Akash Trehan
Computer Science & Engineering
Indian Institute of Technology Bombay

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B.Tech.
Male
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Examination	University	Institute	Year	CPI / %
Graduation	IIT Bombay	IIT Bombay	2019	9.73
Intermediate/+2	C.B.S.E.	Guru Ram Dass Public School	2015	94.80
Matriculation	I.C.S.E.	St. Joseph's Convent School	2013	96.83

Pursuing B.Tech. (Hons) in Computer Science and Engineering

Academic and Technical Achievements

- Presently **Department Rank 2** in the Computer Science batch of 121 students
- Secured **All India Rank 24** in **JEE Advanced 2015** out of 150,000 students
- Received IIT Bombay's **Institute Academic Prize twice**, for 2015-16 and 2017-18
- Awarded the Kishore Vaigyanik Protsahan Yojana (**KVPY**) Fellowship by Govt. of India
- **1st** position in **InOut Hackathon Blockchain Track** 2017, Bangalore and **Ubisoft GameJam** 2017, Pune
- **Runner Up** in **Yahoo! Japan HackU** 2017
- **2nd Runner Up** in **Microsoft code.fun.do Hackathon** 2016 and **Kandy Sugar Hackathon** 2016
- **6th** position among 1028 teams worldwide in **Seccon CTF** 2017
- **1st** position in **XLR8** 2015 for making a remote controlled obstacle crossing robot

Internships

- **Framework for Enforcing Security Policies in API based Web Apps** *(May '18 – July '18)*
  Guide: Prof. Jean Yang *Carnegie Mellon University (CMU)*
  - Developed a language-agnostic approach to specify and enforce access policies on REST APIs for database-backed apps
  - Implemented approach on top of **Python Django REST framework** with expressive cell-level, query-sensitive permissions
  - Developed case studies and automated testing to demonstrate reasonable performance overheads

- **Improving Fuzzing of Javascript Engines** *(May '17 – July '17)*
  Guide: Prof. Giovanni Vigna and Prof. Christopher Kruegel *University of California, Santa Barbara*
  - Made modifications to American Fuzzy Lop in **C language** which resulted in faster block coverage
  - **Found a bug in Apple Safari's javascript interpreter** - JavaScriptCore
  - Generated environments for automated running of experiments using **kubernetes** and **docker**

Open Source Contributions

- **OWASP ZeroDay Cyber Research Shellcoder** | *Open Web Application Security Project*
  - Implemented a new OSX x86 shellcode module using **assembly programming** for penetration testing
  - Successfully demoed at **DEFCON Labs** 2016 and **BlackHat EU**

- **SymEngine** | *Fastest symbolic manipulation library written in C++*
  - Implemented a new Infinity class in **C++** to handle calculations which could lead to infinitely large values
  - Added new functions for manipulations of symbolic polynomials and trigonometric functions

Key Projects

- **Bachelor Thesis: Blocktree - Solving Blockchain Scalability Problems** *(July '18 – Present)*
  Guide: Prof. Manoj M. Prabhakaran *IIT Bombay*
  - Designing and analysing a new permissioned and general-purpose **distributed** data structure with flexible policies, to address scalability issues in **Blockchain** in terms of both storage and computation power
  - Developing a proof of concept **python** implementation of the algorithms and network protocols for it
  - Theoretically proving **security** and robustness of the construction in various adversarial environments

- **SpamSlam - Spam prevention using Blockchain** | *Hack InOut 4.0 Winner* *(Oct '17 – Oct '17)*
  - Used Gnosis' **Ethereum** based **javascript** APIs to create mini prediction markets for emails, using a **Django** backend
  - Used **Machine Learning** techniques to create an approximate oracle for the prediction market

