

# ISU Computer Science Advising Handout

## Careers, Jobs, and Flexibility

The discipline of Computer Science has arisen as one of the highest-paying fields, preparing graduates for a wide range of careers including software engineering, graphics, databases, and cyber security. 70% of the new STEM jobs over the next decade are expected to be CS related. National starting salaries are around \$65,000 with career salaries averaging \$147,000 (Robert Half 2017). CS majors with MBAs in technical management positions may earn significantly more.

An ISU Bachelor of Science in CS provides its students with a broad, yet rigorous computer science education, and its graduates with the following outcomes: the requisite qualifications for obtaining employment as a computer scientist; an understanding that life-long learning is an integral part of personal, professional and social interaction; and the requisite qualifications for pursuing an advanced degree in CS or a related field, particularly when the curriculum is augmented with additional selected math courses. While many CS graduates focus on technical work, a CS major can also be a general purpose degree; by adding a minor in Philosophy, CS majors can go on to Law School, or with a minor in Business Administration, they may complete the MBA in a 5th year; this is particularly important for those students interested in graduate work as part of ISU's National Information Assurance Training and Education Center (NIATEC). They will be immersed in a virtual learning environment based on modern software design and development processes.

## Advising Process

Students wishing to become computer science majors should contact the CS office (David Beard [beard@isu.edu](mailto:beard@isu.edu) 208.282.2684) to have an advisor assigned to them and to sketch out an initial program of study. Before the beginning of their final year of study, students should insure their degree works page indicates all degree and major requirements are completed. At the beginning of their final semester, students need to apply for graduation. All courses and prerequisites applying toward the Computer Science major and minor must be passed with a grade of "C-" or higher. For all CS major or minor courses after 1181, CS students are expected to have a laptop computer with sufficient capacity to run various tools within virtual machines. Students are expected to adapt to new operating systems, DBMSs, programming languages, development environments, software engineering techniques, and security protocols.

## Bachelor of Science in Computer Science

MATH 1170		Calculus I	4cr
MATH 1175		Calculus II	4cr
MATH 2275		Calculus III	4cr
MATH 2240		Linear Algebra	3cr
CS/MATH 1187		Applied Discrete Structures	3cr
OR	MATH 2287	Foundations of Mathematics	3cr
PHYS 2211		Engineering Physics	4cr
OR	MATH 3360	Differential Equations	3cr
MATH 3350		Statistical Methods	3cr
OR	MATH 4450	Mathematical Statistics I	3cr
OR	MGT 2216	Business Statistics	3cr
MATH 3352		Introduction to Probability	3cr
OR	MGT 2217	Advanced Business Statistics	3cr

FIGURE 1 MATHEMATICS AND SCIENCE

Computers are fundamentally mathematical devices created by mathematical logicians including Von Neumann and Turing, and based on the works of Babbage, Boole, and Whitehead/Russell. Computer Scientists are expected to analyze and implement solutions involving calculus, linear algebra, mathematical logic, and statistics. Those students interested in

graduate school in Computer Science are urged to take Math 2287, 3352, 4450, 4406, and 4407; a double major in Math and Computer Science might also be considered. Figures 1 and 2 detail required Math and Computer Science courses.

CS 1181	Computer Science and Programming I	3cr
CS 1182	Computer Science and Programming II	3cr
INFO 1150	Software and Systems Architecture	3cr
CS 2275	Computer Organization and Assembly	3cr
CS 3308	Data Structures and Programming	3cr
INFO 3307	Systems Analysis and Design	3cr
INFO 3380	Networking and Virtualization	3cr
CS 3385	Data Structures and Algorithms	3cr
INFO 4411	Intermediate Information Assurance	3cr
CS 4481	Programming Language, Theory, and Compilers	3cr
INFO 4407	Database Design and Implementation	3cr
CS 4471	Operating Systems	4cr
CS 4488	Advanced Software Engineering and Project	3cr

**FIGURE 2 REQUIRED COMPUTER SCIENCE AND RELATED COURSES**

*6 Elective Credits from the Following List:*

- Any 4000 level Computer Science course;
- INFO 4412 through 4416, 4430, 4482, 4484;
- MATH 4406, 4407, 4408, 4441, 4442, 4451, PHIL 4470.

## Computer Science Minor

Some students in other disciplines may find increased knowledge about Computer Science useful. The following courses as well as 6 credits from the above list of approved electives or CS 3385 or Info 4407 or 4411 are required for the minor.

