Software Engineering

Department Information

- **Department Chair:**
  Simone Ludwig, Ph.D.
- **Program Coordinator:**
  Saeed Salem, Ph.D.
- **Department Location:**
  258 QBB
- **Department Phone:**
  (701) 231-8562
- **Department Email:**
  gradinfo@cs.ndsu.edu
- **Department Web Site:**
  ndsu.edu/cs/
- **Application Deadline:**
  April 1 for fall admission; September 1 for spring admission* No summer admission for any Software Engineering Program
- **Credential Offered:**
  Ph.D., M.S., M.S.E, Certificate
- **English Proficiency Requirements:**
  TOEFL iBT 79; IELTS 6.5

Program Description

Software Engineering is focused on the application of systematic, disciplined, and quantifiable approaches to the development, operation, and maintenance of software systems. Inclusive of computer programming but going well beyond, Software Engineering is concerned with methodologies, techniques, and tools to manage the entire software life cycle, including development of requirements, specifications, design, testing, maintenance, and project management. The advent of Software Engineering is a natural result of the continuous quest for software quality and reusability, and the maturing of the software development industry.

The Department of Computer Science offers a Graduate Certificate in Software Engineering, Master of Software Engineering, Master of Science in Software Engineering, and Ph.D. in Software Engineering. The programs are designed to appeal to both full-time students and software professionals who are employed and wish to pursue a program part time. The Master of Software Engineering is a course work only program while the Master of Science in Software Engineering is a course work, comprehensive examination and research program. For additional information, see the Computer Science website (https://www.ndsu.edu/cs/graduates) or contact the Computer Science Department at (701) 231-8562 or gradinfo@cs.ndsu.edu.

**Spring admissions are given only occasionally, depending on funding and faculty interest. If there are no spring openings, spring applicants are automatically considered for the subsequent fall semester.*

In addition to the Graduate School requirements (http://bulletin.ndsu.edu/past-bulletin-archive/2020-21/graduate/admission-information), applicants must fulfill the program requirements listed below:

Certificate

1. B.S. or equivalent degree from an educational institution of recognized standing, including 12 semester hours or equivalent of Computer Science or Software Engineering courses from an educational institution of recognized standing, or at least one year full-time professional software engineering experience;
2. Programming skill in a modern higher level programming language, preferably C++, C#, or Java;
3. A 2.85 (on a 4.0 scale) GPA in previous course work.

Master of Software Engineering

1. Bachelor's level (B.S., B.A., Sc.B., etc.) degree from an educational institution of recognized standing;
2. Ability to design and implement a program consisting of several interacting classes that might total approximately 100 executable statements;
3. International Students require a minimum TOEFL ibT of 79 or an IELTS of 6.5.
4. A 3.0 (on a 4.0 scale) GPA in previous coursework. Conditional admission may be given with a 2.7 or higher GPA and professional experience.

Master of Science

1. Four year or longer B.S. or equivalent degree from an educational institution of recognized standing with at least a 3.0 grade point average on a 4.0 grade point scale. Eighteen semester hours or equivalent in Computer Science from an educational institution of recognized standing, or at least 2 years of full-time professional software engineering experience. Full time professional experience may offset the GPA requirement at the rate of 0.1 in GPA for each 18 months of such experience to a maximum of 0.3 in GPA;
2. Programming skill with one modern higher level programming language, preferably C++, C#, or Java.
3. A 3.0 (on a 4.0 scale) GPA in all previous coursework.

Doctor of Philosophy

1. Four year or longer B.S. or equivalent degree from an educational institution of recognized standing with at least a 3.25 grade point average (GPA) on a 4.0 grade point scale. Eighteen semester hours or equivalent in Computer Science from an educational institution of recognized standing, or at least 3 years of full-time professional software engineering experience. Significant full-time professional software development experience may offset this GPA requirement at the rate of 0.1 in GPA for each 2 years of such experience to a maximum of 0.4 in GPA. If the applicant has an M.S. or equivalent degree from an educational institution of recognized standing, the GPA in that degree should be at least 3.35 on a 4.0 scale.
2. Programming skill in at least 1 higher level programming language, preferably C++, C#, or Java.

Graduate Certificate

Code	Title	Credits
CSCI 713	Software Development Processes	3
Select two of the following:		6
CSCI 714	Software Project Planning and Estimation	
CSCI 715	Software Requirements Definition and Analysis	
CSCI 716	Software Design	
CSCI 717	Software Construction	
CSCI 718	Software Testing and Debugging	
CSCI 848	Empirical Methods in Software Engineering	3
Total Credits		12

Masters of Software Engineering

Code	Title	Credits
Core Courses - 15 Credits		
CSCI 713	Software Development Processes	
CSCI 715	Software Requirements Definition and Analysis	
CSCI 716	Software Design	
CSCI 718	Software Testing and Debugging	
CSCI 848	Empirical Methods in Software Engineering	
Electives - 15 Credits		
CSCI 714	Software Project Planning and Estimation	
CSCI 717	Software Construction	
CSCI 724	Survey of Artificial Intelligence	
CSCI 736	Advanced Intelligent Systems	
CSCI 765	Introduction To Database Systems	
CSCI 834	Knowledge Based Systems	
CSCI 846	Development of Distributed Systems	
CSCI 847	Software Complexity Metrics	
Total Credits - 30		

