



Computer Engineering

What it means to be a Computer Engineer!

Gajendra Circle Initiative (GCI) from IIT Madras Alumni Association and The Hindu Group

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What it means to be a Computer Engineer!

Introduction

Computer science or computing science (sometimes abbreviated CS) is the study of the theoretical foundations of information and computation, and of practical techniques for their implementation and application in computer systems. It is frequently described as the systematic study of algorithmic processes that create, describe, and transform information. According to Peter J. Denning, the fundamental question underlying computer science is, "What can be (efficiently) automated?" Computer science has many sub-fields; some, such as computer graphics, emphasize the computation of specific results, while others, such as computational complexity theory, study the properties of computational problems. Still others focus on the challenges in implementing computations. For example, programming language theory studies approaches to describe computations, while computer programming applies specific programming languages to solve specific computational problems, and human-computer interaction focuses on the challenges in making computers and computations useful, usable, and universally accessible to people.

The general public sometimes confuses computer science with careers that deal with computers (such as the noun Information Technology), or think that it relates to their own experience of computers, which typically involves activities such as gaming, web-browsing, and word-processing. However, the focus of computer science is more on understanding the properties of the programs used to implement software such as games and web-browsers, and using that understanding to create new programs or improve existing ones.

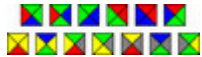
What You Learn in Computer Engineering?

As a discipline, computer science spans a range of topics from theoretical studies of algorithms and the limits of computation to the practical issues of implementing computing systems in hardware and software

Theoretical computer science – The broader field of theoretical computer science encompasses both the classical theory of computation and a wide range of other topics that focus on the more abstract, logical, and mathematical aspects of computing.

Theory of computation – The study of the theory of computation is focused on answering fundamental questions about what can be computed and what amount of resources are required to perform those computations. In an effort to answer the first question, computability theory examines which computational problems are solvable on various theoretical models of computation. The second question is addressed by computational complexity theory, which studies the time and space costs associated with different approaches to solving a computational problem.

The famous "P=NP?" problem, one of the Millennium Prize Problems, is an open problem in the theory of computation.



P = NP ?

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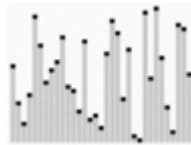
Computability theory

Computational complexity theory

Cryptography

Algorithms and data structures –

$O(n^2)$

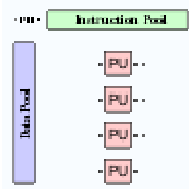


Analysis of algorithms

Algorithms

Data structures

Computer elements and architecture –

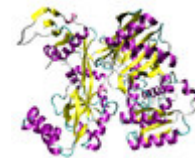
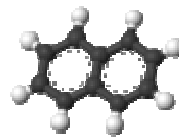


Digital logic

Microarchitecture

Multiprocessing

Computational science – Computational science (or scientific computing) is the field of study concerned with constructing mathematical models and quantitative analysis techniques and using computers to analyze and solve scientific problems. In practical use, it is typically the application of computer simulation and other forms of computation to problems in various scientific disciplines.



Numerical analysis

Computational physics

Computational chemistry

Bioinformatics

Artificial Intelligence – This branch of computer science aims to create synthetic systems which solve computational problems, reason and/or communicate like animals and humans do. This theoretical and applied sub-field requires a very rigorous and integrated expertise in multiple subject areas such as applied mathematics, logic, semiotics, electrical engineering, philosophy of mind neurophysiology, and social intelligence. This can be used to advance the field of intelligence research or be applied to other subject areas, which require computational understanding and modeling such as in finance or the physical sciences. It all started with the grandfather of computer science and artificial intelligence, Alan Turing, who proposed the Turing Test for the purpose of answering the ultimate question... "Can computers think?"

Software Engineering – The area of software engineering specializes in storage, transfer and communication of data rather than the computational analysis of data. Although many computer scientists seek software engineering positions it is not necessarily computer science related. In 2004, a newly established degree of software engineering established by both ACM and IEEE was formed to address these issues; a document called CCSE was written to explain the details. In addition those with degrees in Information Technology or Management Information Systems are often found to be necessary supportive roles for both software engineering and computational work.