MATH 1170		Calculus I	4cr
OR	MGT 2217	Advanced Business Statistics	3cr
INFO 1150		Software and Systems Architecture	3cr
CS 1181		Computer Science and Programming I	3cr
CS 1182		Computer Science and Programming II	3cr
CS 2275		Computer Organization and Assembly	3cr
CS 3308		Data Structures and Programming	3cr

**FIGURE 3 COMPUTER SCIENCE MINOR**

## Computer Science Courses

**CS 1181 Computer Science and Programming I 3 credits.** Problem solving methods and algorithm development with an emphasis on programming style. Secure software design/coding concepts for resilient software. Equivalent to INFO 1181. Satisfies Objective 7 of the General Education Requirements. Pre-or-COREQ: MATH 1147 or MATH 1143 F, S

**CS 1182 Computer Science and Programming II 3 credits.** Object Oriented Programming and design. Sorting and searching. Recursion. Event-driven programming. UML class-diagrams. Secure software design/coding concepts for resilient software systems. PREREQ: CS 1181 or INFO 1181. F, S

**CS 1187 Applied Discrete Structures 3 credits.** Boolean algebra and logic; sets, functions, and relations; iteration, recursion, and induction; algorithms; programming in pseudocode; basic counting principles; graphs and trees; and other selected topics from discrete mathematics. Equivalent to MATH 1187. PREREQ: CS 1181. S

**CS 2275 Computer Organization and Assembly 3 credits.** Systems programming & assembly: effect of computer architecture on the performance and correctness of code including data representation, machine language, compilation, code optimization, memory hierarchy, linking, pipelining, virtual memory, I/O storage, and operating systems. Pre or COREQ Info 1150 & CS 1182. PREREQ: Math 1143. D

**CS 3308 Data Structures and Programming 3 credits.** Introduction to data structures and their associated algorithms. Abstract data types, linked lists, stacks, queues, trees, pointers. Sorting Searching. Elementary threading. Extensive programming projects. Prereq: CS 1182 & Math 1143. D

**CS 3393 Computer Science Internship 1-3 credits.** Internship program coordinated by CS faculty providing significant exposure to computer science issues and techniques. May not be used to fulfill computer science major or minor requirements. Prereq: Info 3307, info 4407, CS 3308, CS 2275, Math 1175, Engl 1102. D

**CS3321 Software Engineering 3 credits.** Techniques and tools for conceiving, designing, testing, deploying, maintaining, and documenting large software systems with particular focus on the structured analysis and design phases including task analysis, human factors, costs, and project and team management. PREREQ: CS3308, D.

**CS 3385 Data Structures and Algorithms 3 credits.** The design, construction, and analysis of data structures, algorithms, and complexity beyond CS 3308. Balanced trees, heaps, hash tables, graphic algorithms, sorting and searching. Space and time complexity. Significant coding projects. PREREQ: CS 3308, CS 2275, MATH 1175, Math 2240 & (CS/MATH 1187 or MATH 2287). D

**CS 4420 Computer Security and Cryptography 3 credits.** Public key and private key cryptography, key distribution, cryptographic protocols, requisite mathematics and selected topics in security and cryptography. PREREQ: CS 3385. D

**CS 4444 Image and Audio Processing 3 credits.** Image/audio acquisition, quantization, spatial and spectral filters, sharpening, smoothing, compression, segmentation. PREREQ: CS/MATH 1187, MATH 3352, and MATH 3360. D

**CS 4451 Database Theory Design Programming 3 credits.** Data models, relational algebra and calculus, SQL and stored procedures, database design, ER diagrams, normalization theory, data storage, index structures, performance analysis, concurrency control. Database programming language access. PREREQ: CS 3385. D

**CS 4458 Computer Graphics 3 credits.** Graphics, primitives, scan conversion, transformations, object hierarchies, curves and surfaces, solid modeling, visible surface determination, illumination, shading, manipulation and advanced modeling techniques. PREREQ: CS 3385 D

