FOR, WHERE, RESEARCH ABOUT UNIV/PROOF?

Cracking.org is one of the best ways to understand how you should filter to a span of the last 5 years. This helps you to filter those professors who are picking in their field but not currently active in research. The next step should be to browse through current papers in the area of your interest. Then, you should be able to decide who the prestigious professors are actually applying to PhD. Firstly, you get to know what the professor is working on. If you are planning to take a sabbatical, etc. Secondly, you get to hear about the work on a first-hand basis. It might help you enormously to decide whether you are a good fit for the lab. Thirdly, very few people take the time to contact the professors, and such interactions might tell the professor’s research that you have a better understanding of your profile.

HOW DID YOU DECIDE WHICH COLLEGES TO APPLY TO? HOW SHOULD ONE DECIDE HOW MANY COLLEGES TO APPLY TO?

I can particularly speak for PhD. Here in the PhD. application, the university ranking takes a lot of importance. The professors should revolve around professors, their research, and their labs. Some very good universities might have the best professors in Computer Science, but they might lack the position in the area that you are targeting. Also, active research professors should be an important part of the communication. If one has a very specific basis based on location, college, community, etc. then the choices might differ but on a general level, for a PhD. the above three things should be enough to help you shortlist colleges. Again, the public standard is around 10 colleges which I feel is decent enough given the high application fees. Also, 10 colleges give you enough chance of selection while preparing with enough data about the available jobs. Personally, I applied to 7 colleges and I never had (or was unable) to make the Ph.D. If this realization, I realized all the professors at these universities did work that were aligned with my interests and my profile was a strong match with their research. I was planning to apply to EPLF and CISPA as they have some really good security professors but then did not as they had an early deadline.

WHAT IS THE SCENARIO OF GETTING FUNDING? HOW EASY IS IT TO GET TASHIP OR FELLOWSHIP?

PhD students are almost always guaranteed funding for the entirety of their PhD program. MS students, however, are not guaranteed funding for the entirety of a few MS programs like Cornell/Princeton, but it is possible to get a TA/Rship in some of your semesters. The ease of getting these positions, as well as whether they pay a standard wage, varies widely, depending on the research funding. There are a few scholarships, grants, and loan programs in India, like the Narotam Sekhsaria Foundation, for students. Some universities also grant fellowships at the time of admission, but I am unfamiliar with the selection process.

FINALLY, ANY WORDS OF ADVICE FOR STUDENTS LOOKING TO APPLY IN THE NEXT SEASON?

Be confident in yourself and your applications! Talk to other people in the same boat like your friends who are also applying to grad school. It will help relieve stress to some extent. Talk to professors and knowledgeable seniors; they often have really great pieces of advice! Know that grad school applications are really stochastic and uncertain, so don’t fret too much during or after the applications; just have faith and you’ll make it through!

WHAT ARE THE CULTURAL OR ACADEMIC DIFFERENCES/SIMILARITIES THAT YOU OBSERVED WHEN COMPARED TO INDIAN UNIVs?

There are many differences for sure. Personally, I found the focus on coursework to be less in the universities in the west and more on research. While this could be confusing, it is worth noting that the perspective is definitely helpful for students to develop their interests themselves and at their own pace. The research topics available here are diverse and contrived curriculum helps students to take up more courses in different areas and courses units in the first few courses, which is a common scenario in almost all Indian universities. Another striking thing is the presence of a huge student body in the universities, which is different from the purpose of a placement cell should not be to actually put students into jobs but only to make them ready for the application process and aware them of the opportunities present. Preparing for the interview also portrayed some of the universities of the students with considerable doubt, interviews, and help the students to actually study the company they are applying to and not merely going through the motions of getting a high package or Day 1 jobs.

FINALLY, ANY WORDS OF ADVICE FOR STUDENTS LOOKING TO APPLY IN THE NEXT SEASON?

I think I would say “just apply” if you feel you are not industry-ready. It is always good to invest some years in yourself in at the least amount of doubt. And anyway, having the IITB tag would ensure you land somewhere nice no matter whatever path you take.

WHEN SHOULD ONE GIVE GRE & TOEFL? HOW SHOULD ONE PREPARE FOR THE SAME?

I just practised the free mock tests and prepared much for the AWA. For TOEFL, I used various mock tests provided with the exam registration and used those to improve my exam solving technique. For GRE, I reviewed the - 200 page long syllabus online from the web and did not really prepare much for the AFOE. For TOEFL, I also practised the free mock tests and practised the Speaking section a bit.

IDEALLY, WHEN SHOULD ONE START WORKING ON THE SOP? HOW SHOULD ONE GET IT REVIEWED?

You should give yourself about 4 months to write an SoP. What I mean by this is, even 4 months before the earliest deadline, you should have figured out approximately what you’re going to write in your SoP and should start writing a very rough draft of the SoP. That way, when you start iterating on it, you should send it out to a bunch of seniors to get it reviewed. You should choose a set of trusted seniors, those who already know your field of interest as well as those who do not. If you feel like your initial ideas fit and your interest in their specific research areas 3) general CS degree; NLP research culture, etc. I ended up applying to 14 universities. I think a general 10-15 universities is a good number to apply to.

WHAT ARE THE RECOMMENDED NUMBER OF LORS ONE SHOULD GET? DOES AN LOR FROM THE COMPANY THAT ONE INTERRED HOLD VALUE FOR MS/PHD APPLICATIONS?

