

SUMER CAMPS ATTENDED

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ABSTRACT. Here, I discuss the essential contents of the three summer camps I have attended so far, during my B.Sc. years. I list the camps in chronological order, from oldest to most recent.

1. IMSC SUMMER CAMP

1.1. Camp whereabouts and schedule. My first summer camp was at the Institute of Mathematical Sciences. It was formally termed “Groups, Representations and Algebras”. Official website: <http://www.imsc.res.in>

The summer camp was from May 9th to June 17th. Lectures were held on weekdays from 11:30 a.m. to 1:00 p.m. and tutorial sessions were held in the afternoon from 2:30 p.m. to 3:30 p.m.

The address:

Institute of Mathematical Sciences,
CIT Campus, Tharamani
Chennai 600 113

1.2. Lecture topics. There were three lecture series:

- **Finite dimensional C^* algebras** by V.S. Sunder. I have printouts of the lectures. Sunder’s personal webpage is <http://www.imsc.res.in/~sunder> and his email ID at imsc.res.in is `sunder`.
- **Jacobson Density Theorem and applications** by K.N. Raghavan. I have printouts of the lecture. Raghavan’s personal webpage is <http://www.imsc.res.in/~knr> and his email ID at imsc.res.in is `knr`.
- **Representation theory of $GL_2(F_p)$ and $SL_2(F_p)$** by Amritanshu Prasad. Amritanshu Prasad’s personal webpage is <http://www.imsc.res.in/~amri> and his email ID at imsc.res.in is `amri`.

The notes are available online at:

<http://www.imsc.res.in/~amri/gl2p.pdf>

1.3. Tutorials. The tutorials were conducted by research scholars working at the IMSc:

- Tutorials for Sunder’s lectures were conducted by Ved Prakash and Jijo S. Both are Ph.D. students under Sunder. While Ved is a student of IMSc, Jijo is a student of the Chennai Mathematical Institute.
- Tutorials for Raghavan’s lectures were conducted by Ved Prakash and Shyamashree Mukhopadhyaya. Shyamanshree is a student of the Chennai Mathematical Institute and is doing her Ph.D. under Raghavan.
- Tutorials for Amritanshu Prasad’s lectures were conducted by Swagata Sarkar, who is a post-doctoral fellow at IMSc.

1.4. Why I applied for the summer camp. Reasons for my applying for the summer camp:

- I had been extremely interested in group theory for the past one year, and I wanted to learn more about the subject. At the time of applying, I was reading about some techniques which were used as tools in the classification of finite simple groups.

I felt that a summer camp would give me an ideal environment in which to expand the frontiers of my knowledge.

- In the **Algebra II** course that was going on at the time I applied, the instructor was teaching representation theory. I was fascinated by results such as the fact that characters form an orthonormal basis and that the character completely determines the representation. I was keen to learn more of the subject.
- My institute (CMI) had a close relationship with the Institute of Mathematical Sciences. Many of our courses at CMI were taught by IMSc faculty. I had visited IMSc a few times and had enjoyed some of the books in the library. I was keen to study under the guidance of IMSc professors.

1.5. **What I gained out of it.** The summer camp at IMSc helped me in a number of ways:

- Each of the three lecture series contained some fascinating topics. Professor Sunder’s series helped me place the representation theory of finite groups in a broader context. Dr. Raghavan’s series led me to appreciate and work with noncommutative ring theory for the first time. Dr. Amritanshu Prasad’s lecture series gave me a hands-on feel for finding the irreducible representations of a group using a wide range of machinery.
- I had many discussions with Dr. Amritanshu Prasad in which I learnt a little more of representation theory and of other miscellaneous topics within mathematics.
- I exposed myself to the wide range of books in the IMSc library and picked a little bit from many branches of mathematics.
- The problem-solving sessions in the tutorial helped sharpen my ability to express my ideas clearly.

2. MICROSOFT RESEARCH SUMMER SCHOOL

2.1. **Summer school whereabouts.** The formal name of the summer school was “Microsoft Research Summer School on Algorithms, Complexity, and Cryptography”. It was organized jointly by Microsoft Research and the IISc Mathematics Initiative (IMI). The “summer school” was held in the IISc mathematics department from May 22nd to June 10th.

Information about the summer school is available at:

<http://www.math.iisc.ernet.in/~imi/sacc.htm>

The camp was held at:

Department of Mathematics,
Indian Institute of Science,
Bangalore 560 012

2.2. **Structure of the summer school.** Classes for the summer school began at 10 a.m. and continued till 5:30 p.m., Mondays to Saturdays, with a lunch break from 1:00 p.m. to 2:30 p.m.

