



## Manoj Kumar

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## Education

year	Degree	Institute	%age or CGPA
----	(Dual) B.Tech+M.Tech	Indian Institute of Technology, Delhi	8.042
2017	Class 12th	Navjeevan Public School, Sikar	98.20
2015	Class 10th	ABN Sr. sec. school, Maulasar(Raj)	93.50

## Scholastic Achievements

- 2018 **Joint Entrance Examination(Advanced)** AIR 119(OB) among more than 1,500,000 students
- 2018 **Joint Entrance Examination(Mains)** AIR 405(OB) among more than 1,500,000 students
- 2017 Awarded with **silver medal** by Education Minister of Rajasthan for performing exceptionally well in class XII
- 2017 Secured **3<sup>rd</sup> merit** in Class XII(RBSE board) among more than **2,000,00** students who appeared in the exam
- 2020 Certified in Data Structures and Algorithms Program (**CCDSAP**) by **Codechef**

## Engineering Courses

<b>Computer Science</b>	<b>Machine Learning*</b> , <b>Analysis and Design of Algorithms*</b> , <b>Principles of Artificial Intelligence*</b> , <b>Computer Networks*</b> , Programming Languages, Discrete Mathematical Structures, <b>Data Structure and Algorithms</b> , <b>Computer Architecture</b> , Digital Logic and System Design, Design Practices
<b>Mathematics</b>	<b>Probability theory and Stochastic Process</b> , Linear Algebra and Differential Equations, Calculus
<b>Electrical</b>	Signals and Systems, Principle of Electronic Materials, Introduction to Electrical Engineering
<b>Online Courses</b>	Graph Search, Shortest Paths, and Data Structures; Machine Learning*

\*courses currently pursuing

## Major Projects

### K-MEDIAN IN A DIRECTED TREE

ALGORITHMS, C++

Prof. Smruti Ranjan Sarangi, IIT Delhi

February 2020 - April 2020

- Module programmed in C++ that computes **k-medians** in a directed tree (edges directed from child to parent) in  $O(Pk^2)$  complexity.
- The project aims to find the **optimal placement of cache proxies** in a computer network maintaining **minimum overall cost**.
- Implemented in 2 phases and each phase uses a space of  $O(nk)$  complexity (better than already established  $O(n^2k)$  complexity).
- Method employs **dynamic programming** for efficiency whereas best known algorithm for undirected tree is **NP-hard**.

\*k is the number of resources(proxyes) to be placed; 'P' is the path length of tree & 'n' is number of vertices/nodes in tree.

### SOFTWARE COMPARISON

SOFTWARE ENGINEERING

Prof. Smruti Ranjan Sarangi, IIT Delhi

December 2019 - January 2020

- Comparison of softwares used as *web browsers, pdf readers, music players, mail clients* etc. based on with similar functionalities.
- Analyzing the reasons for the **less efficiency of a feature** of one software as compared to other softwares with same functionality.
- Debugging the software features of **statically linked, non-stripped** version of the software using **Flamegraph**.
- Replacement of **less efficient** feature of one software with a **well efficient** corresponding feature in other software of same class.

### MIPS ARCHITECTURE PROCESSOR

COMPUTER ARCHITECTURE, VHDL, C++

Prof. Preeti Ranjan Panda, IIT Delhi

January 2020 - July 2020

- Module consists the VHDL implementation of a **multi-cycle MIPS architecture processor** on FPGA and **pipelined simulation** of the processor with *Variable delays* and *single-layer Cache memory* in C++.
- BlockRAM Memory Generation** is used to store the data as well as machine code and initialize the machine code using the **coe file**.
- Demonstrated on FPGA which contains the different components **ALU**, **Register File** and **Memory** and executes a large subset of the MIPS instructions. A *state machine* is used to implement the control of the processor.
- Implemented a **5-stage pipelined MIPS** C++ simulation by removing data hazards by avoiding stalls via **forwarding or bypassing**.
- Analyzed the efficiency of the processor by varying *HIT* and *MISS* probabilities; and **variable delays** after each memory access.

## ENCRYPTED VOTING PROTOCOL

MODERN CRYPTOGRAPHY

Prof. Subodh Sharma, IIT Delhi

August 2020 - present

- An individually verifiable voting protocol with complete recorded-as-intended and counted-as-recorded guarantees.
- Protocol does rely on several **cryptographic** constructs to establish its correctness and maintain indiv. & community **vote secrecy**.
- Software independent and bare-handed. Uses random distribution of pre-printed ballots with optional **cast-or-audit** component.
- The protocol optionally supports **voter verifiable paper audit trails(VVPAT)**.