3 letters of recommendation are ideal (and also a requirement!). Try to get letters from advisors or supervisors whom you have worked closely with and who can attest, at a reasonably personal level, your abilities and style of performing research. Great letters, even from famous professors, are not as impactful. Research-oriented letters hold the most value for most MS/PhD applications. An LoR from a company certainly holds value, especially if your letter writer is someone you closely worked with and impressed; the letter will likely be very positive. However, in general, company software development is valued less than company research, which is valued less than academic research. There are of course many exceptions.

WHY DID YOU DECIDE WHICH COLLEGES TO APPLY TO? HOW SHOULD ONE DECIDE HOW MANY COLLEGES TO APPLY TO?

Note that I was applying for a PhD in CS, specifically in NLP/Speech. I checked a) university rankings in CS, b) rankings of a specific subject in my subfield (NLP) and c) general ranking and research culture for top 20-30 universities. These were ‘coarse’ criteria. After this, I ranked all these universities using my own NLP-PHI-derived criteria, broadly 1) number of professors working in my field, 2) their suitability for and interest in my specific research areas, 3) general CS degree; NLP research culture, etc. I ended up applying to 14 universities. I think a general 10-15 universities is a good number to apply to.

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"No hootenannies, sing-alongs, raucous laughter, the clinking of glasses, celebratory gunfire, or barbershop quartets after 10 pm, as well as no whistling, no spontaneous Biohazard drills, or Tuvan throat singing"

Dr Sheldon Lee Cooper, PhD reminds Dr Leonard Hofstadter, of the Article 23 Subsection 2C on loud noises, mentioned in The Roommate Agreement.

"Hey! Where are the keys?" I asked as I carried my luggage from the auto when for the first time, I witnessed my lush-green campus and beautiful Mumbai rainfall in the last week of July. “With the security guard. Put the luggage quickly, and come to Convocation Hall. The Orientation has started!” my roomie said.

Due to the continuum of quarrels I have with my younger sibling, we always studied in separate rooms and having a permanent roommate for three years, was going to be a big challenge! Still and all, things went pretty well (maybe our consecutive birthdays helped, who knows), and with my roomie, I struck up my first friendship in insti. But when you get teensy hostel rooms (looking at you, H3), tiny adjustments become essential and herein, comes our Roommate Agreement!

The Roommate Agreement might not be a Sheldon-Esque agreement, an evenly spaced and neatly formatted, formally signed, and printed document, but just a bunch of implicit rules, you bound your roomie to follow!

Even though about two years have passed with most of the clauses rendered inapplicable (except the Wingman Clause, quite naturally), these often unsaid but sincerely followed rules of companionship bring back wonderful memories. College friends that you can share all your joy and sorrow with, are but a blessing in disguise. A roommate can be one such blessing (use the following algorithm!) who, like Leonard does for Sheldon, keeps your dear sanity in check!

---

**THE ROOMMATE AGREEMENT**

1. **THE NIGHTLIGHT CLAUSE**
   In any case, my roommate would allow me to switch off the lights after midnight, and I would wake him up in the morning. Thanks to the pact, that even though my roomie slept at around 4 am, he only missed one Physics Lab. He later gave a Pink Slip but slept through that lab too, so there’s that.

2. **THE GIRLFRIEND CLAUSE**
   If (ever) my roommate gets a girlfriend and brings her to our hostel room, I will pack my belongings and stay in my wingie's room indefinitely. Needless to say, it was just a pipedream, and never saw the light of day.

3. **WINGMAN CLAUSE**
   Self Explanatory. You are encouraged to undertake further readings of the clause in The Friendship Agreement.

4. **KEY-HOLDER LIABILITY CLAUSE**
   As one key got lost for good, the primary job of the incumbent, is to unlock the room after the lecture ends. This subsection was later removed with the invention of number locks.

5. **WATER-RETRIEVAL CLAUSE**
   Alternate night duties to fill up both the water bottles. The floor water supply not being adequate, the roommate is expected to use the water tank, downstairs in the mess.

6. **THE PANEER CONUNDRUM**
   Contingent upon the Service of Extra Veg Specials in our mess, my roommate has an obligation to timely inform me. I shall oblige and inform my roommate in case of Extra Non-Veg.

7. **PRIVACY POLICY**
   One is strictly not allowed (or advised) to unlock the roommate’s phone (and by implication, read his WhatsApp chats), as he is asleep, using his thumbprint. The policy, as stated by my roommate, when broken (again) might lead to some stringent actions being taken.
Hey readers,

Hope this finds you and your loved ones happy and sound. We are delighted to bring to you the 2022 edition of our department’s student newsletter, bitStream. This is the first time we’re publishing in the print form.

With this edition, we’ve gone all in! We’ve cover interviews with professors, talks with alumni, discussions on some important but untouched topics, and introduced a fun section as well!

We want to thank everyone who has contributed to this newsletter in any capacity. We would like to especially extend our gratitude towards the faculty, alumni and students who graciously volunteered for the interviews and helped us document their experiences. If you have some topic that you would like to be covered, feel free to contact us. Do share your thoughts and suggestions on this edition by writing to us at editor@cse.iitb.ac.in.

Team bitStream 2021-22