

# Erik Jonsson School of Engineering and Computer Science

## Graduate Program in Computer Science

### Objectives

The Graduate Program in Computer Science provides intensive preparation in the design, programming, theory, and applications of computers. The Department of Computer Science offers courses of study leading to the [MS in Computer Science](#), the [MS in Software Engineering](#), the [PhD degree in Computer Science](#), and the [PhD degree in Software Engineering](#). Training is provided for both academically oriented students and students with professional goals in the many business, industrial, or governmental occupations requiring advanced knowledge of computer theory and technology. Courses and research are offered in a variety of subfields of computer science, including operating systems, computer architecture, computer graphics, pattern recognition, automata theory, combinatorics, artificial intelligence, data and network security, natural language processing, database design, computer networks, programming languages, software systems, analysis of algorithms, computational complexity, software engineering, software testing, software reliability, scheduling, visualization, fault-tolerant computing, parallel processing, telecommunications networks, telecommunications software, performance of systems, VLSI, computational geometry, and design automation.

A comprehensive program of evening courses is offered which enables part-time students to earn the master's degree or to select individual courses of interest.

### Facilities

The Department of Computer Science systems are comprised of a private virtualization cloud, several individual computer servers, computer workstations, and desktop computers. Research laboratories are available for parallel processing, distributed systems, software engineering, high-performance computing, graphics, programming languages and systems, telecommunications, CAD and graph visualization, image understanding and processing, artificial intelligence, big data, natural language processing, speech processing, and web technologies. The Department of Computer Science network connects through Internet 2 with other research universities, gigabit ethernet intranet, and pervasive wireless connectivity.

# Master of Science in Computer Science

33 semester credit hours minimum

## Program Faculty

FACG> ecs-computer-science-ms

**Professors:** Farokh B. Bastani, Sergey Bereg, Ovidiu Daescu, Yvo G. Desmedt, Ding-Zhu Du, András Faragó, Paul Fishwick, Xiaohu Guo, Gopal Gupta, Zygmunt Haas, Kevin Hamlen, Sanda M. Harabagiu, Dung T. Huynh, Jason Jue, Murat Kantarcioglu, Latifur Khan, Andrian Marcus, Neeraj Mittal, Dan I. Moldovan, Sriraam Natarajan, Yu-Chung (Vincent) Ng, Tien Nguyen, Simeon C. Ntafos, Balakrishnan Prabhakaran, Ravi Prakash, Kamil Sarac, Haim Schweitzer, Bhavani Thuraisingham, W. Eric Wong, Weili Wu, I-Ling Yen, Rym Zalila-Wenkstern

**Associate Professors:** Feng Chen, Lawrence Chung, Jorge A. Cobb, Vibhav Gogate, Benjamin Raichel, Nicholas Ruoizzi

**Assistant Professors:** Xinya Du, Emily Kyle Fox, Yunhui Guo, Shuang Hao, Rishabh Iyer, Kangkook Jee, Chung Hwan Kim, Jin Kim, Jessica Ouyang, Yapeng Tian, Shiyi Wei, Yu Xiang, Wei Yang

**Professors Emeriti:** R. Chandrasekaran, Ivor P. Page, William J. Pervin, Balaji Raghavachari, Ivan Hal Sudborough, Klaus Truemper, Subbarayan Venkatesan, Kang Zhang

**Professors of Instruction:** Ebru Cankaya, John Cole, Doug DeGroot, Timothy (Tim) Farage, Shyam Karrah, Pushpa Kumar, Nhut Nguyen, Greg Ozbirn, Miguel Razo-Razo, Jeyakesavan (Jey) Veerasamy

**Associate Professors of Instruction:** Sridhar Alagar, Gordon Arnold, Anjum Chida, Wei Pang Chin, Bhadrachalam Chitturi, Michael Christiansen, Chris I. Davis, Karen Doore, Neeraj Gupta, Khiem Le, Anarag Nagar, Mehra Nouroz Borazjany, Jalal Omer, Mark Paulk, Jason W. Smith, Laurie Thompson, James Willson, Nurcan Yuruk

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NOTE> Please be advised, the admissions section below feeds in from a separate page. Any changes made to the admissions section below will not be retained. Please contact [catalog@utdallas.edu](mailto:catalog@utdallas.edu) with any questions.