Eminent speakers included:

- Adi Shamir (working at the Weizmann Institute) who gave his talks via video teleconferencing. He talked on:
- Eran Tromer (working at the Weizmann Institute) who gave his talks via Video Conferencing. He talked on the following:
 - Special-purpose hardware for factoring
 - Cryptanalysis through cache address leakage
- Dan Boneh (working at Stanford University) who came to India to give his talks. He talked on the following:
 - Pairing-based cryptosystems
 - Network security
 - Phishing attacks
- Bela Bollobas intended to come, but cancelled his trip because he was feeling unwell.
- Kivank Mihcak who works at Microsoft Research, came to India for his talks. He talked on the following:
 - Mathematics of transforms
 - Mark embedding, robust signal hashing
- Kamal Jain who works at Microsoft Research, came to India for his talks. He talked on the following:
 - Auctions and game theory
 - Polynomial-time algorithms for market equilibria
- Ravi Kannan who works at Yale University, gave a talk on approximation algorithms.

The Microsoft Research people involved in organizing gave a number of lectures and tutorials:

- Ramaratnam Venkatesan
- Satya Lokam
- Vijay Patankar
- David Jao

Microsoft Research is currently working on bringing out complete Lecture Notes for the summer school.

2.3. **Why I applied.** A full document describing my reasons for wanting to participate is available at:

<http://www.cmi.ac.in/~vipul/academics/msrs/whyiwanttoparticipate.pdf>

2.4. **The application contents.** The contents of the application can be found in the folder:

<http://www.cmi.ac.in/~vipul/academics/msrs/>

2.5. **What I gained out of it.** The experience at Microsoft Research helped me in a number of ways:

- This was my first exposure to a research wing of a corporate organization. I was quite surprised to observe that even the people working in Microsoft Research were almost as “pure” as those working in universities. The only difference was that the general areas in which they worked were those areas deemed important for applications.

The people working at Microsoft Research were keen to interact more with students from CMI and welcomed us to intern with them in the coming holidays.

- I was also impressed with the professionalism of some of the instructors, particularly the way they could easily switch from theoretical concerns to practical considerations.
- I learnt a lot about cryptography and its basic problems. I also began appreciating why the security angle is important even for tasks not directly concerned with security.
- Some abstract stuff I had learnt in group theory, black-box groups, complexity theory, elliptic curves and number theory was revisited in the summer school from concrete cryptographical and security-related perspectives.

3. VSRP AT TIFR

3.1. **Camp whereabouts.** The **Visiting Students’ Research Programme (VSRP)** in Mathematics was conducted by the **Tata Institute of Fundamental Research (TIFR)** from June 15th to July 14th.

Details about the VSRP can be found at:

<http://www.math.tifr.res.in/~vsrp>

Address of the institute:

Tata Institute of Fundamental Research
Homi Bhabha Road, Colaba
Mumbai 400 005

3.2. **My work.** In the VSRP, I did a summer project under the guidance of Professor Dipendra Prasad of TIFR. The task was to read and understand a paper titled “Lie Group Representations of Polynomial Rings” by Bertram Kostant. At the end of the programme, I gave a slide show of one section of the paper. Although I was not able to complete the entire paper, I mastered one section (the one that I presented) and got a reasonable understanding of another section.

Professor Dipendra Prasad’s email ID at `math.tifr.res.in` is `dprasad`.

His personal webpage is:

<http://www.math.tifr.res.in/~dprasad>

3.3. **Other stuff in the camp.** Apart from this, the camp also included:

- 3-4 lectures a week by TIFR professors, on various topics in analysis and differential geometry.
- Night lectures by VSRP students on topics, supervised by two research scholars at TIFR.

3.4. Why I applied. TIFR is reputed to be the best place for mathematics research within India. Moreover, I had been hearing about the Visiting Students' Research Programme since my days at the IMO Training Camp. I was keen to apply to VSRP for the following reasons:

- To get experience of doing research/reading work in one of India's best research institutes, under a leading researcher
- To learn important areas of mathematics
- To have a look at TIFR, and decide whether it would be a suitable place to apply to for Graduate School.

3.5. My experience. I have logged my experience in the initial entries of:

<http://whatisresearch.blogspot.com>

3.6. What I gained out of it. I gained in the following ways:

- The VSRP was my first attempt at reading and trying to understand a long mathematics paper. Initially, progress was slow, but towards the end, I managed to master some important components of the paper.

The experience helped me understand and appreciate why research and reading work often goes slower than hoped/expected. I also decided to learn from my mistakes and ensure that in future, I would not make the same mistakes that slowed me down in the beginning.

- During VSRP, I also interacted with other mathematics students from different backgrounds and with different interests. I had fruitful discussions with some of the students, particularly relating to some questions in group theory.
- Some of the VSRP lectures set me thinking along certain lines. For instance, there were some nice lectures in differential geometry, and there was also a lecture on how to randomly select points from spaces.
- I had many personal discussions with Professor Dipendra Prasad that not only improved my mathematical knowledge but also helped me develop the necessary temperamental qualities.