Department of Computational and Data Sciences (CDS)
Indian Institute of Science, Bangalore

Computer and Data Systems (CD-CS)

PhD and M.Tech (Research) Admissions 2017

This brochure provides information on the Research Admission process into the Computer and Data Systems Stream (CD-CS) of CDS for 2017. It describes the research laboratories in the CD-CS stream which are accepting students this year, and the topics for the written and oral components of the research interview. A ***Preference Sheet*** appended at the end of this brochure must be filled and signed by you when you appear for the interview.

A. Research Activities at CDS

Research activities at CDS are categorized into two streams: *Computational Science* and *Computer and Data Systems*. Research admissions are conducted *separately* for each stream, so please refer the appropriate brochure.

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

The interview process for the Computer and Data 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 CD-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:*** *Topics and papers related to labs selected in preference sheet*. Candidates choosing a lab are **required** to be prepared on the lab-related topics, and **encouraged** to read suggested papers, if any, for the lab. These are given in the lab listing in pages 2&3.

Note: **Preference will be given to candidates applying for the PhD program. So students with a Bachelors' degree are encouraged to apply for a (Direct) PhD. Candidates for PhD are strongly advised to prepare well** on their fundamentals, come with focus on the research areas they would like to target in their PhD, be well versed with the target research areas, and have clarity on the preferred lab and the kind of work done in the preferred lab in the targeted research areas. e.g., if you would like to do PhD research in cloud computing, you are expected to have Masters-level knowledge on distributed/cloud computing and the research opportunities that exist in this area. Responses like "I would like to work in cloud computing, but I do not know about the field, but can pick up if admitted" will not be encouraged.

C. List of labs that accept students

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 Computing, Internet of Things (IoT) applications.

   Lab-related Topics for Interview: Operating Systems, Distributed Systems, Graph Algorithms.

   Suggested Paper Reading for Interview: "GoFFish: A Sub-Graph Centric Framework for Large-Scale Graph Analytics", Simmhan, et al, https://arxiv.org/abs/1311.5949

2. **Machine And Language Learning (MALL) Lab**

   Faculty: **Partha Pratim Talukdar** (http://www.talukdar.net)

   Website: https://malllabiisc.github.io

   Areas: Machine Learning, Natural Language Processing.

   Lab-related Topics for Interview: Machine Learning, Natural Language Processing.

   Suggested Paper Reading for Interview: http://talukdar.net/papers/NELL_aaai15.pdf

3. **Middleware And Runtime Systems (MARS) Lab**

   Faculty: **Sathish Vadhiyar** (www.serc.iisc.ernet.in/~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.

   Lab-related Topics for Interview: Operating Systems, Graph Algorithms.

   Suggested Pointers and Paper Readings 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.

4. **Video Analytics Lab**

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

   Website: http://val.serc.iisc.ernet.in/valweb/index.html

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

   Lab-related Topics for Interview: Signal Processing, Image Processing, Probability.

   Suggested Paper Reading 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）

5. **Computer Aided Design Laboratory**

   Faculty: **S. K. Nandy** (http://cadl.iisc.ernet.in/cadlab/people/nandy/)

   Website: http://cadl.iisc.ernet.in/cadlab/

   Areas: System-on-Chip (SoC) design for applications spanning media streaming and network processing

   Lab-related Topics for Interview: Computer Architecture.

6. Cloud Systems Lab

Faculty: **J. Lakshmi** (http://www.serc.iisc.in/~jlakshmi)

Website: http://www.serc.iisc.in/facilities/cloud-systems-lab/

Areas: Cloud System Architectures for end-to-end QoS of hosted applications with regard to performance, security, dependability and fault tolerance; virtualization stack for compute, network and storage clouds; Cloud middleware for elasticity, placement optimization and QoS.

Lab-related Topics for Interview: Operating Systems, Distributed Systems, Computer Organization.

Suggested Paper Reading for Interview: M. Rosenblum and T. Garfinkel, "Virtual machine monitors: current technology and future trends," in Computer, vol. 38, no. 5, pp. 39-47, May 2005.
URL: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=1430630&isnumber=30853

Preference Sheet for Ph.D./M.Tech(Res) Research Admissions – Computer and Data Systems Stream (CD-CS)

Carefully review the brochure and Research Lab descriptions before filling in this Preference Sheet. Choose the lab(s) whose research areas most closely match your own interests. You may choose up to three labs. Ph.D. students, if admitted, will be placed in the lab(s) chosen here, and this selection is binding.

1. Name: _____
2. Application No: _____
3. Program: *(Tick one or both)* [ ] Ph.D./Direct Ph.D. [ ] M.Tech. (Research)
4. External Research Program Candidate? *(Tick one)* [ ] No [ ] Yes

Select one to three of the Research Labs below.

[ ] Distributed Research on Emerging Applications & Machines (DREAM) Lab

[ ] Machine And Language Learning (MALL) Lab

[ ] Middleware & Runtime Systems (MARS) Lab

[ ] Video Analytics Lab

[ ] Computer Aided Design Laboratory

[ ] Cloud Systems Lab

I have read and understood the brochure and the instructions before filling in this Preference Sheet.

Signature: _____

Date:_____

Place:_____