## Admission Requirements

The University's general admission requirements are discussed on the [Graduate Admission](#) page.

Applicants are admitted on a competitive basis.

The student entering the Computer Science MS program should have an undergraduate degree equivalent to a baccalaureate in a quantitative science, including calculus and linear algebra. However, special arrangements (requiring more than the minimal number of semester credit hours) can be made for students with an undergraduate degree in other fields.

Minimum requirements are:

- Bachelor's degree which includes 2 semesters of calculus and 1 semester of linear algebra.
- A strong foundation in programming.
- A GPA (grade point average) of at least 3.0 (last 60 semester credit hours). GPA in quantitative courses of at least 3.3.
- GRE revised scores of 308, 153, 155, and 4 for the combined, verbal, quantitative, and analytical writing components, respectively, are advisable based on our experience with student success in the program.

## Degree Requirements

Students lacking an undergraduate degree in computer science must complete the courses listed below. At the discretion of the graduate advisor, a diagnostic exam may be required. The required leveling courses common to all master's students are:

Required Leveling Courses

[CS 5303](#) Computer Science I

[CS 5330](#) Computer Science II

[CS 5333](#) Discrete Structures<sup>1</sup>

[CS 5343](#) Algorithm Analysis and Data Structures<sup>1</sup>

[CS 5348](#) Operating Systems Concepts<sup>1</sup>

Substitution of [CS 5303](#) and/or [CS 5330](#) by professional experience will be considered

Additional leveling courses required for the various degree plans are:

**For the Data Sciences Track:**

[CS 3341](#) ([SE 3341](#)) Probability and Statistics in Computer Science and Software Engineering

**For the Cyber Security Track:**

[CS 5390](#) Computer Networks

### For the MS in Software Engineering:

[SE 5354](#) Software Engineering

### For the Networks and Telecommunications Track:

[CS 3341](#) ([SE 3341](#)) Probability and Statistics in Computer Science and Software Engineering

[CS 5390](#) Computer Networks

### For the Traditional Computer Science:

[CS 5349](#) Automata Theory

[CS 5390](#) Computer Networks

The University's general degree requirements are discussed on the [Graduate Policies and Procedures](#) page.

The student may choose a thesis plan or a non-thesis plan. The thesis plan requires a minimum of 27 semester credit hours of courses, plus completion of an approved thesis (six thesis semester credit hours). This thesis is directed by a supervising professor and must be approved by the head of the Department of Computer Science. The non-thesis plan also requires a minimum of 33 semester credit hours of courses.

By a judicious planning of courses chosen from the computer science curriculum, supervised and approved by the graduate advisor, students may pursue the MS degree in Computer Science while emphasizing specific areas of the discipline. Students may also choose to receive the MS degree in Software Engineering. Because of the rapidly changing nature of the computer science discipline, the specific courses required may change by the time of the student's admission. A listing of the required courses will be specified by the student's advisor. Specific degree requirements follow.

## Core Requirements (15 semester credit hours)

### Data Sciences Track

[CS 6313](#) Statistical Methods for Data Science

[CS 6350](#) Big Data Management and Analytics

[CS 6363](#) Design and Analysis of Computer Algorithms

[CS 6375](#) Machine Learning

Choose one course from the following five courses:

[CS 6301](#) Special Topics in Computer Science [when topic is Social Network Analytics]

