



## A Research Career in Computer Science: Options and Opportunities

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## Why Research?

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- Do you want to find answers to fundamental questions?
- Do you get a kick from solving problems?
- Do you want to build something?
- Do you value the freedom to do what interests you and what you think important?



## How to start on a research path?

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- Informal method  
Join a good research group and participate in the ongoing research
- Get formal training to do research by joining PhD programme at a good school, and lead research teams after finishing PhD
- Major Institutes in India offering PhD: all the IITs, IISc, TIFR, IIMSc, IIIT Hyderabad etc.



## Why PhD?

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- PhD is not just about doing research;  
**it is learning about how to do research**
- Highest professional degree in the world; takes you to the top of the academic and professional ladder
- It is beginning of one's research career.
- It is not about learning existing knowledge but about creating new knowledge and to innovate
- Makes you look for more and more knowledge, and trains you to do quality work for the rest of the life



## Why PhD?

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- As Indian industry shifts from “earning through services” paradigm towards R&D and intellectual property creation more and more PhDs are required
- More and more multinationals are starting their operations in India. They require PhDs in large numbers
- As more and more professionals are required quality faculty is required to teach them



## Usual Fears!!

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- It is too difficult, I may not be able to finish.
- It takes too long, my peers will already be professionally established and earning high salary by the time I finish.
- There will be no good job openings.
- I will have only one option after PhD: become a teacher!



## What after PhD?

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- Academic jobs (give lot of freedom – follow your research interests, consult, start your own company)
- High-tech companies (in India) increasingly interested in hiring PhDs (e.g. IBM, Intel, TI, Motorola, Microsoft, Cadence, Mentor Graphics, Synopsis, HP, GE, Sun, SGI, TRDDC/TCS, Infosys, Wipro).
- R&D Jobs in government organizations like NIC, DRDO, CAIR, BARC, C-DAC
- Normally, PhDs are offered higher designations and higher starting salaries than BTechs/MTechs
- PhDs have a very different career path compared to BTechs and MTechs



## What is involved in doing PhD?

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- It is about doing research
- Formulating problems whose answers are important/interesting
- Answers we want to know, but do not know
- Solve such problems and get peer review by writing thesis and papers



## Nature of Research problems

- Problems can range from open theoretical problems to evolutionary technology problems
- Modeling complex theoretical problems
- Modeling and building prototype systems
- Mix of the above
- A wide range of problems to choose from depending upon interests and abilities



## What is involved in doing PhD?

- Major requirement is to do original research, write it up as a thesis, and get peers to accept it.
- Secondary requirements:
  - courses
  - comprehensive exam
  - state-of-art seminar
  - open seminar
- Usually takes 4-5 years.



## What it takes

- Requires drive and motivation.
- Requires HARD WORK at a consistent pace.
- Requires suitable background, creativity, and intelligence.



## PhD at IIT Kanpur

- A place which gives immense academic freedom
- One of the oldest and the most recognized centre for computing activities in the country (our alumni are all over the world)
- Young and vibrant faculty (currently 22 and recruitment is going on), many of whom are recognized over the world



## Areas of Research

- Theory, algorithms
- Operating systems, embedded systems, distributed computing
- Networking, wireless networking, mobile computing
- Software Engineering and reliability, software architecture
- Programming Languages, Compilers for High Performance Architectures
- Parallel processing, HPC, Grid Computing
- Database systems, Data mining, MIS
- Internet technologies, multimedia systems
- CAD, VLSI, computer architecture
- Computer graphics
- AI, logic and machine translation



## Areas of Research ...

- Interdisciplinary research work in areas like
  - cognitive sciences (Psychology, linguistics, philosophy, EE, Biosciences and Bioengineering)
  - machine intelligence, human computer interaction (EE, HSS)
  - computational biology (Biosciences and Bioengineering., EE)
  - interface design (HSS, Design program)
  - natural language technology (HSS)
  - security, encryption (EE, Math)
  - quantum computing (Phy, Chm, EE)
  - embedded systems, and hardware design (EE)
  - Robotics (ME, EE, AE)
  - Networks, VLSI (EE)
  - High performance and Grid computing (ME, AE, EE)



## Benefits to PhD students

- Scholarship of about Rs 10,000 pm
- Contingency grant of Rs 5,000 every year to buy books
- Office space and dedicated PC with access to internet
- Access to well stocked printed and digital libraries



## Unique benefits to PhD scholars in CSE, IITK

- Higher fellowships (about 25-30%) than students in other departments and other institutes
- Fellowships supported by leading industry: Infosys, IBM, Microsoft, DNV (about 50% higher than normal fellowships)
- International travel support to attend conferences once a year
- International travel support even more than once a year if you have a paper in a top rated conference (Supported by our alumni Mr Rao Remala of Microsoft)



## Continued.....

- Support to spend six months to an year with the best research groups any where in the world
- Support to attend summer/winter schools in USA, Europe and rest of the world
- Support to attend national conferences
- Chance to interact with the best in the world through chaired/visiting faculty and Research-I Foundation programmes



## Research-I Foundation

- Funded by Mr. NR Narayana Murthy.
- Opportunity for outstanding researchers anywhere in the world to visit the department.
- Opportunity for IIT/K faculty and students to visit and work with top researchers anywhere in the world.  
(First visitor Prof. Dana Ballard (Rochester), lead a Workshop on "Computation and the Brain" with participation from NCBS, NBRC, NIMHANS, and others during February 2004.)



## Where are IITK PhDs?

- Faculty at institutions in India and abroad
- With R&D labs of companies
- With research organizations and government (CAIR, NIC, DRDO)



## IITK Campus

- About 10 miles north-west of Kanpur city. Good bus and taxi service between the campus and the city
- Pollution free and safe with very rare power outages
- Self contained campus with lot of cultural activities, student film societies, sports facilities, gym, play grounds, swimming pool, shopping center, restaurants, banks, post office, health services, wired hostels, cable TV network etc.



## Kanpur City

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- Biggest historical and industrial town of central India
- On the southern banks of Ganges (close to Lucknow, Allahabad, Varanasi, Jhansi, Aligarh)
- Well connected by rail (direct trains to Delhi and north, Calcutta, Assam, Orissa, Mumbai, Hyderabad, Bangalore, Chennai etc.)
- Airport in Kanpur but major airport is Lucknow (50 miles). Flights to Delhi, Calcutta, Mumbai, Pune, Hyderabad, Bangalore, Chennai)



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Interested in joining the PhD  
programme at IIT Kanpur?