Computer Science

Undergraduate Student Handbook
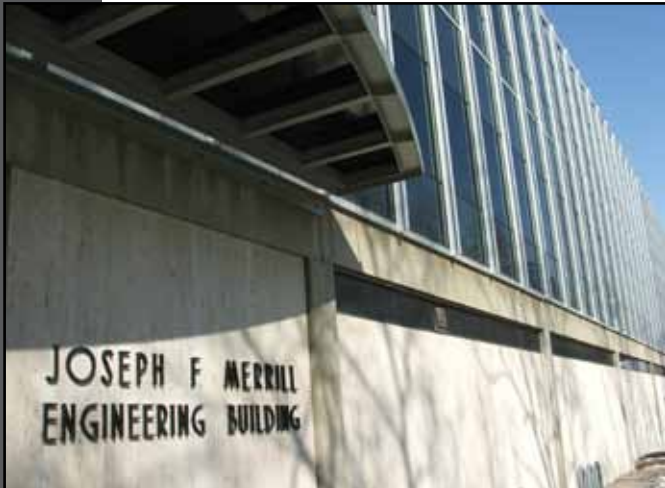## 2013-2014
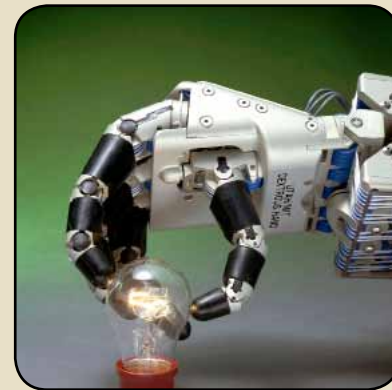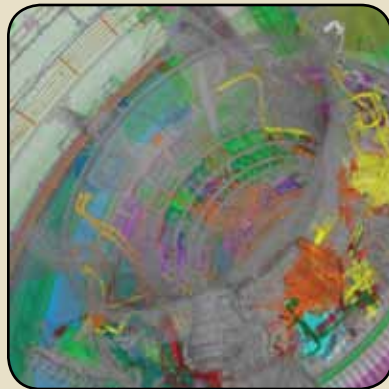
SCHOOL OF COMPUTING
THE UNIVERSITY OF UTAH

Welcome to the
School of Computing

> "Almost every influential person in the modern computer-graphics community either passed through the University of Utah or came into contact with it in some way."
>
> -The Algorithmic Image:
> Graphic Visions of the Computer Age
> by Robert Rivlin

The School of Computing was originally founded as the Computer Science Department at the University of Utah in 1965 by three electrical engineering faculty members (In 2000, the department officially became the School of Computing). In 1985, the department reached 10 full-time faculty members. By 1996, it had doubled to 20. Today the School of Computing boasts 40 regular faculty members, four research faculty, and 19 adjunct faculty, with more than 420 CS undergraduate students, 90 CE undergrads, 140 enrolled in the M.S. program and 130 enrolled in the CS Ph.D. program.

Our Research Areas Include:

- Computer Graphics and Visualization
- Computer Systems
- Information Management
- Natural Language Processing and Machine Learning
- Program Analysis, Algorithms and Formal Methods
- Robotics
- Scientific Computing
- Computer Architecture

The School of Computing at the University of Utah has a long history of distinguished faculty and alumni who have made substantial contributions to research and industry. SoC Ph.D. graduate John Warnock (1969) developed the Warnock recursive subdivision algorithm for hidden surface elimination, and later founded Adobe Systems, which developed the Postscript language for desktop publishing. Alan Ashton, 1970 Ph.D. graduate went on to teach at Brigham Young University and founded WordPerfect. Computer animation pioneer Ed Catmull, received both his B.S. and Ph.D. degrees in computer science from the University of Utah. Today he is the co-founder and president of Walt Disney and Pixar Animation Studios. He received a technical Academy Award in 1996 from the Academy of Motion Picture Arts and Sciences for "pioneering inventions in Digital Image Compositing."

Today's School of Computing faculty and students continue to carry the tradition of innovative research and technological advancements at the University of Utah.

Table of Contents

Administration

Departmental Leadership

Director, School of Computing

Al Davis
MEB 3190
Phone: 801-581-3991
ald@cs.utah.edu

Embedded/multi-core architecture, auto. domain specific architecture synthesis, VLSI, asynchronous circuits

Associate Director, School of Computing

Ellen Riloff
MEB 3140
Phone: 801-581-7544
riloff@cs.utah.edu

Natural language processing, information retrieval, and artificial intelligence

Associate Director, School of Computing

Ross Whitaker
WEB 3464
Phone: 801-587-9549
whitaker@cs.utah.edu

Computer vision, visualization, and image processing

Industrial Liaison
Assistant Professor

Matthew Might
MEB 3450
Phone: 801-581-8224
might@cs.utah.edu

Security, parallelism, verification and optimization

Undergraduate Program

Director, Undergraduate Studies

Jim de St. Germain
MEB 3190
Phone: 801-585-3352
germain@cs.utah.edu

Artificial Intelligence, parallel computing, autonomous agents

Director, Educational Programs

Joe Zachary
MEB 3190
Phone: 801-581-7079
zachary@cs.utah.edu

Application of computers to education

Assistant Professor, Lecturer

Peter Jensen
MEB 3148
Phone: 801-585-9418
pajensen@cs.utah.edu

Assistant Professor, Lecturer

Erin Parker
MEB 3190J
Phone: 801-587-9505
parker@cs.utah.edu

Programming languages, Computer memory systems and performance

Administration

Graduate Programs

Director, Graduate Studies
Director, Scientific Computing & CES

Mike Kirby
WEB 3602
Phone: 801- 585-3421
kirby@sci.utah.edu

Scientific computing
and visualization

Director, Computer Engineering
Directer, Digital Media

Erik Brunvand
MEB 3142
Phone: 801-581-4345
elb@cs.utah.edu

Computer architecture
and VLSI systems

Director, Data Management & Analysis

Feifei Li
MEB 3464
Phone: 801-585-6673
lifeifei@cs.utah.edu

Databases, large-scale
data management

Director, Game Engineering
Master Games Studio

Mark van Langeveld
MEB 3122
Phone: 801-376-9071
longfieldstudio@gmail.com

Director, Graphics/ Visualization

Charles Hansen
WEB 4692
Phone: 801-581-3154
hansen@sci.utah.edu

Visualization, computer
graphics, parallel computa-
tion, computer vision

Executive Director, Master Games Studio

Robert Kessler
MEB 3146
Phone: 801-581-4653
kessler@cs.utah.edu

Systems software and
software engineering

Director, Robotics

John Hollerbach
MEB 2196A
Phone: 801-585-6978
jmh@cs.utah.edu

Robotics, teleoperation,
virtual reality, and human
motor control

Director, Combined BS/MS Program
Director, Image Analysis

Thomas Fletcher
WEB 4686
Phone: 801-587-9641
fletcher@sci.utah.edu

Shape analysis, computer
vision/image analysis, diffu-
sion tensor image processing

Faculty

Director, Graduate Admissions

Rajeev Balasubramonian
MEB 3414
Phone: 801-585-4553
rajeev@cs.utah.edu

Computer architecture: clustered processors, memory hierarchy bottlenecks

Assistant Professor

Adam Bargteil
MEB 3456
Phone: 801-585-0132
adamb@cs.utah.edu

Computer graphics and animation

Professor

Martin Berzins
MEB
Phone: 801-585-1545
mb@cs.utah.edu

Adaptive numerical methods, parallel algorithms, computational fluid and solid mechanics applications

Dean, College of Engineering

Richard Brown
WEB 1692
Phone: 801-585-7498
brown@utah.edu

Microprocessor design, circuits to minimize leakage, solid-state chemical sensors.

Professor

Elaine Cohen
MEB 2891
Phone: 801-581-8235
cohen@cs.utah.edu

Computer graphics, scientific visualization, geometric modeling, mechanical design

Associate Professor

Matthew Flatt
MEB 3122
Phone: 801-587-9091
mflatt@cs.utah.edu

Programming languages and systems

Professor

Guido Gerig
WEB 3686
Phone: 801-585-0327
gerig@sci.utah.edu

Medical image analysis

Professor

Ganesh Gopalakrishnan
MEB 3428
Phone: 801-581-3568
ganesh@cs.utah.edu

Dynamic formal verification of message passing (MPI), thread programs.