Computer Engineering defines the core knowledge areas of computer engineering as the following:

- Algorithms
- Computer architecture and organization
- Instrumentation and automation
- Robotics and artificial intelligence
- Circuit analysis
- Signal and systems
- Database systems
- Digital electronics
- Digital signal processing
- Electronics
- Embedded systems
- Human-computer interaction
- Interactive systems engineering
- Operating systems
- Programming fundamentals
- Social and professional issues
- Software engineering
- VLSI design and fabrication
- Computer networking
- Fault diagnostic and tolerant systems
- Parallel and distributed computing
- Control engineering
- Microprocessor interfacing and programming

The breadth of disciplines studied in computer engineering is not limited to the above subjects, but can include any subject found in engineering.

Opportunities

Computer engineers make important practical contributions in many other areas, as outlined below:

- Harnessing the continuing improvements in computer systems performance for general-purpose, scientific, and multimedia applications
- Implementing increasingly sophisticated single-chip embedded computing systems for a variety of consumer and industrial applications
- Improving user interfaces in computers and other consumer electronic devices
- Designing reliable software systems for financial, transportation, and other critical applications
- Creating more robust solutions for computer and network security
- Developing innovative applications of wireless communication capabilities in computers and other electronic devices

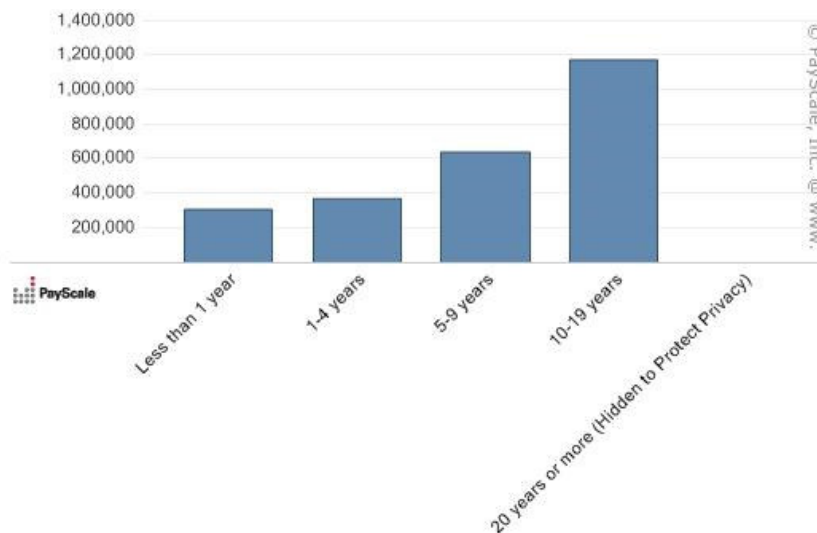
A computer science major can lead to many different career options. Students have chosen careers in:

- Computer Engineering
- Software Engineering
- Database Administration
- Systems Analysis
- Computer Programming
- Operations Research Analysis
- Computer Sales and Service
- Network Administration
- Teaching
- University Teaching
- Cryptography
- Artificial Intelligence
- Computer Aided Design
- Bioinformatics