[CS 6320](#) Natural Language Processing

[CS 6327](#) Video Analytics

[CS 6347](#) Statistical Methods in AI and Machine Learning

[CS 6360](#) Database Design

Cyber Security Track

[CS 6324](#) Information Security

[CS 6363](#) Design and Analysis of Computer Algorithms

[CS 6378](#) Advanced Operating Systems

Choose two courses from the following four courses:

[CS 6332](#) Systems Security and Binary Code Analysis

[CS 6348](#) Data and Applications Security

[CS 6349](#) Network Security

[CS 6377](#) Introduction to Cryptography

Intelligent Systems Track

[CS 6320](#) Natural Language Processing

[CS 6363](#) Design and Analysis of Computer Algorithms

[CS 6364](#) Artificial Intelligence

[CS 6375](#) Machine Learning

Choose one course from the following two courses:

[CS 6360](#) Database Design

[CS 6378](#) Advanced Operating Systems

Interactive Computing Track

[CS 6326](#) Human Computer Interactions

[CS 6363](#) Design and Analysis of Computer Algorithms

Choose three of the following five courses:

[CS 6323](#) Computer Animation and Gaming

[CS 6328](#) Modeling and Simulation

[CS 6331](#) Multimedia Systems

[CS 6334](#) Virtual Reality

[CS 6366](#) Computer Graphics

Networks and Telecommunications Track

[CS 6352](#) Performance of Computer Systems and Networks

[CS 6363](#) Design and Analysis of Computer Algorithms

[CS 6378](#) Advanced Operating Systems

[CS 6385](#) Algorithmic Aspects of Telecommunication Networks

[CS 6390](#) Advanced Computer Networks

Systems Track

[CS 6304](#) Computer Architecture

[CS 6363](#) Design and Analysis of Computer Algorithms

[CS 6378](#) Advanced Operating Systems

[CS 6396](#) Real-Time Systems

Choose one course from the following four courses:

[CS 6349](#) Network Security

[CS 6376](#) Parallel Processing

[CS 6380](#) Distributed Computing

[CS 6397](#) Synthesis and Optimization of High-Performance Systems

Traditional Computer Science Track

[CS 6363](#) Design and Analysis of Computer Algorithms

[CS 6378](#) Advanced Operating Systems

[CS 6390](#) Advanced Computer Networks

Choose two courses of the following three courses:

[CS 6353](#) Compiler Construction

[CS 6360](#) Database Design

[CS 6371](#) Advanced Programming Languages

Students must satisfy the core requirements by either earning a 3.19 minimum grade point average OR by earning a 3.0 minimum grade point average in the five core courses and taking an extra approved elective (beyond the minimum degree requirements of 33 semester credit hours) and maintain the required GPA.

## Electives (minimum of 18 semester credit hours)

At least 12 semester credit hours of 6000/7000 level elective CS courses, that could include 6 semester credit hours of thesis with approval of a graduate advisor.

In addition, at least 6 semester credit hours from among:

- [ECSC 5177](#) (maximum three semester credit hours)
- CS 6000/7000 level elective courses
- only one of [CS 5333](#), [CS 5343](#) or [CS 5348](#); students should consult their graduate advisors to get approval for this course.

A minimum grade point average of 3.0 is required for elective courses.

Approved electives must be taken to make a minimum of 33 semester credit hours.

While the Department of Computer Science offers both the Master of Science in Computer Science and the Master of Science in Software Engineering degrees, students are not permitted to pursue both degrees.

**NOTE:** Students changing program from MS\_CS/PhD\_CS to MS\_SE/PhD\_SE or MS\_SE/PhD\_SE to MS\_CS/PhD\_CS must submit a new online graduate application. The admissions committee in the department will review the application and make a decision.