Faculty

Professor

Mary Hall
MEB 3466
Phone: 801-585-1039
mhall@cs.utah.edu

Optimization, parallel-
ization and compilers

Professor

Tom Henderson
WEB 2871
Phone: 801-581-3601
tch@cs.utah.edu

Computer vision, mobile
robotics

Professor

Lee Hollaar
MEB 4154
Phone: 801-581-8224
hollaar@cs.utah.edu

Digital intellectual
property law

Distinguished Professor

Chris Johnson
WEB 3850
Phone: 801-581-7705
crj@sci.utah.edu

Scientific computing, visual-
ization, imaging, and prob-
lem solving environments

Associate Professor

Sneha Kasera
MEB 3408
Phone: 801-581-4541
kasera@cs.utah.edu

Computer networks/systems,
mobile systems and wireless
networks, network security

Assistant Professor

Miriah Meyer
WEB 4887
Phone: 801-585-6513
miriah@cs.utah.edu

Visualization and large
multidimensional data

Professor

Valerio Pascucci
WEB 4646
Phone: 801-587-9885
pascucci@sci.utah.edu

Computer graphics, compu-
tational geometry, geometric
programming, solid modeling

Assistant Professor

Jeff Phillips
MEB 3424
Phone: 801-585-7775
jeffp@cs.utah.edu

Algorithms, data mining and
machine learning

Faculty

Assistant Professor

Zvonimir Rakamaric
MEB 3442
Phone: 801-581-6139
zvonimir@cs.utah.edu

Formal verification
methods

Assistant Professor

Jur van den Berg
MEB 3138
Phone: 801-585-5379
Berg@cs.utah.edu

Robotics, virtual
environments

Associate Professor

John Regehr
MEB 3470
Phone: 801-581-4280
regehr@cs.utah.edu

Embedded, real-time &
operating systems, sensor
networks, static analysis

Associate Professor

Suresh Venkatasubramanian
MEB 3442
Phone: 801-581-8233
suresh@cs.utah.edu

Algorithms, computational
geometry and data mining

Professor

Rich Riesenfeld
WEB 2897
Phone: 801-581-5843
rfr@cs.utah.edu

Computer graphics, geometric
modeling, design

Associate Professor

Kobus van der Merwe
MEB 3490D
Phone: 801-581-3012
kobus@cs.utah.edu

Network systems, cloud
computing, security, mobile
netwroking

Professor

William Thompson
MEB 3446
Phone: 801-585-3302
thompson@cs.utah.edu

Computer vision, visual
perception

Assistant Professor

Cem Yuksel
WEB 2686
Phone: 801-581-4439
cem@cemyuksel.com

Animation, computer
graphics

School of Computing Office Staff

Office Manager

Karen Feinauer
MEB 3190
Phone: 801-585-3551
karenf@cs.utah.edu

Master's Advisor

Ann Carlstrom
MEB 3190
Phone: 801-581-7631
annc@cs.utah.edu

Academic Advising Coordinator

Kelly Olson
MEB 3190
Phone: 801-581-8224
kelly@cs.utah.edu

Academic Advisor

Vicki Jackson
MEB 3190
Phone: 801-581-8224
vicki@cs.utah.edu

Communications

Chris Coleman
MEB 3190
Phone: 801-581-8580
coleman@cs.utah.edu

Accountant

Sara Mathis
MEB 3190
Phone: 801-581-8224
smathis@cs.utah.edu

Accountant

Callie Martens
MEB 3190
Phone: 587-3652
callie@cs.utah.edu

Accountant

Chethika Wijayawardhana
MEB 3190
Phone: 801-587-9266
chethika@cs.utah.edu

School of Computing Degrees

The School of Computing offers a Bachelor of Science degree in computer science. The undergraduate program begins with a set of three courses that give students a solid background in object-oriented programming while exposing them to the breadth of issues that arise in computer science.

Students then take seven core courses in discrete mathematics, software engineering, computer organization, algorithms and data structures, software systems, and theory. They build on this background by choosing seven electives from the breadth of the School's course offerings (which includes advanced courses in theoretical computer science, scientific computing, artificial intelligence, databases, operating systems, computer networks, programming languages, graphics, computer architecture, and digital design).

Each student's undergraduate program is capped with a senior project. Along with an in-depth study of computing, the curriculum encompasses a general education in mathematics, science, and the humanities.

The School also offers a combination B.S./M.S. degree for students who wish to complete both the Bachelor and Master of Science degrees in a total of five years. Students who want to use computers in another field may opt for a minor in computer science to supplement another degree at the University of Utah.

Undergraduate Degrees

Bachelor of Science in Computer Science

Bachelor of Science in Computer Science
   Emphasis: Entertainment Arts & Engineering

Bachelor of Science in Computer Engineering

Undergraduate Minor

Computer Science

Combined Degree Program

Bachelor's/ Master's Degree

Graduate Degrees

COMPUTER SCIENCE DEGREES
   • Computer Science (MS)
   • Computer Science (Non-Thesis MS)
   • Computer Science (PhD)

COMPUTING DEGREES
   • Computer Engineering (MS and PhD)
   • Data Management and Analysis (MS and PhD)
   • Digital Media (MS)
   • Game Engineering (MS)
   • Graphics and Visualization (MS and PhD)
   • Image Analysis (MS and PhD)
   • Robotics (MS and PhD)
   • Scientific Computing (PhD)

A Bachelor of Science in computer engineering is jointly offered by the School of Computing and the Department of Electrical and Computer Engineering. Information about that program is available in a separate handbook or from www.ce.utah.edu.

The School of Computing offers a computer science bachelor's degree with an emphasis on Entertainment Arts and Engineering. The focus of this track is to provide interested students with the necessary skills and knowledge to enter the arena of computer gaming and animation.

School of Computing Degree Options

BACHELOR OF SCIENCE DEGREE

The standard Bachelor of Science in computer science track is a software -oriented degree which includes 18 computer science courses, including required core, theory and elective courses. A student must be admitted as a computer science major by the School in order to take upper-division courses and pursue the computer science degree. Computer science pre-majors take five introductory math and computer science courses before applying to the major.

ENTERTAINMENT ARTS EMPHASIS

Interested students are encouraged to explore the Entertainment Arts and Engineering (EAE) emphasis through the computer science degree. This track requires courses which are relevant to computer game designers and computer animators, including drawing courses and film courses. The EAE curriculum results in a computer science degree, with an emphasis on the entertainment arts.

COMBINED B.S./ M.S. PROGRAM

The combined Bachelor of Science/ Master of Science program in computer science allows students to earn a B.S. and M.S. in approximately five academic years. The B.S./ M.S. can combine a B.S. in either computer science or computer engineering with an M.S. in either computer science or computing. Undergrads will begin graduate-level courses during the senior year in order to complete the master's degree in just one additional year.

Computer Science Pre-Major

PRE-MAJOR STATUS

Any student can become a computer science pre-major by informing the University Registrar or the School of Computing academic advisor. It is advisable to do this early to ensure receiving information about the major and staying advised of any changes that may be made in degree requirements. Declaration as a pre-major will also enable participation in activities associated with the degree program, such as the Undergraduate Student Advisory Committee, and allows students to apply for School of Computing scholarships.

Pre-majors are required to take the following courses and must achieve a C- or better (at minimum) in each course. Further, the average GPA in these courses, and the students overall UofU GPA, must be a 3.0 or higher in order to apply for full major status (FMS).

Please note that the 3.0 GPA is the minimum requirement and may not result in placement as a full major; for example when there are more applicants than available spots. In such cases, the top applicants will be selected by the SoC undergraduate admittance committee.

PRE-MAJOR REQUIREMENTS All five courses are required in order to apply for full major status (FMS)		
CS 1400	Intro to Computer Science	3 credits
CS 1410	Object-Oriented Programming	4 credits
CS 2420	Algorithms & Data Structures	4 credits
Math 1210	Calculus I	4 credits
Math 1220	Calculus II	4 credits

1: Note: the math department requires a C or higher to advance to the next level of math

2: Students who are not promoted to FMS should consult with the SoC advisors about possible paths to be considered in future years. The may include retaking pre-major courses, taking CS courses that do not have a major status pre-req, or taking advanced math courses.