• **Programming network switches with P4 and framework for P4 primitives** *(Jan '18 – Aug '18')*
Guide: Prof. Mythili Vutukuru *IIT Bombay*
- Implement a distributed Stateful Load Balancer in P4 using proactive and reactive communication
- Used **python** Scapy to generate network traffic and extract useful statistics out of PCAP files
- Implemented a framework that provides primitives to simplify the development of P4-based applications
- **Published this work in P4EU Workshop at IEEE ICNP 2018**

• **Isolated Network Infrastructure for Security Experiments** *(Dec '16 – May '17)*
Guide: Prof. R.K. Shyamasundar *IIT Bombay*
- Set up a network of VMs mimicking an infrastructure with a DNS, Mail, Proxy, Web and Time server
- Used **vagrant combined with VirtualBox** to ease the process automatic generation of VMs
- Demonstrated **dictionary attacks, stack smashing and Man-in-the-Middle attacks** using the infrastructure

• **Indexing Schemes for Data Recording Systems** | *Course Project* *(Aug '17 – Nov'17)*
- Hacked **postgres** internals for implementing a new index to support large continuous stream of incoming data and store it in a manner suitable for future access
- Implemented stratergies for incremental organization of B+ trees in memory and on disk to support both insertion and queries with reasonable efficiency, and without the delays of periodic batch processing
- **Implemented the stepped-merge algorithm paper in C language** for merging B+ trees on disk for faster queries

• **Real-time Chat Application** | *Course Project* *(Apr '17 – May '17)*
- Built a multithreaded chat server using Linux socket programming in **C and C++**, with LDAP login support
- Implemented secure salted password hashing with Argon2i algorithm for storing passwords in database
- Built an **Android** and command-line client application with features like group chat, friend requests and last seen

• **Malware Classifier** | *Course Project* *(Apr '17 – May'17)*
- Trained **machine learning** models in **python** with **400 GB data from Microsoft** to classify malware samples
- Extracted n-gram frequency, segment size, pixel intensity as features from malware binary and assembly
- Used gradient boosting and filtering based on random forest feature importance score for better results

• **3D Graphical Modelling and Animation** | *Course Project* *(Jul '17 – Nov '17)*
- Implemented hierarchical models of 3D toys using **C++ OpenGL** and texture mapped for surface detail
- Simulated a spotlight and general direction lights and used shading algorithms for lighting and shadows
- Generated an animation video by recording keyframes and interpolating them

• **Compiler for a C-like language** | *Course Project* *(Jan '18 – May '18)*
- Developed a compiler for a C-like language in **python**, for MIPS instruction set architecture
- Supported major functionalities like function calls, if-else statements, loops and arithmetic expressions

• **Smashing the Stack** | *Course Project* *(Apr '17 – May'17)*
- Demonstrated techniques like **ret2libc attack** and **NOP spray** for exploiting buffer overflows, bypassing Data Execution Prevention (DEP) and Address Space Layout Randomization (ASLR) mitigations
- Demonstrated **format string exploits** to get arbitrary memory reads and writes

• **LendIt - Book lending website** | *Hack InOut 3.0 Finalist - NIT Surat* *(Aug '16 – Aug'16)*
- Implemented a backend using **python Django** for the Lendit website, which allows user interaction, sending notifications, searching and lending books, maintaining a user profile among other features
- Got selected among the **top 7** (out of 50) development projects and went through to the final round

Programming Skills

C/C++, Python, Bash, x86 assembly, MIPS assembly, SQL, Java, Javascript, Django, jQuery, Docker, kubernetes, Vagrant, OpenGL, LaTeX, Arduino, MATLAB, Git

Positions of Responsibility

• **Founder & Manager** | *CSE Cybersecurity Club - IIT Bombay* *(Nov '16 – Present)*
• **Teaching Assistant** | *Data Structures and Algorithms - IIT Bombay* *(Jul '18 – Present)*
• **Web Convener** | *Student Technical Activities Body - IIT Bombay* *(May '16 – May '17)*
• **Volunteer** | *Web and Coding Club - IIT Bombay* *(May '16 – May '17)*