1. See Electives section for additional information for these specific courses.

## Doctor of Philosophy in Computer Science

75 semester credit hours minimum beyond the baccalaureate degree

## Program Faculty

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**Professors:** Farokh B. Bastani, Sergey Bereg, Ovidiu Daescu, Yvo G. Desmedt, Ding-Zhu Du, András Faragó, Paul Fishwick, Xiaohu Guo, Gopal Gupta, Zygmunt Haas, Kevin Hamlen, Sanda M. Harabagiu, Dung T. Huynh, Jason Jue, Murat Kantarcioglu, Latifur Khan, Andrian Marcus, Neeraj Mittal, Dan I. Moldovan, Sriraam Natarajan, Yu-Chung (Vincent) Ng, Tien Nguyen, Simeon C. Ntafos, Balakrishnan Prabhakaran, Ravi Prakash, Kamil Sarac, Haim Schweitzer, Bhavani Thuraisingham, W. Eric Wong, Weili Wu, I-Ling Yen, Rym Zalila-Wenkstern

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## Objectives

The Department of Computer Science offers a Doctor of Philosophy in Computer Science.

The doctoral program is tailored to the student. The student must arrange a course program with the guidance and approval of a faculty member chosen as his/her graduate advisor. Adjustments can be made as the student's interests develop and a specific dissertation topic is chosen.

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catalog@utdallas.edu with any questions.

## Admission Requirements

The University's general admission requirements are discussed on the [Graduate Admission](#) page.

Applicants are admitted on a competitive basis.

A student may be admitted under one of two possible options. The student must have:

### Admission Option One

- A master's degree in computer science or its equivalent, and
- A GPA (grade point average) of at least 3.5, and
- GRE revised scores of at least 315, 156, 159, and 4 for the combined, verbal, quantitative, and analytical writing components, respectively, are advisable based on our experience with student success in the program.

### Admission Option Two

- A BS in related area that includes two semesters of calculus and linear algebra with
- A GPA of at least 3.5 in the last 60 semester credit hours, and
- GRE revised scores of at least 315, 156, 159, and 4 for the combined, verbal, quantitative, and analytical writing components, respectively, are advisable based on our experience with student success in the program.

## Degree Requirements

Students lacking an undergraduate degree in computer science must complete the courses listed below. The required leveling courses common to all graduate students are:

Required Leveling Courses

[CS 5303](#) Computer Science I

[CS 5330](#) Computer Science II

[CS 5333](#) Discrete Structures

[CS 5343](#) Algorithm Analysis and Data Structures

[CS 5348](#) Operating Systems Concepts

Substitution of [CS 5303](#) and/or [CS 5330](#) by professional experience will be considered.

Additional leveling courses required for the various degree plans are:

**For the Data Sciences Track:**

[CS 3341](#) ([SE 3341](#)) Probability and Statistics in Computer Science and Software Engineering

**For the Cyber Security Track:**

[CS 5390](#) Computer Networks

**For the MS in Software Engineering:**

[SE 5354](#) Software Engineering

**For the Networks and Telecommunications Track:**

[CS 3341](#) ([SE 3341](#)) Probability and Statistics in Computer Science and Software Engineering

[CS 5390](#) Computer Networks

**For the Traditional Computer Science:**

[CS 5349](#) Automata Theory

[CS 5390](#) Computer Networks

The University's general degree requirements are discussed on the [Graduate Policies and Procedures](#) page.

**Core requirements:**

The core requirements for the PhD degree in Computer Science are the same as the ones listed on the [Master of Science in Computer Science](#) page or on the [Master of Science in Software Engineering](#) page.

**Also required are:**

- Pass a qualifying examination.
- Pass [CS 6382](#) Theory of Computation with a grade of B or better
- Two CS or SE 7000 and above level courses
- Sufficient CS electives for a total of at least 75 semester credit hours beyond the baccalaureate degree. At least 9 semester credit hours of organized advanced Computer Science electives must be taken at UT Dallas. The student is encouraged to consult with an advisor in choosing electives.

## Dissertation

A dissertation is required and must be approved by the graduate program. A student must arrange for a dissertation advisor willing to guide this dissertation. The student must have a dissertation supervising committee that consists of no less than four members of whom at least three must be from the Computer Science faculty. Students must enroll in a minimum 3 dissertation semester credit hours in the degree plan. The dissertation may be in computer science exclusively or it may involve considerable work in an area of application.