Computer Science Full Major

FULL MAJOR STATUS

In order to become a full major, a student must complete the required pre-major courses and then apply for full major status. An application may be submitted online via the CS website when the student expects to complete these requirements. Applications for admission are reviewed at the end of spring and summer semesters. New majors are only allowed into the major during fall semesters.

One may not pre-register for any upper division classes in computer science without first being admitted as a full major or a minor. Transfer students should be advised that they will only be allowed to start into full major status during the fall and should plan their transfer accordingly. Meeting with the academic advisor early to plan pre-major courses is the best way to ensure these requirements will be met in time for a fall start.

DOUBLE MAJORING

Some students may wish to earn a degree in computer science as their second bachelor's degree. This is possible as long as the requirements for both degrees are met. In some cases, fewer additional class hours are needed for similar majors (ex: computer engineering, electrical engineering, or mathematics).

University general education and bachelor degree requirements will only need to be completed once and will be applied to both degrees. Students pursuing a double major must notify the academic advisor in both majors to become registered with the University and ensure they are meeting both sets of major requirements.

ADDING A MINOR

Students are encouraged to enhance their computer science education by adding a minor to their degree. A minor is not required, but may allow a CS student to explore other areas of interest at the University of Utah. Students may add a minor by contacting the departmental advisor for the minor for which they plan to pursue after they have been admitted to their intended major.

Computer Science Graduation Requirements

SCHOOL OF COMPUTING GRADUATION REQUIREMENTS

A minimum of 17 CS classes must be taken. Ten CS classes (30 credits) must be taken at the University of Utah. A student may repeat major courses (CS/math/science) only once. All major classes taken to satisfy degree requirements must be taken for a letter grade (CR/NC not accepted). A min. grade of C- or better is required for all major courses.

GENERAL EDUCATION REQUIREMENTS
Every student must complete a set of University-wide graduation requirements before receiving their bachelor's degree. The Office of Undergraduate Studies is responsible for overseeing this program. The General Education requirements are described in the University of Utah General Catalog. See University College for minimum grade requirements. The requirements for CS majors are more specific.

a. The writing requirement (WR2) is satisfied by either Wrtg 2010 or ESL 1060 (for students who speak English as a second language).

b. The quantitative reasoning (QR) requirement is satisfied by Math 1210 which is required for computer science pre-majors.

c. The two-course requirement in physical and life sciences (SF) is satisfied by classes required for the major, and no additional courses are needed.

d. Students must take two intellectual explorations courses in each: fine arts (FF), humanities (HF), and social sciences (BF). Two of these six courses must be upper division – one should meet the diversity (DV) requirement and one should meet the international (IR) requirement. Students should consult with the CS academic advisor to be sure they select appropriate classes to satisfy these requirements with a minimum number of credit hours .

e. The American institutions (AI) requirement can be satisfied by taking one of Econ 1740, Hist 1700, PolS 1100, or Honors 2212.

University Bachelor Degree Requirements

UNIVERSITY BACHELOR DEGREE REQUIREMENTS
The University graduation requirements for the Bachelor of Science degree
are described in the University of Utah General Catalog. See University College for
minimum grade requirements.

a. The communication/ writing (CW) requirement: Computer science
    majors must take either Wrtg 3015, Wrtg 3014, Wrtg 3012, or
    Honors 3200 which may be taken by students participating in the
    University Honors Program. This class should be taken prior to
    taking the computer science senior project course.

b. The quantitative intensive (QI) course requirement is satisfied by CS
    3810, CS 4150 and CS 4400, all of which are required for CS majors.

c. The diversity (DV) requirement can be satisfied by taking a course
    from an approved list as part of the intellectual explorations courses.

d. The international (IR) requirement can be satisfied by taking a course
    from an approved list as part of the intellectual explorations courses.

e. Students must complete a minimum of 122 total semester hours of
    course work. At least 40 of the 122 hours must be upper-division
    classes. Upper-division classes are numbered 3000 or above. Credits
    from two-year colleges will not count toward University upper
    division hours. At least 30 of the total credit hours and 20 of the last
    30 hours must be taken at the University of Utah.

It is possible to take some classes that can satisfy several general education require-
ments at once, such as incorportaing the diveristy, upper-division, and international
requirements into your six required general education courses. Please ask the computer
science academic advisor about such options.

Math, Science and Engineering Requirements

MATH, SCIENCE AND ENGINEERING REQUIREMENTS		
Seven classes in math, science, and/or engineering are required. The School of Computing requires a grade of C- or better in each of these courses (CR/NC not accepted). Please note that the math department requires a solid "C" grade in pre-requisite math courses in order to take the next math course.		
Math 1210	Calculus I	4 credits
Math 1220	Calculus II	4 credits
Math 2210	Calculus III	3 credits
Physics 2210	Physics for Scientists and Engineers I	4 credits
One math elective must be selected from the following. C- or better required.		
Math 2270 [1]	Linear Algebra	4 credits
CS 3130 [2]	Engineering Probability and Statistics	3 credits
Two additional math/ science courses, each of which must be at least three semester hours, may be chosen from among the following. C- or better required.		
Any non-CS class from the Colleges of Engineering, Mines, or Science that requires Calculus II as a prerequisite or corequisite. [3]		
Physics 2220	Physics for Scientists and Engineers II	4 credits

[1] Math 2250 covers the same material as Math 2270 and 2280, although in less depth. Hence, if 2270 is used as a required elective, Math 2250 may not be counted as an elective.

[2] If CS 3130 or ECE 3530 is used as one of the required math/science electives, Math 5010 and/or Math 3070 may not be counted as math elective.

[3] Math 2200 will not be accepted. Biol 1210: Principles of Biology or Chem 1210: General Chemistry I may also be accepted as a math/ science elective (labs not required).

Computer Science Major Requirements

COMPUTER SCIENCE MAJOR REQUIREMENTS A minimum grade of C- or better is required for all required major courses.		
CS 1400	Intro to Computer Science	3 credits
CS 1410	Intro to Object-Oriented Programming	4 credits
CS 2420	Intro to Algorithms & Data Structures	4 credits
CS 2100	Discrete Structures	3 credits
CS 3500	Software Practice I	4 credits
CS 3505	Software Practice II	3 credits
CS 3810	Computer Organization	4 credits
CS 4150	Algorithms	4 credits
CS 4400	Computer Systems	4 credits
Theory restricted elective. C- or better required. One of the following must be com-		
CS 3100	Models of Computation	3 credits
CS 3200	Scientific Computing	3 credits
Seven CS elective classes: See next page for guidlines and restrictions		
Capstone requirement. C- or better required. Choose one set:		
CS 4000	Senior Capstone Design	3 credits
CS 4500	Senior Capstone	3 credits
Students enrolling in the Senior Capstone course (CS 4500) must graduate before the next offering of the course. The capstone course is about demonstrating the skills and abilities learned in other CS courses. It is highly recommended that a majority of your CS electives be completed before taking the capstone.		
CS 4940	Undergraduate Research	3 credits
CS 4970	Bachelor's Thesis	3 credits
Approval from the Undergraduate Director and an advising faculty member is required. Students should begin research for the thesis course at least one semester before enrolling in CS 4970.		

[1] EAE 4500 & EAE 4510 may be accepted as an alternate senior capstone project. Special permission is required by the EAE director for non-EAE track students to enroll.

Computer Science Elective Requirements

CS Elective Requirements. C- or better required.

Seven (7) total CS electives (3-4 credits each), 3000-level or higher are required for the regular CS track. All courses must be taken for a letter grade. Grad-level CS courses may be accepted with permission of the professor, but may not count for both an undergrad and graduate degree. Seminars, CS 3130 not accepted. Note that **only (1) mobile development course (such as, but not limited to: iPhone, Android devlopment) will be accepted as an elective**.

See track elective suggestions (following page) for suggestions. Students should be aware of required pre-requisites and plan early for registration of desired electives. See additional requirements/restrictions below.