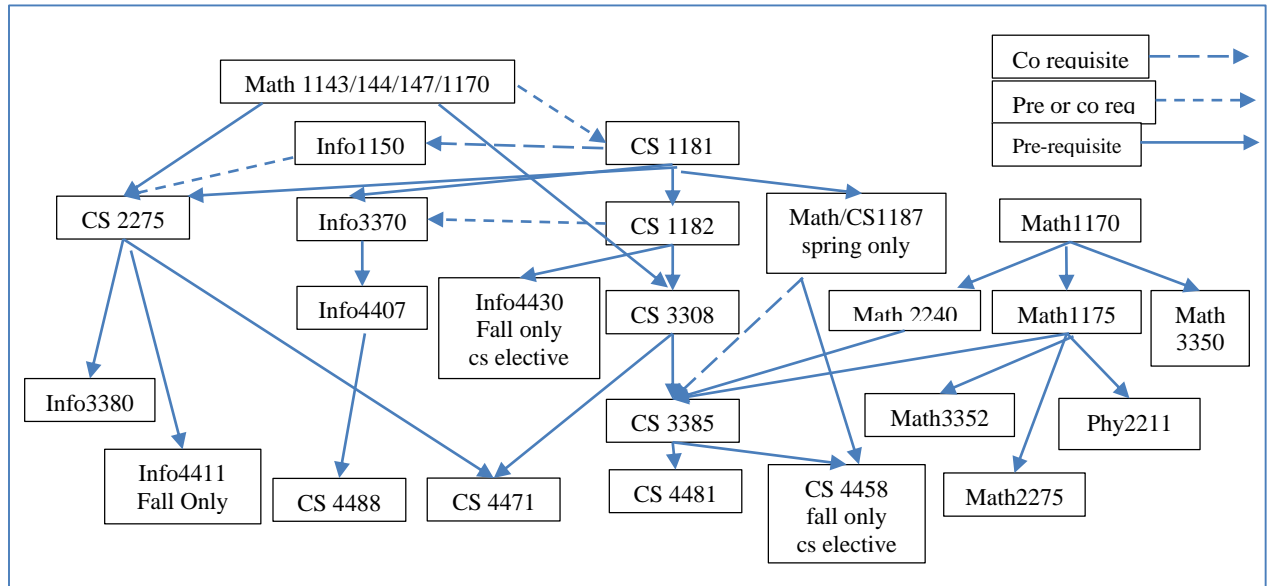
**CS 4471 Operating Systems 4 credits.** Theory, design, implementation of software systems to support the management of computing resources. Concurrency, mutual exclusion synchronization, scheduling. Process, memory, security. I/O files, device management. Extensive systems programming including implementation of an OS. PREREQ: CS 3308& 2275. D

**CS 4480 Theory of Computation 3 credits.** Finite representations of languages, deterministic and nondeterministic finite automata, context free languages, regular languages, parsing, Turing Machines, Church's Thesis, uncomputability, computational complexity classes. PREREQ: CS 3385. D

**CS 4481 Compilers 3 credits.** Design and construction of compilers. Theory and pragmatics of lexical, syntactic, and semantic analysis. Interpretation. Code generation for a modern architecture. Run-time environments. Includes a large compiler-implementation project. PREREQ: CS 3385. D

**CS 4488 Advanced Software Engineering and Project 3 credits.** Analysis, specification, design, implementation, and testing of a large software project. Formal approach and tools. Software lifecycles; human computer interaction; project and team management. Uses a different programming language. PREREQ: CS 3385 & INFO 3307& INFO 4407. D

# Computer Science Prerequisite Chaining



## Computer Science 2.5 Year Plan of Study

The ISU Bachelor in Computer Science is a 120 credit hour degree that generally requires 4 years of full-time study to complete the required major, general education, and elective courses. However, the CS major courses can be completed in 5 semesters starting either spring or fall as detailed below. \*Students who have not completed 54 credit hours, will require an override; please list all completed CS and Math courses in the request.

First or Second Year					
Fall			Spring		
CS 1181	Intro to Computer Science	3	Math 1170	Calculus I	4
Math 1147	Pre-Calculus	5	CS 1182	Computer Science & Prog. II	3
Info 1150	Software and Systems Arch	3	CS 2275	Comp Org and Assembly	3
Engl 1101	Critical Reading and Writing	3	Math 1187(Sp Only)	Discrete Math	3
			Info 3307*	Systems Analysis & Design	3
Second or Third Year					
Fall			Spring		
CS 3308	Data Structures & Prog.	3	CS 4471	Operating Systems	4
Math 1175	Calculus II	4	Math 3352	Probability	3
Math 2240	Linear Algebra	3	CS 3385	Data Structures & Algorithms	3
Info 3380*	Networks	3	Info 4407*	Databases	3
Info 4411(fallOnly)*	Information Assurance	3	Math 2275	Calculus III	4
Third or Fourth Year					
Fall					
CS 4488	Senior Project	3			
Info 4430(fallOnly)*	Web App. Development	3			
CS 4481	Compilers	3			
CS 4458(fallOnly)	Computer Graphics	3			
Physics 2211	Engineering Physics	4			