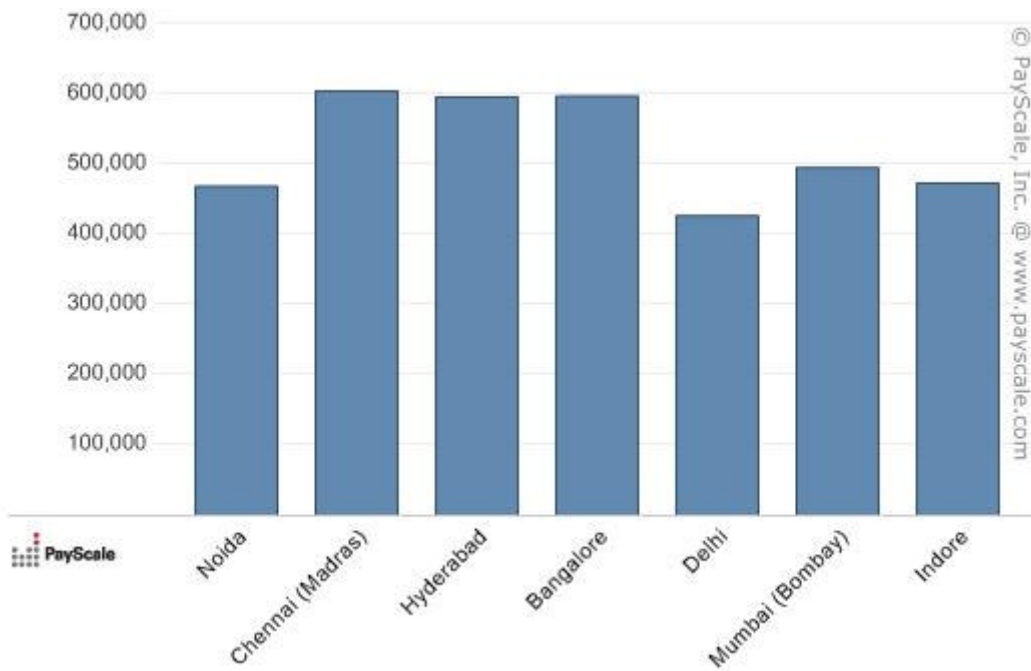
Salary Profile

This section provides salary profile of Computer engineers in India based on years of experience, city of employment, type of employer.

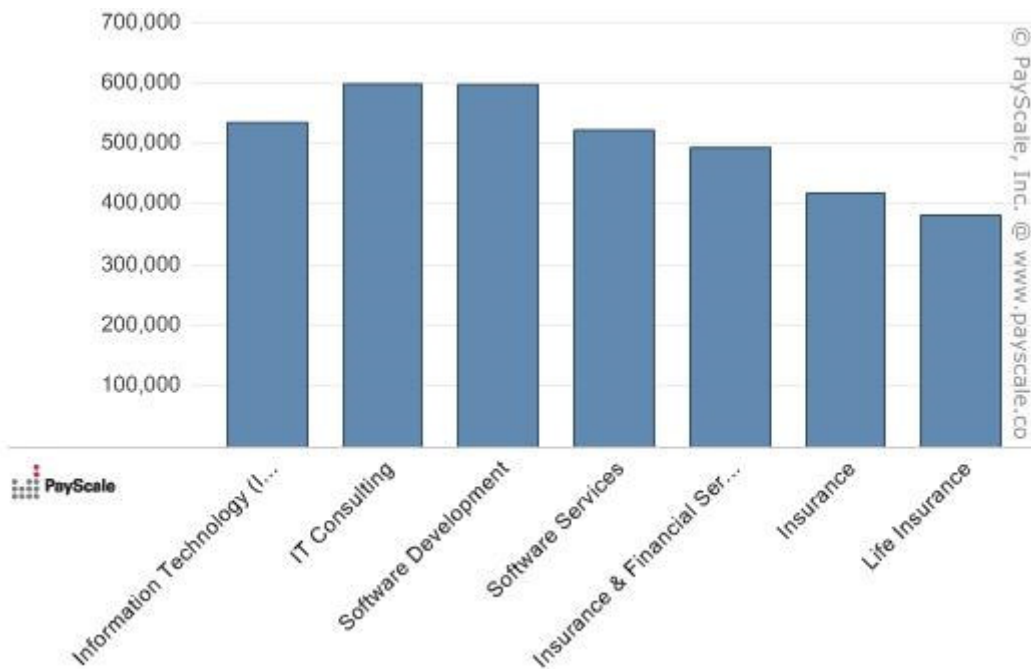
Salary Range for Computer Engineers (Years of experience)