1. CS _____ / _____ / _____(3-4 cr)
2. CS _____ / _____ / _____(3-4 cr)
3. CS _____ / _____ / _____(3-4 cr)
4. CS _____ / _____ / _____(3-4 cr)

For the final three electives, students may choose any regular CS elective as allowed above, OR no more than (3) of the following options. C- or better required.

- (1) CS 4010, Internship (with approval)

- (1) CS 4940, Undergraduate Research (if not used for the capstone)

- (1) CS 4950), Independent Study (with approval)

- Up to (2) EAE courses (such as, but not limited to: EAE 3600, 3605, 3640, 3660, and EAE special topics)

- Up to three credits of 1-2 credit CS electives, such as, but not limited to, CS 3011, CS 3020, CS 3992, CS 4010, CS 4190, CS 5040 and special topics.

  Four-credit classes from the above category cannot be combined with one or two-credit courses to equal an elective.

5. CS _____ / _____ / _____(3-4 cr)
6. CS _____ / _____ / _____(3-4 cr)
7. CS _____ / _____ / _____(3-4 cr)

Undergraduate Track Elective Suggestions

Software

Software Development
4230: Parallel Programming
4480: Computer Networks
4540: Web Software Architecture
5140: Data Mining
5460: Operating Systems
5470: Compilers
5530: Database Systems
5540: Human Computer Interaction
5785: Adv. Embedded Software
5xxx: Scripting Language/Design

Web/Mobile Development
4540: Web Software Architecture
4480: Computer Networks
5530: Database Systems
5540: Human Computer Interaction
4xxx: iPhone/Android Development
5xxx: Scripting Language/Design

Hardware

Computer Organization
3700: Digital System Design
3710: Computer Design Lab
5460: Operating Systems
5710: Digital VLSI Design
5830: VLSI Architecture

Embedded Systems
3710: Computer Design Lab
4480: Computer Networks
5470: Compilers
5780: Embedded System Design
5785: Adv. Embedded Software
5789: Embedded Sy/Kinetic Art

CAD for Digital Systems
5710: Digital VLSI Design
5740: Computer-Aidied Design
5745: Testing/Verif. Digital Circuits
5750: Synthesis/Veri. VLSI Sys.
5830: VLSI Architecture

Data

Information
5140: Data Mining
5300: Artificial Intelligence
5350: Machine Learning
5530: Database Systems

Computer Systems

Computer Systems
4230: Parallel Programming
4480: Computer Networks
5460: Operating Systems
5470: Compilers
5530: Database Systems

Programming Languages
5100: Foundations of CS
5470: Compilers
5510: Programming Languages
5xxx: Scripting Language/Design

Artificial Intelligence

Robotics
5300: Artificial Intelligence
5310: Robotics
5320: Computer Vision
5350: Machine Learning
5780: Embedded System Design
5xxx: Robot Control

Artificial Intelligence
4640: Image Processing Basics
5130: Computational Statistics
5140: Data Mining
5300: Artificial Intelligence
5320: Computer Vision
5340: Natural Language
5350: Machine Learning

Graphics/ EAE

Visual Computing
3200: Intro Sci Comp
4600: Intro Computer Graphics
4640: Image Processing Basics
5320: Computer Vision
5350: Machine Learning
5610: Interactive Comp Graph
5630: Scientific Visualization
5650: Perception for Graphics

EAE Courses (2 allowed as electives)
3600: 3D Modeling
3605: Adv. 3D Modeling
3640: Digital Figure Sculpting
3660: Machinima
5xxx: Character Rigging

CS Degree Requirements

COMPUTER SCIENCE 2013-2014   B.S. Degree Requirements

For advising, contact ugrad-help@cs.utah.edu or call 801-581-8224 to schedule an appointment

PRE-MAJOR REQUIREMENTS:

C- or better in each course, and a minimum 3.0 average GPA (overall and within pre-major courses) required to apply for full major status.

1. CS 1400, Intro. to CS _____ (3-F/S/U)
2. CS 1410, Object-Orient. Prog. _____ (4-F/S)
3. CS 2420, Algorithms/Data Struct. _____ (4-S/U)
4. Math 1210, Calculus I (QA) _____ (4)
5. Math 1220, Calculus II (QB) _____ (4)

GENERAL EDU. REQUIREMENTS:

Honors options also accepted for WR2, CW, and AI requirements.

1. Wrtg 2010, Intermediate Writing (WR2) _____ (3)
2. Wrtg 3012 or 3014 or 3015 (CW) _____ (3)
3. American Institutions (AI) _____ (3)

SIX Intellectual Exploration (IE) courses required. TWO must be upper division (3000-level or above), ONE must satisfy the Diversity requirement and ONE must satisfy the International requirement.

4. Fine Arts (FF): _____ (3)
5. Fine Arts (FF): _____ (3)

6. Humanities (HF): _____ (3)
7. Humanities (HF): _____ (3)

8. Social/Behavioral Science (BF): _____ (3)
9. Social/Behavioral Science (BF): _____ (3)

- Upper Division (3000+ level IE) _____
- Upper Division (3000+ level IE) _____
- Diversity (DV) _____
- International (IE) _____

MATH / SCIENCE ELECTIVES:

C- or better required in all math/science courses. TWO additional electives must be 3+ credits each, and qualify as follows:

Accepted: Math, science or engineering courses with Math 1210 as a pre- or co-requisite (See DARS). Biol 1210, Chem 1210 also accepted.

Not Accepted: CS courses (except CS 3150). Math 2200, Math 2250 not accepted if Math 1270 and/or Math 2200 are taken. Math 3010 and/or 3070 not accepted if CS 3150/ECE 3530 is taken.

1. Physics 2210, Physics I _____ (4)
2. Math 2210, Calculus III (QB) _____ (3)
3. Math 2270 Linear Algebra (QB)
   or CS 3130 Eng. Prob & Stats (QI) _____ ( )
4. _____ ( )
5. _____ ( )

The following requirements are restricted to FULL Majors:

C- or better required in all CS courses. CR/NC grading option not allowed for any major requirement. 2.5 GPA (overall & CS courses) required to graduate.

MAJOR REQUIREMENTS:

1. CS 2100, Discrete Structures _____ (3-F,S)
2. CS 3500, Software Practice I _____ (4-F)
3. CS 3505, Software Practice II _____ (3-S)
4. CS 3810, Computer Organization (QI) _____ (4-F)
5. CS 4150, Algorithms (QI) _____ (3-S)
6. CS 4400, Computer Systems (QI) _____ (4-F)

CS ELECTIVES:

Choose 7 total CS courses, 3000-level or above, 3-4 credits each. Seminars and CS 3150 not accepted. Only 1 Mobile Apps course will be accepted.

1. CS _____ / _____ / _____ ( )
2. CS _____ / _____ / _____ ( )
3. CS _____ / _____ / _____ ( )
4. CS _____ / _____ / _____ ( )
5. CS _____ / _____ / _____ ( )
6. CS _____ / _____ / _____ ( )
7. CS _____ / _____ / _____ ( )

No more than 3 of the following may be accepted above as CS electives:

- (1) CS 4910, Internship
- (1) CS 4940, Research (if not used for capstone)
- (1) CS 4950, Independent Study
- Up to (2) EAE courses: EAE 3600, 3601, 3640, 3660
- (1) combination of 1-2 credit CS courses (3 credits total):
  CS 3811, 3830, 4190, 3940 and 1-2 credit special topics courses

THEORY RESTRICTED ELECTIVE

Choose ONE: (If both classes are taken, one will count as a CS elective above)

CS 3100, Models of Computation (QI) _____ (3-F)

or

CS 3200, Scientific Computing _____ (3-S)

CAPSTONE REQUIREMENT:

Choose ONE set: (Permission required from Undergraduate Director for thesis)

CS 4000, Senior Capstone Design _____ (3-F)
CS 4500, Senior Capstone Project _____ (3-S)

or

CS 4940, Undergraduate Research _____ (3)
CS 4970, Bachelor's Thesis _____ (3)

See the CS Undergraduate Handbook online for complete details, restrictions & requirements
Updated 05/13

CS Suggested Course Outline

The CS degree can be completed in four full-time years if the student can take the pre-major courses during freshman year. If a student must take preparatory classes as a freshman, more than four years may be required. It is possible to take general education and/or math requirements during the summer. This table is meant only as a guide, since the scheduling of electives may vary. See the departmental advisor for suggested changes to this sequence.