**NOTE:** Students changing program from MS\_CS/PhD\_CS to MS\_SE/PhD\_SE or MS\_SE/PhD\_SE to MS\_CS/PhD\_CS must submit a new online graduate application. The admissions committee in the department will review the application and make a decision.

## Graduate Level Designation in Cyber Operations

The Department of Computer Science has been designated as a National Security Agency (NSA) Center of Academic Excellence in Cyber Operations (CAE in CyberOps). This designation endorses that the below listed courses cover cyber operations related knowledge units identified by NSA CAE in CyberOps program. Based on this designation a student completing eight courses (that include six core courses and two elective courses) from the list below will have the following notation recorded on their transcript.

### "Completed Curriculum Requirements for National Security Agency's Graduate Level Designation in Cyber Operations at UT Dallas"

Students meeting the requirements of this program can have the designation clause recorded on their transcripts by applying prior to their graduation. For the application process, please visit the Education web page under Computer Science Department web site.

Core Courses:

[CS 6324](#) Information Security

[CS 6332](#) Systems Security and Binary Code Analysis

[CS 6340](#) Wireless Networks

[CS 6349](#) Network Security

[CS 6363](#) Design and Analysis of Computer Algorithms

[CS 6390](#) Advanced Computer Networks

Elective Courses:

Two electives among the below courses:

[CS 6301](#) Special Topics in Computer Science [when topic is Developing and Securing the Cloud, Edge and IoT]

[CS 6335](#) Language-based Security

[CS 6348](#) Data and Applications Security

[CS 6377](#) Introduction to Cryptography

[CS 6378](#) Advanced Operating Systems

[CS 4397](#) Embedded Computer Systems<sup>2</sup>

[CS 4398](#) Digital Forensics<sup>2</sup>

2. CS 4397, and CS 4398 do not count as an elective in the CS/SE graduate degree plan.

## Graduate Certificate in Cyber Defense

15 semester credit hours

The Department of Computer Science has been designated as a National Security Agency (NSA) Center of Academic Excellence in Cyber Defense Education (CAE in CDE). This designation endorses that the below listed courses cover cyber defense related knowledge units identified by NSA CAE in CDE program. Based on this designation a student completing the below courses will qualify to obtain a certificate in information assurance. Students meeting the requirements of this program can obtain their certificate by applying prior to their graduation. For the application process, please visit the Education web page under Computer Science Department web site.

## Program Faculty

FACG> ecs-computer-science-ms

**Professors:** Farokh B. Bastani, Sergey Bereg, Ovidiu Daescu, Yvo G. Desmedt, Ding-Zhu Du, András Faragó, Paul Fishwick, Xiaohu Guo, Gopal Gupta, Zygmunt Haas, Kevin Hamlen, Sanda M. Harabagiu, Dung T. Huynh, Jason Jue, Murat Kantarcioglu, Latifur Khan, Andrian Marcus, Neeraj Mittal, Dan I. Moldovan, Sriraam Natarajan, Yu-Chung (Vincent) Ng, Tien Nguyen, Simeon C. Ntafos, Balakrishnan Prabhakaran, Ravi Prakash, Kamil Sarac, Haim Schweitzer, Bhavani Thuraisingham, W. Eric Wong, Weili Wu, I-Ling Yen, Rym Zalila-Wenkstern

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## Admission Requirements

Students must gain admission to the MS CS program or be eligible to take graduate courses in CS as a non-degree seeking student

## Certificate Requirements

Students must complete the following five courses with a GPA of 3.2 or better.

[CS 6324](#) Information Security

[CS 6348](#) Data and Applications Security

[CS 6349](#) Network Security

[CS 6332](#) Systems Security and Binary Code Analysis

[CS 6378](#) Advanced Operating Systems

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