## ProLog and Toy OCaml Interpreter

PROGRAMMING LANGUAGES, OCAML

Prof. Sanjiva Prasad, HOD (IIT Delhi)

February 2020 - March 2020

- Module programmed and implemented in OCaml using **OCamllex** and **OCamlyacc** for reading and parsing the inputs respectively.
- Basic functionalities of **ProLog** implemented using the techniques of **back-tracking**, **rule unification** for the resolution of queries.
- **SECD**, **Krivine machine** is used to implement Ocaml functionalities.

## 3D Structures using Graphs

DATA STRUCTURES AND ALGORITHMS, JAVA

Prof. Subodh Kumar, IIT Delhi

November 2019 - December 2019

- **Graph data structure** implemented by storing vertices and edges of a triangle in nodes to create 3D structures by linking triangles.
- Queries handled such as insert, neighbors, **topological distance**, centroid, **connected components**, **diameter** of the shape etc.
- **Dijkstra Algorithm** is implemented to find the minimum distance between two connected triangle nodes.

## Multi-threaded Producer Consumer Platform

DATA STRUCTURES AND ALGORITHMS, JAVA

Prof. Subodh Kumar, IIT Delhi

September 2019 - October 2019

- Module programmed in Java for multiple buyers and sellers to purchase and sell items using **thread synchronization** and **locks**.
- Maintained inventory and catalogue which sells product of the **most preferred seller** by maintaining priorities of each seller.
- Solved the problem of multiple threads to remain **synchronized** and sell the products from catalogue maintaining **thread safety**.

## UART Implementation on FPGA

DIGITAL LOGIC & SYSTEM DESIGN, VHDL

Prof. Anshul Kumar, IIT Delhi

October 2019 - November 2019

- The **Universal Asynchronous Receiver -Transmitter** (UART) implemented in VHDL for asynchronous serial communication that takes in **serial data** at given **baud rate** with a higher frequency of receiver to check discrepancies and converts it to **parallel 8-bits** for storage, which is then fed to the transmitter that generates serial data output.
- Implemented a **memory** of size **256 bytes** to store bytes (8 parallel bits) and by a single push signal, transmitter transfers the byte to the computer serially. **GTK terminal** is used for communication.

## Technical Skills

<b>Programming Skills</b>	Proficient in <b>C/C++</b> , <b>JAVA</b> , Python, OCaml, MATLAB, Prolog, LaTeX, javascript
<b>Softwares</b>	Android Studio, Visual Studio, Git
<b>Hardwares</b>	Xilinx ISE Design Suite and Vivado (VHDL and Verilog), MIPS assembly
<b>Web Development</b>	HTML, CSS, JavaScript(Basic)

## Extracurricular Activities

### Representative, Indoor Sports Club (ISC), IIT Delhi

April 2019 - March 2020

- Responsible for **administering all hostel affairs** related to *Chess, Carrom and Snooker Pool* in allotted hostel budget.
- Guided participants to **secure Silver** in Chess & Snooker Pool clinching **Prestigious ISC Trophy among 13 hostels**.
- Managed and executed various competitions- Inter-hostel and Inter-IIT Open Trials to increase Indoor Sports culture.

### Volunteer, National Service Scheme (NSS), IIT Delhi

September 2018 - PRESENT

- Regular volunteer in NSS, IIT Delhi, that consists the work on a diverse range of **social issues** through various **events** and **projects** which are aimed towards the benefit of people in and around IIT Delhi.
- Selected as Best Volunteer in **APNA PARIVAAR** project that aims to provide opportunities to **orphan kids** to gain confidence and develop their personality. It also consists of organizing **educational trips**, doubt clearing and teaching sessions.
- Volunteered in project **BACHPAN** that aims at improving the quality of life of the **less fortunate children** by providing them **education** and healthy childhood in and around IIT campus which include children of the construction site workers inside the campus.

### Academic Mentorship, Board of Student Wellfair, IIT Delhi

July 2019 - December 2019

- Selected for **Academic Mentor** of MCP100 (Engg. Visualization & Comm.) for one semester on the basis of academic performance.
- Guided First year students by organizing doubt clearing meetings and **tutorial solving sessions** to prepare them for the exams.

- During COVID19 lockdown, conducted a **survey** in all over India to assess **in-home** and **out-of-home discretionary activity engagement**. Built a **static website** to collect responses and analyzed the data. April 2020 - June 2020
- Worked as **Marketing Team Head** in the biggest cultural fest of north India, **Rendezvous, IIT Delhi** July 2019 - October 2019
- Worked on the position of **Events Team Head** in **Tryst**, annual technical fest of IIT Delhi February 2019 - March 2019
- **Intellify**: Developed problem solving video content for unprivileged students of Delhi govt. schools. May 2020 - June 2020
- Technical Content Writer at **GeeksforGeeks**. May 2020 - PRESENT
- Worked for the post of Content Developer Expert (Mathematics) intern at **Doubtnut**. May 2020 - June 2020
- **Common Room Committee** member, Girnar House, IIT Delhi. May 2020 - April, 2020
- **Hobbies**: Competitive Coding, blog writing, indoor games