*CS 1410 may be taken during the freshman fall semester by passing a proficiency test to waive CS 1400. If 1400 is needed, students may take CS 1400 fall semester, 1410 in the spring and 2420 in the summer semester to stay on track.

	Fall Semester	Spring Semester
Freshman (27 credits)	CS 1400 (or CS 1410*) 3 Math 1210 Calc I 4 Wrtg 2010 Writing 3 General Ed 3 _____ (13)	CS 1410 (or CS 2420*) 4 Math 1220 Calc II 4 American Institutions (AI) 3 General Ed 3 _____ (14)
Summer * if needed (7 credits)	CS 2420 Intro to Algorithms & Data Structures 4 Math 2210 Calculus III 3 _____ (7)	
Sophomore (28 credits)	CS 3500 Software Prac. I 4 CS 3810 Comp. Org. 4 Math 2270 or CS 3130 4 or 3 General Ed/ DV 3 _____ (15)	CS 2100 Discrete 3 CS 3505 Software Prac. II 3 CS elective 3 Phys 2210 Physics I 4 _____ (13)
Junior (29 credits)	CS 4400 Comp. Systems 4 CS elective 3 CS elective 3 Math/ Science elective 4 _____ (14)	CS 3200 Theory elective 1 3 CS 4150 Algorithms 3 CS elective 3 Wrtg 3012, 3014 or 3015 3 Gen Ed/ IR/ Upper Division 3 _____ (15)
Senior (31 credits) _122 total credits_	CS 4000 or CS 4940 3 CS elective 3 CS elective 3 General Ed/ Upper Division 3 (Free elective if needed**) 3 _____ (15)	CS 4500 or CS 4970 3 CS elective 3 Math/ Science elective 4 General Ed 3 (Free elective if needed**) 3 _____ (16)

1 Choose between CS 3100 or 3200 for the theory requirement. CS 3100 is offered in the fall.

2 The thesis option requires special permission from the faculty and Undergraduate Director. This option is intended for students who are considering graduate school.

General Eds include FF, HF, BF requirements. See advisor for doubling these with the DV and IR requirements.

** Free electives only needed if student has not yet reached the 122 total credit hours required to graduate.

Entertainment Arts and Engineering Program

ENTERTAINMENT ARTS AND ENGINEERING EMPHASIS

The School of Computing provides a specialty track through the computer science program with an emphasis on Entertainment Arts and Engineering (EAE). The EAE emphasis is a joint program between the School of Computing and the College of Fine Arts Division of Film Studies.

The purpose of this program is to provide an undergraduate, interdisciplinary academic path for those students that wish to have careers in the digital entertainment industry (video games, digital animation, computer generated special effects, etc.). There are currently two specified tracks: video games and animation, differing by the junior year game/ animation series of classes.

The key feature of this program is its interdisciplinary nature. Students from both computer science and fine arts take common classes throughout their undergraduate years, culminating in a year-long senior studio project where students build a video game or animation from the ground up. Students in the program choose either a bachelor's degree in film studies or computer science. The requirements listed below are for the computer science Bachelor of Science degree, with an emphasis in EAE.

All requirements of the general computer science degree must be met. The specifics of the track are listed below where they extend the requirements of the traditional computer science bachelor's degree:

EAE GENERAL EDUCATION REQUIREMENTS
Same as the regular CS track (page 13), with the following exception: Fine arts (FF) requirement — Art 1020 (Non-major Basic Drawing) replaces one fine arts elective.
EAE UNIVERSITY BACHELOR DEGREE REQUIREMENTS
Same as the regular CS track (page 14) with the following exception: CW requirement — FA 3600 (Writing for New Media) replaces the upper division writing requirement.

Entertainment Arts and Engineering Program

EAE MATH, SCIENCE AND ENGINEERING REQUIREMENTS

Six classes in math, science, and/or engineering are required. The School of Computing requires a grade of C- or better in each of these courses (CR/NC not accepted). Please note that the math department requires a solid "C" grade in prerequisite math courses in order to take the next math course.

Math 1210	Calculus I	4 credits
Math 1220	Calculus II	4 credits
Math 2210	Calculus III	3 credits
Physics 2210	Physics for Scientists and Engineers I	4 credits
CS 3130	Engineering Probability and Statistics	3 credits

One additional course, at least three hours, may be chosen from the following. C- or better required.

Math 2270	Linear Algebra	4 credits
Any non-CS class from the Colleges of Engineering, Mines, or Science that requires Calculus II as a prerequisite or corequisite [1]		
Biol 1210	Principles of Biology	4 credits
Chem 1210	General Chemistry I	4 credits
Physics 2220	Physics for Scientists and Engineers II	4 credits

[1] CS 3130 or ECE 3530 covers material similar to Math 5010 and/or Math 3070, and as such Math 5010 and/or Math 3070 may not be counted as an elective. Math 2200 will not be accepted.

Biol 1210, Chem 1210, Phys 2210 and Phys 2220 additional labs not required.

Entertainment Arts and Engineering Program

COMPUTER SCIENCE EAE MAJOR REQUIREMENTS

A minimum of 17 computer science classes must be taken. Ten CS classes (30 credits) must be taken at the U of U. A student may repeat CS, math and EAE major courses only once. All major classes taken to satisfy degree requirements must be taken for a letter grade; they may not be taken for CR/NC. A min. grade of C- or better is required for all major courses.

EAE 1400	Intro to Computer Science	3 credits
EAE 1410	Intro to Object-Oriented Programming	4 credits
EAE 2420	Intro to Algorithms & Data Structures	4 credits

CS Core Requirements. C- or better required.

CS 2100	Discrete Structures	3 credits
CS 3500	Software Practice I	4 credits
CS 3505	Software Practice II	3 credits
CS 3810	Computer Organization	4 credits
CS 4150	Algorithms	3 credits
CS 4400	Computer Systems	4 credits

Required Courses. C- or better required.

EAE 3600	3D Modeling	3 credits
EAE 3660	Machinima	3 credits
CS 5300	Artificial Intelligence	3 credits

CHOOSE ONE:
CS 5460	Operating Systems	4 credits
CS 5470	Compilers	4 credits

CS 5530	Databases	3 credits

Theory Restricted Elective. C- or better required. Choose one of the following:

CHOOSE ONE:
CS 3200	Scientific Computing	3 credits
CS 3100	Models of Computation	3 credits

Entertainment Arts and Engineering Program

Film requirements. C- or better required. The following classes are required:		
FILM 2700	Survey of Videogame Theory	3 credits
FILM 3500	Film Production I	4 credits

Series requirement. C- or better required. One of the following series must be taken:		
COMPUTER ANIMATION SERIES:		
FILM 2610	Computer Animation I	4 credits
FILM 2620	Computer Animation II	4 credits
GAME DEVELOPMENT SERIES:		
FILM 3710	Traditional Game Development	4 credits
FILM 3720	Alternative Game Development	4 credits

Computer science elective. C- or better required. Any CS elective 4000 level or above, at least 3 credits, will be accepted. One of the following classes is *recommended*:		
CS 4540	Web Software Architecture	3 credits
CS 4480	Computer Networks	3 credits
CS 4600	Intro to Graphics	3 credits
CS 5350	Machine Learning	3 credits
CS 5630	Scientific Visualization	3 credits

Capstone requirement. C- or better required. Both courses are required:		
EAE 4500	Senior Project I	3 credits
EAE 4510	Senior Project II	3 credits

[1] Must be 3-4 credits. Excludes ANY OTHER EAE COURSES, CS seminars, and CS 3130.

COMPUTER SCIENCE 2013–2014 B.S. Degree Requirements
Entertainment Arts & Engineering (EAE) emphasis
For advising, contact ugrad-help@cs.utah.edu or call 801-581-8224 to schedule an appointment

PRE-MAJOR REQUIREMENTS:

C- or better in each course, and a minimum 3.0 average GPA (overall and within pre-major courses) required to apply for full major status.

