Department of Computational and Data Sciences (CDS)

Indian Institute of Science, Bangalore

Research Admission Procedure

PhD and M.Tech (Res) Aug 2019 Cycle

Research activities at CDS are categorized into two streams: *Computational Science (CD-CP)* and *Computer and Data systems (CD-CS)*. The candidate must apply for CDS and the department committee will shortlist the candidates for a research interview based on their GATE Score and/or B.Tech./M.Tech. scores. The shortlisted candidates must attend an interview, which consists of a *written component* and an *oral interview*. Candidates must carefully review their eligibility and labs they are interested in, and choose one stream, either CD-CP (Computational Science) or CD-CS (Computer and Data System). This is done at the time of interview by filling the *combined preference sheet*. The written and oral topics will be different for these two streams. Please refer to the appropriate brochure carefully before the interview so that you may prepare accordingly and fill the combined preference sheet when you arrive at the interview.

Computer and Data Systems (CD-CS)

PhD and M.Tech (Res), Aug 2019 Cycle Admission Brochure

This brochure provides information on the Research Admission process into the Computer Systems Stream (CDS-CS) of CDS for 2019. It describes the *research laboratories* in the CDS-CS stream which are accepting students this year, and the *topics* for the written and oral components of the research interview. A *combined Preference Sheet* appended at the end of this brochure must be filled and signed by you when you appear for the interview.

A. Research Streams at CDS

Research activities at CDS are categorized into two streams: *Computational Science (CD-CP)* and *Computer and Data systems (CD-CS).* Research admissions are conducted *separately* for each stream, so please refer the appropriate brochure. **This brochure is only for Computer and Data Systems (CD-CS) stream.**

B. Research Admission Process – Computer and Data Systems Stream (CD-CS)

The interview process for the Computer Systems stream has two stages: **Written** and **Oral** (both conducted on the same day).

1. **Written component** *(Duration: 30 minutes):* A written exam consisting of short answer questions is conducted first to test the candidate's suitability for the research programs at CDS. The questions will be from the following subjects: *Programming in C, Data Structures, Algorithms, Discrete Mathematics, Probability and Statistics*. The level of preparation expected will be at the final year engineering undergraduate level.
2. **Oral Interview**: Candidates who are successful in the written component will attend an oral interview before a CDS-CS faculty committee. In the oral interview, you will be questioned on:
    - ***Basic Area Subjects:*** *Programming in C, Data Structures, and Algorithms*. Students are expected to be prepared in all these subjects for oral examination. The level of preparation expected will be at the final year engineering undergraduate level.
    - ***Lab-related Topics and Suggested Paper Readings:*** You will be questioned on the *topics and papers related to labs selected in preference sheet*. Candidates choosing a lab **must** be prepared on ***at least one*** of the lab-related topics, and are **encouraged** to read suggested papers, if any, for the lab. These topics and papers are given in the lab listing given in the next page.

Note: Preference will be given to Ph.D. candidates. Candidates for PhD are strongly advised to prepare well on their fundamentals, come with a focus and knowledge of the research areas they would like to target in their PhD, and have clarity on the preferred lab(s) and the kind of work done in those labs in the targeted research areas. Review the research topics

and the papers from the labs you are interested in. Responses like *"I would like to work in a specific area. But I do not know anything about the field and can pick up if admitted"* are not helpful.

C. List of labs accepting students for this admissions cycle

1. Distributed Research on Emerging Applications & Machines (DREAM) Lab

Faculty: Yogesh Simmhan (http://cds.iisc.ac.in/faculty/simmhan)
Website: www.dream-lab.in

Areas: Distributed Systems, Big Data Platforms, Large-scale Graph Algorithms, Cloud and Edge Computing, Internet of Things (IoT) applications, Distributed analytics.

Topics for Interview: Operating Systems, Distributed Systems (or) Graph Algorithms.

Text Books:

- Operating System Concepts, Silberschatz, Galvin Gagne, 9th Ed., http://bit.ly/2UHs0sy
- Distributed Systems: Concepts and Design, Coulouris, Dollimore, Kindberg, Blair, 5th Ed.
- The Algorithm Design Manual, Steven S. Skiena, http://bit.ly/2DBcTeq

Suggested Papers for Interview:

- Ching, Avery, Sergey Edunov, Maja Kabiljo, Dionysios Logothetis, and Sambavi Muthukrishnan. "One trillion edges: Graph processing at facebook-scale." *Proceedings of the VLDB Endowment* 8, no. 12 (2015): 1804-1815. http://bit.ly/2V22nrH
- Chen, Chien-An, Myounggyu Won, Radu Stoleru, and Geoffrey G. Xie. "Energy-efficient fault-tolerant data storage and processing in mobile cloud." *IEEE Transactions on cloud computing* 3, no. 1 (2015): 28-41. http://bit.ly/2VwGZdc

Accepting Ph.D. and M.Tech. (Res) Students

2. Middleware And Runtime Systems (MARS) Lab

Faculty: Sathish Vadhiyar (http://cds.iisc.ac.in/faculty/vss);
Website: mars.cds.iisc.ac.in

Areas: High performance computing (HPC), Parallel computing – middleware, system software, algorithms and applications on large-scale parallel computers and GPUs.