Master of Science

Code	Title	Credits
Core Courses		12
Students must complete the core within five semesters of their entering the program.		
CSCI 713	Software Development Processes	
CSCI 715	Software Requirements Definition and Analysis	
or CSCI 718	Software Testing and Debugging	
CSCI 716	Software Design	
CSCI 765	Introduction To Database Systems	
Six credits (not part of the core) from:		6
CSCI 714	Software Project Planning and Estimation	
CSCI 715	Software Requirements Definition and Analysis	
CSCI 717	Software Construction	
CSCI 718	Software Testing and Debugging	
CSCI 845	Formal Methods for Software Development	
CSCI 846	Development of Distributed Systems	
CSCI 847	Software Complexity Metrics	
CSCI 848	Empirical Methods in Software Engineering	
Other Computer Science or Computer Engineering courses selected with and approved by the student's graduate advisory committee. (six - thesis students) or three (paper students)		3-6
CSCI 790	Graduate Seminar (in software engineering areas (1 credit each), approved by adviser)	3
Research Component*		3-6
CSCI 797	Master's Paper	
or CSCI 798	Master's Thesis	
Total Credits		33

Students seeking an option in cybersecurty must take 9 credits from the below list. No more than 3 credits can be from CSCI 790.

Code	Title	Credits
CSCI 676	Computer Crime & Forensics	3
CSCI 793	Individual Study/Tutorial (cybersecurity focus)	1-5
CSCI 791	Temporary/Trial Topics (cybersecurity focus)	1-5
CSCI 790	Graduate Seminar (cybersecurity focus)	1-3
CSCI 669	Network Security	3
CSCI 773	Foundations of the Digital Enterprise	3
CSCI 783	Topics In Software Systems (cybersecurity focus)	3

* Either a thesis option or comprehensive study paper based on a significant software development project undertaken by the student, perhaps as a member of a team, either at the University or as part of a job. This project will require design, implementation, and testing of a significant piece of computer software.

Doctor of Philosophy

Code	Title	Credits
Select 5 from the courses listed below and not duplicating any items used to satisfy requirements for the Master of Science degree:		15
CSCI 713	Software Development Processes	
CSCI 714	Software Project Planning and Estimation	
CSCI 715	Software Requirements Definition and Analysis	
CSCI 716	Software Design	
CSCI 717	Software Construction	
CSCI 718	Software Testing and Debugging	

CSCI 845	Formal Methods for Software Development	
CSCI 846	Development of Distributed Systems	
CSCI 847	Software Complexity Metrics	
CSCI 848	Empirical Methods in Software Engineering	
Courses in Computer Science or Electrical and Computer Engineering approved by the student's Supervisory Committee.		9
CSCI 899	Doctoral Dissertation	15
Total Credits		90

Students seeking an option in cybersecurty must take 9 credits from the below list. No more than 3 credits can be from CSCI 790.

Code	Title	Credits
CSCI 676	Computer Crime & Forensics	3
CSCI 790	Graduate Seminar (cybersecurity focus)	1-3
CSCI 791	Temporary/Trial Topics (cybersecurity focus)	1-5
CSCI 793	Individual Study/Tutorial (cybersecurity focus)	1-5
CSCI 669	Network Security	3
CSCI 773	Foundations of the Digital Enterprise	3
CSCI 783	Topics In Software Systems (cybersecurity focus)	3

Department Faculty

Anne Denton, Ph.D.
University of Mainz, 1996
Research Interests: Data Mining, Bioinformatics, Scientific Informatics, Databases, Geospatial Data, Cloud Computing

Jun Kong, Ph.D.
University of Texas, Dallas, 2005
Research Interests: Human Computer Interaction, Mobile Computing, Software Engineering

Juan (Jen) Li, Ph.D.
University of British Columbia, 2008
Research Interests: Smart and Connected Health, Semantic Web Technologies, Internet of Things (IoT)

Lu Liu, Ph.D.
University of Texas San Antonio, 2017
Research Interests: Bioinformatics, Data Mining, Machine Learning, Data Science

Simone Ludwig, Ph.D.
Brunel University, 2004
Research Interests: Swarm Intelligence, Evolutionary Computation, Deep Neural Networks, Fuzzy Reasoning, Machine Learning

Kenneth Magel, Ph.D.
Brown University, 1977
Research Interests: Software Engineering, Human-Computer Interfaces, Software Complexity, and Software Design

M. Zubair Malik, Ph.D.
University of Texas at Austin, 2014
Research Interests: Program Analysis, Automated Program Repair, Secure Software Development, Software Verification-Validation and Testing, Software Systems (especially large scale Distributed Systems for Data science and Machine Learning), Formal Methods, Application of Artificial Intelligence in Program Analysis

Saeed Salem, Ph.D.
Rensselaer Polytechnic Institute, 2009
Research Interests: Bio-Informatics and Data Mining

Jeremy Straub, Ph.D.
University of North Dakota, 2015
Research Interests: Multi-tier Mission Architecture & Control, Autonomous Data Link Reduction, Autonomous Vehicle Control, Machine Vision, Super Resolution

Vasant Ubhaya, Ph.D.
University of California-Berkeley, 1971

Research Interests: Algorithm Analysis, Approximation and Optimization

Changhui Yan, Ph.D.
Iowa State University, 2005
Research Interests: Bioinformatics, Computational Biology, Genomics, Machine Learning, Data Mining, Big Data, Cloud Computing

Professors of Practice

Oksana Myronovych, Ph.D.
North Dakota State University, 2009

Affiliate Faculty

Otto Borchert, Ph.D.
North Dakota State University, 2015
Research Interests: Artificial Intelligence, Educational Games, STEM Learning

Hassan Reza, Ph.D.
North Dakota State University, 2002
Research Interests: Software Architecture, Cloud Computing, Architectural Analysis and Description