1. BABCS 1400, Intro to CS _____ (3)
2. BABCS 1410, Object-Orient. Prog. _____ (4)
3. BABCS 2420, Algrthm/Data Struct. _____ (4)
4. Math 1210, Calculus I (QA) _____ (4)
5. Math 1220, Calculus II (QB) _____ (4)

GENERAL EDU. REQUIREMENTS:

Honors options also accepted for WR2, CW, and AI requirements.

1. Wrtg 2010, Intermediate Writing (WR2) _____ (3)
2. FA 3600, Writing for New Media (CW) _____ (3)
3. American Institutions (AI) _____ (3)

Six Intellectual Exploration (IE) courses required. TWO must be upper division (3000-level or above), ONE must satisfy the Diversity requirement and ONE must satisfy the International requirement.

4. ART 1020, Basic Drawing (FF) _____ (3)
5. Fine Arts (FF): _____ (3)

6. Humanities (HF): _____ (3)
7. Humanities (HF): _____ (3)

8. Social/Behavioral Science (BF): _____ (3)
9. Social/Behavioral Science (BF): _____ (3)

- Upper Division (3000+ level IE) _____
- Upper Division (3000+ level IE) _____
- Diversity (DV) _____
- International (IR) _____

MATH / SCIENCE ELECTIVES:

C- or better required in all math/science courses.

ONE additional math/science elective is required (at least three credits). Choose any non-CS math or science class with Math 1220 (Calculus II) as a pre- or co-requisite. Physics 2220 will also be accepted. Math 2200, 5010, 3070 not allowed.

1. Physics 2210, Physics I _____ (4)
2. Math 2210, Calc III (QB) _____ (3)
3. CS 3130, Eng Prob & Stats (QB) _____ (3)
4. _____ ( )

FILM REQUIREMENTS:

1. FILM 2700, Intro to Video Games _____ (3)
2. FILM 3500, Film Production _____ (4)

The following requirements are restricted to FULL Majors.
C- or better required in all CS courses. CR/NC grading option not allowed for any major requirement. 2.5 GPA (overall & CS courses) required to graduate.

MAJOR REQUIREMENTS:

1. CS 2100, Discrete Structures _____ (3-F/S)
2. CS 3500, Software Practice I _____ (4-F)
3. CS 3505, Software Practice II _____ (3-S)
4. CS 3810, Computer Organization (QI) _____ (4-F)
5. CS 4150, Algorithms (QI) _____ (3-S)
6. CS 4400, Computer Systems (QI) _____ (4-F)

EAE REQUIREMENTS:

1. EAE 3600, 3D Modeling _____ (3-F)
2. EAE 3660, Machinima _____ (3-S)
3. CS 5300, Artificial Intelligence _____ (3-S)
4. CS 5530, Database _____ (3-S)

5. Choose ONE: *(If both classes are taken, one counts as the CS elective below)*

   CS 5460, Operating Systems _____ (4-S)

   or

   CS 5470, Compilers _____ (4-S)

CS ELECTIVE

Choose ONE: 4000+ level CS course (3-4 cr). Seminars and EAE courses not accepted. (Suggested: CS 4190, 4340, 4600, 3190, 3690)

1. _____ (3)

SERIES REQUIREMENT:

Choose ONE:

ANIMATION SERIES

   FILM 3610, Computer Animation I _____ (4-F)
   FILM 3620, Computer Animation II _____ (4-S)

   or

GAME DESIGN SERIES

   FILM 3710, Traditional Game Development _____ (4-F)
   FILM 3720, Alternative Game Development _____ (4-S)

THEORY RESTRICTED ELECTIVE

Choose ONE:

CS 3100, Models of Computation (QI) _____ (3-F)

   or

CS 3200, Scientific Computing _____ (3-S)

CAPSTONE REQUIREMENT

1. EAE 4500, Senior Project I _____ (3-F)
2. EAE 4510, Senior Project II _____ (3-S)

See the CS Undergraduate Handbook online for complete details. Updated 06/13

EAE Suggested Course Outline

The CS degree can be completed in four full-time years of study if the student can take the pre-major courses during freshman year. If a student must instead take preparatory classes as a freshman, more than four years may be required. It is possible to take general education and/or math requirements during the summer to ease the load. This table is meant only as a guide, since the scheduling of electives and general education classes may vary.

*EAE 1410 may be taken during the freshman fall semester by passing a proficiency test to waive EAE 1400. If 1400 is needed, students may take EAE 1400 fall semester, 1410 in the spring and 2420 in the summer semester to stay on track.
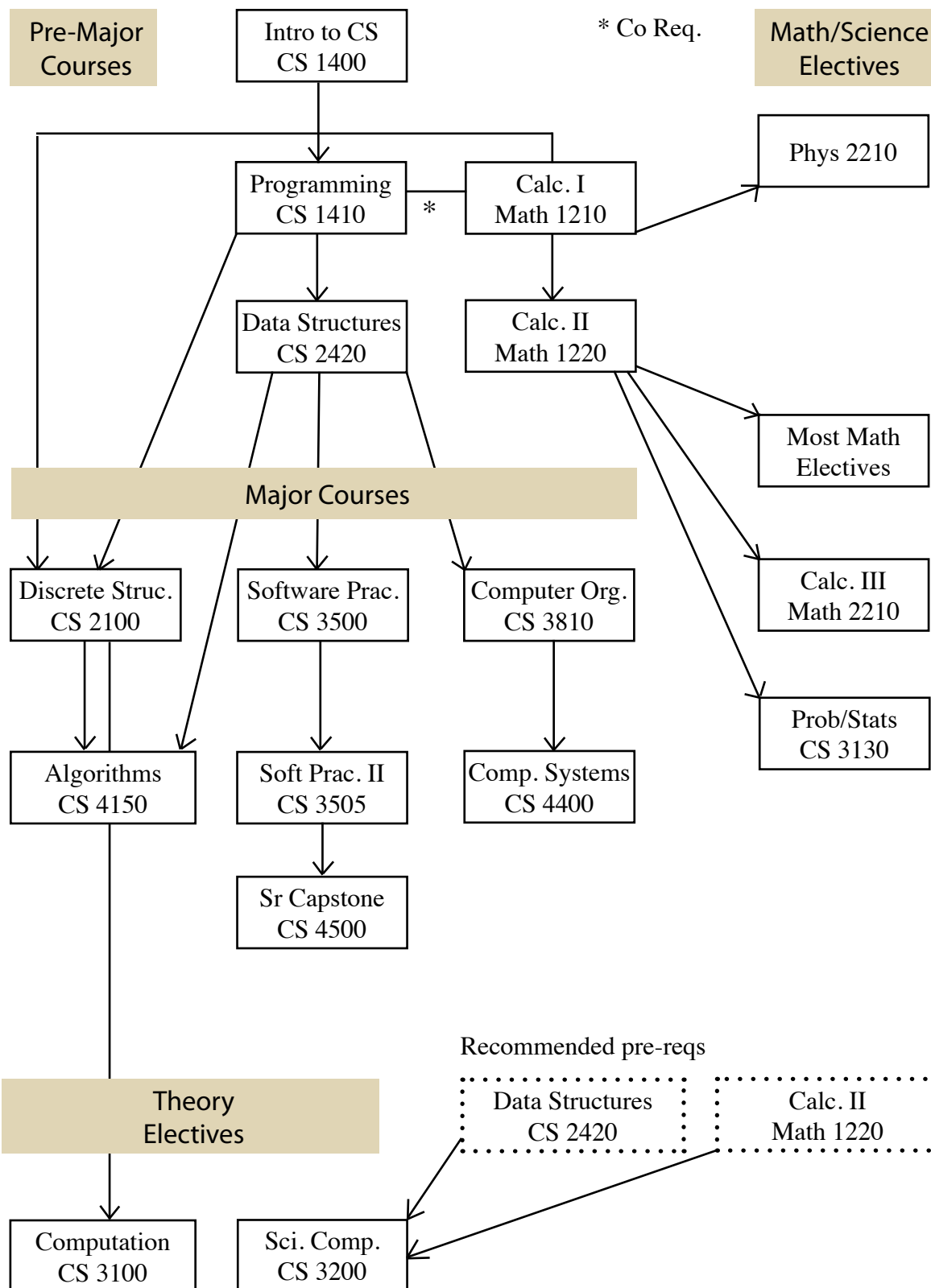
	Fall Semester		Spring Semester	
Freshman (27 credits)	EAE 1400 (or EAE 1410*) Math 1210 Calc I Wrtg 2010 Writing Art 1020 Basic Drawing	3 4 3 3 (13)	EAE 1410 (or EAE 2420*) Math 1220 Calc II American Institutions (AI) Film 2700 Video Games	4 4 3 3 (14)
Summer * if needed (7 credits)	EAE 2420 Intro to Algorithms & Data Structures Math 2210 Calculus III	4 3 (7)		
Sophomore (28 credits)	CS 3500 Software Prac. I CS 3810 Comp. Org. EAE 3600 3D Modeling Film 3500 Film Production	4 4 3 4 (15)	CS 2100 Discrete CS 3505 Software Prac. II EAE 3660 Machinima Phys 2210 Physics I	3 3 3 4 (13)
Junior (32 credits)	CS 4400 Comp. Systems FA 3600 Wrtg New Media Math/ Science elective Film 3610 or 3710	4 3 4 4 (15)	CS 3200 Scientific Comp.[1] CS 4150 Algorithms CS 5460 Operating Syst. Film 3620 or 3720 General Ed/ DV	3 3 4 4 3 (17)
Senior (30 credits) **124 total credits**	EAE 4500 Senior Project I CS 3130 Eng. Prob. & Stats CS elective General Ed Gen Ed/ IR/ Upper Division	3 3 3 3 3 (15)	EAE 4510 Senior Project II CS 5300 A.I. CS 5530 Databases [2] General Ed/ Upper Division General Ed	3 3 3 3 3 (15)