Topics for Interview: Operating Systems, Graph Algorithms.

Suggested Papers for Interview:

- MPI-1: Online tutorial "MPI Complete Reference". Google for it. Read on point-2-point, and collective communications.
- Google for paper "Optimization of Collective Communication Operations in MPICH" by Thakur, Rabenseifner and Gropp, IJHPCA 2005.

Accepting only Ph.D. Students

3. Video Analytics Lab (VAL)

Faculty: R. Venkatesh Babu (http://cds.iisc.ac.in/faculty/venky/)

Website: http://val.cds.iisc.ac.in/

Areas: Deep Learning for Computer Vision, Object Detection, Tracking, Segmentation, Image/Video Representation and Retrieval, Action Recognition, Crowd and Traffic Analysis.

Topics for Interview: Signal Processing, Image Processing, Probability.

Suggested Papers for Interview:

- Girshick, Ross, et al. "Rich feature hierarchies for accurate object detection and semantic segmentation." Proceedings of the IEEE conference on computer vision and pattern recognition. 2014. (https://arxiv.org/pdf/1311.2524)
- Deepak Babu Sam, Shiv Surya and R. Venkatesh Babu,"Switching Convolutional Neural Network for Crowd Counting", CVPR, 2017. (https://arxiv.org/pdf/1708.00199)

Accepting Ph.D. and M.Tech. (Res) Students

4. Visual Computing Lab (VCL)

Faculty: Anirban Chakraborty (http://visual-computing.in/wp-content/uploads/2017/08/anirban-chakraborty.html)

Website: http://visual-computing.in/

Areas: Computer Vision, Image Processing, Person Re Identification, Machine Learning.

Topics for Interview: Image Processing, Linear Algebra, Probability.

Suggested Papers for Interview:

- A. Chakraborty, A. Das, A. K. Roy-Chowdhury, "Network Consistent Data Association", IEEE TPAMI, 2016. (http://visual-computing.in/wp-content/uploads/2017/07/PAMI-2015.pdf)

Accepting Ph.D. and M.Tech. (Res) Students

Preference Sheet – Ph.D./M.Tech. (Res) Admissions Aug 2019 Cycle

Written and Oral Interview for Computational Science (CD-CP) and Computer and Data Systems (CD-CS) are SEPARATE.

Candidates may attend ONLY ONE of CD-CP or CD-CS interview.

Eligibility for CD-CP: *BE / B Tech or equivalent degree in any discipline or M Sc or equivalent degree in Mathematical Sciences; Physical Sciences; Electronics; Instrumentation; Computer Science or Master's in Computer Application. In all cases: a background in Mathematics and Programming is required*

Eligibility for CD-CS: *BE / B Tech or equivalent degree in Computer Science/Engineering; Information Technology/Science; Electrical and Communication Engineering; Electrical Engineering or Master's degree in Computer Science; Computer Application or Electronics. In all cases: a background in Programming is required*

- Carefully review the Brochures, and Research Lab descriptions and websites before filling in this Preference Sheet.
- You may choose **only one stream (CD-CP or CD-CS)**, and up to three labs in that stream.
- **The stream chosen here is binding and cannot be changed after the written interview**.
- Choose the lab(s) whose research areas most closely match your own interests.
- You may change your lab preference during oral interview.

1. **Research Stream *(Tick Only One)*: [ ] CD-CP [ ] CD-CS**
2. Name: _____
3. Application No: _____
4. Program *(Select all that apply)*: [ ] Ph.D.* [ ] M.Tech. (Res)
5. External Research Program Candidate? *(Tick one)* [ ] No [ ] Yes
6. Rank up to three Research Labs in your selected stream using numbers 1, 2 and 3.

If you selected **CD-CP stream** above:	If you selected **CD-CS stream** above:
[ ] Medical Imaging Group	[ ] MARS Lab
[ ] Biomolecular Computation Laboratory	[ ] Video Analytics Lab
[ ] Structural Biology & Bio-Computing Lab	[ ] DREAM Lab
[ ] Computational Mathematics Group	[ ] Visual Computing Lab
[ ] Computational & Statistical Physics Lab	
[ ] QUEST Lab	
[ ] Computational Flow Physics Lab	
[ ] Computer Aided Design Lab	

I have read and understood the brochure and the instructions before filling in this preference sheet.

Signature: _____ Date: _____ Place: _____

*B.E/B.Tech qualified candidates, if selected, shall be placed in the Direct Ph.D. program.