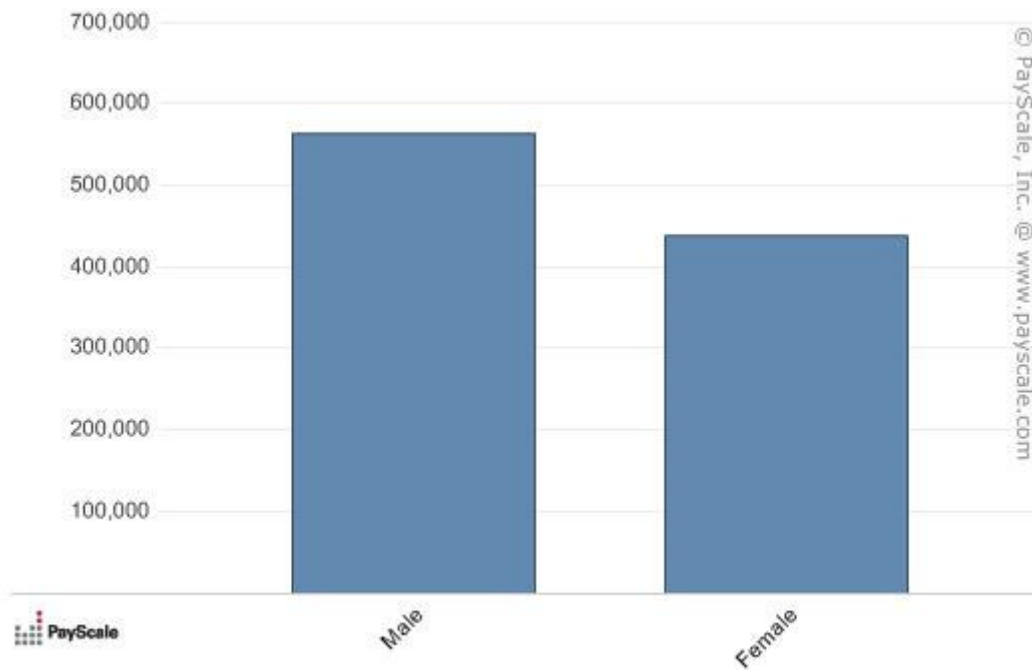
Salary Range for Computer Engineers (by City)



Salary Range for Computer Engineers (by Industry)



Gender Profile



Areas of growth in Computer Engineering

The fields of computer science and database administration are the largest sectors of computer engineering, and many firms employ graduates of computer engineering school as interns. The disaster recovery services and software installation divisions are growing, along with the World Wide Web and internet-related industries. The government, universities, and manufacturers of computer products are additional sectors of the economy that have created a demand for skilled computer engineering professionals.

The demand for computer scientists and database administrators is expected to grow much faster than average through 2014, and all web-based and Internet positions are expected to be one of the fastest growing industries overall. With the rise in complex technology and sophisticated computer systems there will not be a shortage of attractive computer engineering careers across almost every industry.

Reference

This report has been compiled based on the following publications.

- http://en.wikipedia.org/wiki/Computer_engineering
- http://en.wikipedia.org/wiki/Computer_science
- <http://www.pointloma.edu/Academics/AreasofStudy/ComputerScience.htm>
- <http://www.ece.queensu.ca/undergraduate/compprogram/cecareeropportunities.html>
- [http://www.payscale.com/research/IN/Employer=Computer_Sciences_Corporation_\(CSC\)/Salary/by_Industry](http://www.payscale.com/research/IN/Employer=Computer_Sciences_Corporation_(CSC)/Salary/by_Industry)
- <http://www.ulinks.com/engineering/computerengineeringdegreecomputerengineeringcareerschool/courses.htm>

About Gajendra Circle

Gajendra Circle (GC) Initiative is a subset of IITM alumni association, and is aimed at building the IIT Madras brand and strengthening the Institute resources. It has been structured as a collection of city specific cells. GC Hyderabad was constituted in April 2010 with the aim to take up activities which strengthen IIT Madras and have a good resonance with the core team.

About Adayana

Adayana is a leading Human Capital Development organization with its headquarters in Indianapolis, IN, USA and offices across Americas, EMEA, and Asia. Adayana provides comprehensive learning services that leverage best-of-class and proprietary technologies and processes.

For four subsequent years, from 2006 to 2009, TrainingOutsourcing.com recognized us as one of the "Top 20 Companies in the Training Outsourcing Industry" for its unique and diverse capabilities. In 2007, 2008 and 2009 Adayana has been named to the Inc. 500 list of America's 500 fastest growing companies. Adayana offers e-Learning, instructor-led training, mobile learning, gameware and performance support tools to its customers for improving human capital performance.

Adayana India (based in Hyderabad) focuses on India and Asia markets - serving large multinationals in the Automotive, IT/ITES, Healthcare, Agriculture & Food and other verticals. Adayana is a leading player in skill development and capacity building and has partnered with leading universities and colleges to provide finishing school content to improve employability of students.

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