[1] CS 3200 is the recommended theory course, but CS 3100 (fall semester) will also be accepted.
[2] CS 5460 is recommended, but CS 5470 will also be accepted. CS 5470 is offered in the spring.

General Eds include FF, HF, BF requirements. See advisor for doubling these with the DV and IR requirements.

Prereq Core Course Requirements

Pre-Major Courses

Intro to CS
CS 1400

* Co Req.

Math/Science Electives

Programming
CS 1410

*

Calc. I
Math 1210

Phys 2210

Data Structures
CS 2420

Calc. II
Math 1220

Major Courses

Most Math Electives

Discrete Struc.
CS 2100

Software Prac.
CS 3500

Computer Org.
CS 3810

Calc. III
Math 2210

Algorithms
CS 4150

Soft Prac. II
CS 3505

Comp. Systems
CS 4400

Prob/Stats
CS 3130

Sr Capstone
CS 4500

Recommended pre-reqs

Theory Electives

Data Structures
CS 2420

Calc. II
Math 1220

Computation
CS 3100

Sci. Comp.
CS 3200

Continuing Performance

PERFORMANCE REQUIREMENTS

All major courses (computer science, science, engineering, film, and writing) taken to satisfy the major requirements must be taken for a letter grade and must be passed with a C- or better. Mathematics courses require a C or higher to move on to the next level of math.

REPEAT POLICY

A student may repeat required courses for the major and pre-major once only. This includes all CS, math, science and film courses. Withdrawals (W) and grades (A,B,C,D,E,CR/NC) are all counted as an attempt. After two unsuccesful attempts, a student will be removed from the major and must petition to the undergraduate committee for re-admittance. Pre-majors will only be allowed two attempts at pre-major courses. A third attempt will not count toward admittance into the major, but may be considered by petition.

CS major and math/science required courses that have been attempted at the U may not be repeated and transferred from another school for credit in the computer science major.

PROBATION

To remain in good standing and graduate, a student must maintain a cumulative grade point average at the University of 2.5 or higher, and also maintain a grade point average (GPA) of 2.5 in computer science classes. Students whose GPA in either of these categories falls below 2.5 will be placed on probation and given conditions to return to good standing. These conditions must be satisfied during the next two semesters, excluding summers. Students failing to meet their probationary conditions are removed from the major.

ACADEMIC MISCONDUCT

Computer science majors are required to adhere to an Academic Misconduct Policy. Students will be required to review and sign the Policy when applying to the major, and the policy applies to all computer science pre-major and major courses. Failure to adhere to Misconduct standards could result in removal from the major. See the full policy on the CS website www.cs.utah.edu.

Continuing Performance

PROGRAM COMPLETION

Students are expected to complete all requirements for their degree within four years of being admitted as a full major. Students not making satisfactory progress toward their degrees may be dropped from the rolls and declared inactive. The determination that a student is not making satisfactory progress is made in one of two ways.

(1) The student has not completed a computer science course for a period of one year (exceptions made for students who take an official Leave of Absence with the University), or

(2) There is no reasonable way in which the student can complete all degree requirements by the end of the required period of time. In order to be reinstated from inactive status or from being dropped due to low GPA, students must petition the Computer Science Undergraduate Committee. Reinstated students proceed under the latest graduation requirements.

If personal circumstances prevent completion of all degree requirements within four years of acceptance as a full major, a student may request an extension and submit a revised schedule of completion.

EXPIRATION OF CREDITS

All major courses (CS, math, science) will expire after ten years, and it may be necessary for students to retake major courses that are more than ten years old. Students are advised to meet with the undergraduate director to discuss math and CS courses that were taken more than five years prior.

GRADUATION EXIT SURVEY

In order to better serve our students and evaluate our program, computer science graduating seniors are required to complete a Graduation Exit Survey before they are cleared for graduation. All identifying information (name, student ID number) will be removed from student responses to maintain anonymity.

AP and Math Placement

ADVANCED PLACEMENT (AP) EXAM CREDIT

Credit for Advanced Placement tests is given through the University and counts toward the total hours needed to graduate. The Admissions Office assesses all general education AP credits. Specific courses in the Computer Science major (computer science, math, physics, chemistry, and biology) are waived based on high AP exam scores, independent of these credit hours. Students should submit a AP Evaluation Form to the Admissions Office to have their AP credits officially recorded toward University graduation requirements.

The scores on the following page are necessary for the School of Computing to waive a major requirement. While lower scores may result in University of Utah credit, they will not satisfy School of Computing requirements. The School of Computing will not accept AP scores of 3 in some areas. For a detailed list of AP scores that may satisfy general education courses, please visit admissions.utah.edu.

MATH PLACEMENT

Math placement depends on an Accuplacer test score, math scores in AP, ACT or SAT exams, or previous transfer work. Accuplacer, AP, ACT and SAT scores are valid for two years after the test is taken. To challenge a placement score students may take a math placement exam at the Testing Center (801-581-8733, 498 SSB).

Pre-Requisite Requirements	Math Course Placement
ACT Math score of 17 or lower SAT Math score of 420 or lower	Math 990 - Elementary Algebra
ACT Math score of 18-22 SAT Math score of 430-530 Accuplacer EA score of 54 or better	Math 1010 - Intermediate Algebra
ACT Math score of 23-27 SAT Math score of 540-620 Accuplacer CLM score of 60 or better	*Math 1050 & Math 1060 - College Algebra & Trigonometry
ACT Math score of 24-27 SAT Math score of 560-620	*Math 1080 - Pre-Calculus

* Math 1050/1060 OR Math 1080 required for Calc I, not both

Advanced Placement

MATH PLACEMENT CONTINUED

Pre-Requisite Requirements	Math Course Placement
AP AB score of 3 or higher ACT Math score of 28 or higher SAT Math score of 630 or higher Accuplacer CLM score of 95 or better	Math 1210 - Calculus I
AP AB score of 4 or higher AP BC score of 3 or higher	Math 1220 - Calculus II
AP BC score of 4 or higher	Math 2210 - Calculus III

ADVANCED PLACEMENT EXAM COURSE EQUIVALENTS FOR COMPUTER SCIENCE

AP Exam	Required Score	U. Course Waived	Course Placement
Biology	4 or 5	Biol 1210	
Chemistry	4 or 5	Chem 1210	
Physics C: Mech	4 or 5	Phys 2210	Phys 2220
Physics C: E&M	4 or 5	Phys 2220	Phys 2210
Computer Science A Test	5	CS 1400/ 1410	CS 2420
	4	CS 1400	CS 1410

