

Mihir Vahanwala  
B.Tech Computer Science and Engineering (2022)  
CPI: SS.SS

180070035  
UG Third Year  
Male  
15/09/2000

---

## Research Internship

**SUMO Team, INRIA Rennes**

*(Remote Internship, Summer 2020)*

- Studied the **Skolem problem for Linear Recurrence Sequences**, whose decidability for the most general case is a long standing open problem, and reductions which prove its NP-hardness, even in the decidable cases
- Used sophisticated **Diophantine approximations** and **algebraic number theory**, in particular, **Masser's** results, to investigate the novel, but related problem of **Robust Positivity** of Linear Recurrence Sequences
- Intuited a **geometrical perspective** of the known techniques to decide Positivity for LRS
- Invoked **Tarski's results** in the existential theory of reals and the **Mignotte separation bound** on algebraic numbers to establish a **PSPACE upper bound** for the Robust Positivity problem

## Teaching Responsibilities

**Moderator, TSS Learners' Space, L<sup>A</sup>T<sub>E</sub>X Boot Camp**

*(Summer 2020)*

- **Prepared tutorials and assignments**, designed to introduce L<sup>A</sup>T<sub>E</sub>X as an office tool, endow reasonable mastery over frequently useful L<sup>A</sup>T<sub>E</sub>X utilities, and explore **advanced field-specific L<sup>A</sup>T<sub>E</sub>X tricks**
- Oversaw the **logistics** of enrolling **over 300** participants and actively evaluated submissions and provided **personalized feedback**. Used **Piazza** as a forum for announcements, discussions and doubts

**TA, Student Support Services**

*(2019-20)*

- Conducted two Tutorial Service Centre **Help Sessions** for **MA 106: Linear Algebra** in Spring 2020
- Conducted help sessions for **CS 101: Introduction to Computer Programming** in Autumn 2019 and Spring 2020, which entailed **reinforcing concepts, solving doubts and past exams**

**TA, CS 251: Software Systems Laboratory**

*(Prof. Amitabha Sanyal, Autumn 2020)*

- Assisted the professor in designing the **course contents and outline** to adapt to the **online mode**
- Working on **designing challenging assignments** and helping the professor prepare lectures to introduce CSE sophomores to various programming languages and office tools in a **"hands-on"** manner
- Preparing to mentor several teams of students with their intensive **course projects**

## Technical Skills

Each of the following are sorted in roughly decreasing order of experience

**Programming** C++, Python (and Z3), MATLAB, VHDL, Java

**Web Development and Databases** HTML, CSS, JavaScript, SQLite, Django

**Office Tools** L<sup>A</sup>T<sub>E</sub>X, svn, git, AutoCAD, SolidWorks

## Course Projects

### Memory Allocation Simulator

*Prof Ajit Diwan, CS 293- Data Structures and Algorithms Lab, Autumn 2019*

- Devised **efficient data structures** to represent the state of the given programs and memory locations
- Ideated an algorithm to allocate a specified number of consecutive memory locations to **current and pending requests**, if possible, using the **first fit strategy**
- Incorporated cases that allowed for the **deallocation** of a particular instance of a program, or the **termination** of a program, and the subsequent freeing of memory locations
- Implementation as a C++ command line tool that handled 30,000 requests for a billion locations in 10 seconds or less, and **8,000 requests in less than 2 seconds**

### Survey Management

*Prof Amitabha Sanyal, CS 251- Software Systems Lab, Autumn 2019*

- Used the **Django** framework to create a web application that allows users to **sign up/login securely** and then proceed to **edit their profile, create, edit, manage or submit forms**
- Forms were **targeted**, that is, their access was controlled by a code; they were also **modular** in their design, allowing for the surveyor to use different question types and specify the input data type
- Responses were validated and then stored in the backend database for further analysis

### Spanning Tree Protocol

*Prof Varsha Apte, CS 252- Computer Networks Lab*

- Wrote an **object-oriented C++ simulation** of a network of hosts, ports and **learning bridges**
- Given a topology, the simulation would run the **spanning tree algorithm** and unambiguously establish **designated, root and null ports** for each learning bridge
- The program also simulated the exchange of packets between hosts to demonstrate the functionality of learning bridges, that is, **consulting and updating their forwarding tables**

## Scholastic Achievements

- Secured **All India Rank 75** in **JEE-Mains** out of over 1 million candidates *(2018)*
- Secured **All India Rank 96** in **JEE-Advanced** out of 200,000 candidates *(2018)*
- Scored **442 marks** out of 450 in **BITSAT** *(2018)*
- Secured **AP grade** for excellent performance in **EE 111- Introduction to Electrical Systems**, awarded to 3 out of 156 students taking the course *(Autumn 2018)*
- Secured **AP grade** for exemplary performance in **CH 107- Physical Chemistry**, awarded to 11 out of 1023 students taking the course *(Autumn 2018)*
- One of the 12 students to secure **Branch Change** to CSE on the basis of First Year CPI *(2019)*
- Qualified for **INJSO**, Indian National Junior Science Olympiad, having placed in the **National Top 1%** out of 46688 candidates in **NSEJS**, National Standard Examination for Junior Science *(2014-15)*

## Hobby Project

### Basic Chess Engine

- Allows human vs human gameplay, **throws an error at illegal moves**, in accordance with the rules
- Supports gameplay starting from a **custom position setup**, after **verifying the legality** of the position
- Accounts for **50 move rule and draw by threefold repetition**
- Capable of finding **Mate** in upto 6 moves, implemented in **C++** as a command line tool