Computer Science Minor

COMPUTER SCIENCE MINOR

<table>
<tr><td colspan="3">MINOR REQUIREMENTS
The minor consists of a minimum of 18 semester hours of required computer science classes (plus Calculus I). The following classes must be taken (at least three of the following CS courses must be taken at the University of Utah. CS 3500 and the CS 3000-level elective must be taken at the U):</td></tr>
<tr><td>CS 1400</td><td>Intro to Computer Science</td><td>3 credits</td></tr>
<tr><td>CS 1410</td><td>Intro to Object-Oriented Programming</td><td>4 credits</td></tr>
<tr><td>CS 2420</td><td>Intro to Algorithms & Data Structures</td><td>4 credits</td></tr>
<tr><td>MATH 1210</td><td>Calculus I</td><td>4 credits</td></tr>
<tr><td>CS 2100</td><td>Discrete Structures</td><td>3 credits</td></tr>
<tr><td>CS 3500</td><td>Software Practice I</td><td>4 credits</td></tr>
<tr><td>CS Elective:</td><td colspan="2">Students must take at least one additional CS class (3-4 cr) at or above the 3000 level. CS 3505 is recommended.</td></tr>
</table>

In order to be admitted as a computer science minor, a student must have a declared major in another department and be making progress in that major. A CS minor will not be awarded to computer engineering majors (CE), however CE majors should talk to the CS advisor about double majoring in CS and CE.

One may not pre-register for any upper division classes in computer science without first being admitted as a minor. CS minors must contact the CS advisor in order to register for 3000-level CS courses once admitted. Applications for admission are reviewed at the end of spring and summer semesters.

Students wishing to be admitted to the minor are required to take Math 1210, CS 1410, and CS 2420 and must at minimum achieve a C- or better in each course. CS 1400 may be waived for advanced students. Further, the average GPA in these courses, and the students overall UofU GPA, must be above 3.0 in order to apply for minor status.

Please note that the 3.0 GPA is the minimum requirement and may not result in placement as a minor; for example when there are more applicants then available spots. In such cases, the top applicants will be selected by the SoC undergraduate admittance committee at the same time Full Major Status is granted.

B.S./ M.S. Program

COMPUTER SCIENCE B.S./ M.S. DEGREE

The B.S./ M.S. degree program allows students to complete both a bachelor's and master's degree in computer science in five years. Degree requirements are the same as those for earning a B.S. and M.S. separately (122 undergraduate hours + 30 graduate hours), but there are several advantages:

- B.S./ M.S. students are not required to take the Graduation Record Examination (GRE) as part of their graduate school admittance
.
- You will know early that you have been accepted into Grad School, and can plan accordingly

- Students may take graduate classes during their senior year.

- B.S./ M.S. students may take up to 12 graduate-level credits for the undergraduate fee.

School of Computing M.S. Degree Programs:

*Master of Computer Science
*Master of Computing with a computer engineering specialization
*Master of Computing with a graphics and visualization specialization
*Master of Computing with a information technology specialization
*Master of Computing with a robotics specialization

Each of the degrees has two options: course-based and thesis-based. Students wishing to pursue the thesis option for their M.S. degree must also choose the thesis option for their B.S. degree. The bachelor's thesis (CS 4970) will normally constitute a portion of the master's thesis. Students are not eligible to pursue the EAE Master Game Studio degree through B.S./M.S.

Students must be a junior in the CS or CE department in order to apply. International students on a visa are not eligible for B.S./ M.S. programs. Applications for the B.S./ M.S. program are due in May and September, and must include a copy of the student's University of Utah transcript and the B.S./ M.S. application form. For more information about the B.S./ M.S. program, graduate tracks, and how to apply, please visit: www.cs.utah.edu/bsms.

Scholarships

UNDERGRADUATE SCHOLARSHIPS

The School of Computing awards several scholarships each year. Recipients are selected based upon academic performance, rather than financial need. Most are awarded to computer science and computer engineering full majors, or to those students who will become full majors during the following academic year. Applications for these scholarships are available on the Web at www.cs.utah.edu. They must be submitted online by February 15th of the preceding year.

Tuition Waiver Scholarships: These awards are available to students majoring in computer science or computer engineering who are residents of the state of Utah. They cover up to 15 credit hours of resident tuition for two semesters. To be eligible, students must take at least 12 credit hours per semester and have a cumulative GPA of 3.5 or higher.

School of Computing Scholarships: These awards are available to all computer science and computer engineering majors. They range in value from $500 to $4,000, and are made possible by generous donations from the School of Computing faculty, alumni and companies. To be eligible, students must take at least nine credit hours per semester. Scholarships specifically for female students are available.

College of Engineering Scholarships: The College of Engineering awards several scholarships to the top students in the college. CS students may apply for COE scholarships simply by filling out the online application for a CS scholarship. Applications will be reviewed not only by the School of Computing, but will also be reviewed by the College of Engineering Scholarship Committee. Some College scholarships do require an additional essay during the application process. The College also has scholarships available for financial need.

Incoming transfer students and entering freshmen are not eligible to apply for the School of Computing Scholarships or Tuition Waivers until they have been admitted to the University of Utah and declared as a full or pre-major in computer science or computer engineering. These students should consider applying for U o f U or College of Engineering Scholarships.

B.S./ M.S. students are eligible to apply for School of Computing Scholarships, but are only eligible to receive undergraduate scholarship funding while they are finishing their under-graduate career.

Student Involvement

STUDENT PARTICIPATION IN THE SCHOOL OF COMPUTING

    The School of Computing, the College of Engineering, and the University of Utah all offer clubs, courses, and academic support to students which can enhance their undergraduate degree. The following offers a list of many, but not all, opportunities which computer science students are encouraged to explore. For a thorough list of clubs, groups, and activities at the University of Utah, please visit ASUU at www.asuu.utah.edu.

Industry Forum

Students are encouraged to take CS 3011: Industry Forum in their junior or senior year. This course meets once weekly for one credit hour. Students will engage in presentations from local and national business leaders discussing issues in computing from industry perspectives, trends in computer science, professionalism, ethics, career readiness, lifelong learning, and contemporary issues. CS 3011 may be repeated up to three times for credit.

Research Forum

Research forum is encouraged for students who are planning to take the thesis senior project course or plan to go on to graduate school. Students attend weekly presentations from speakers discussing different research opportunities within the School of Computing, as well as problems that remain unsolved in computer science. CS 3020 is a one-credit course, and may be taken along with industry forum, programming challenges, and/ or TA training to take place of one three-credit CS elective. Research forum is encouraged for sophomore or junior students.

Internships

Qualified students may count an internship experience as a CS elective course during the summer between junior and senior year. The benefits of such experience include exposure to ideas which could help with career decisions, making contacts which may be useful sometime in the future, and valuable work experience. Local internship opportunities are posted to the CS jobs board via the Undergraduate link on the CS home page. All internships must be approved by the Director of Undergraduate Studies prior to each semester.

Teaching Assistants

Paid, undergraduate teaching assistant positions are available to outstanding computer science majors. Teaching assistants enroll in CS 5040: Teaching Introductory Computer Science and work 10-20 hours/week.

Student Involvement

STUDENT PARTICIPATION IN THE SCHOOL OF COMPUTING

Independent Study

Students may enroll in one independent study course (three credits) as one of the seven required CS electives. Independent study must be approved by the supporting faculty member and must be taken for a grade. Students who are interested in conducting undergraduate research may consider working with a School of Computing faculty member in an independent study course.

Research
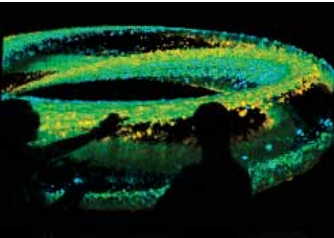
There are a number of ways to become involved in research as an undergraduate student. Students are encouraged to discuss research options and opportunities with College of Engineering faculty. There are two formal research avenues undergraduate students can investigate: The Merrill Engineering Scholars Fellowship and The Undergraduate Research Opportunities Program (UROP). To learn more about research in the School of Computing, visit www.cs.utah.edu/research.

iPhone Association

The University of Utah iPhone Programmer's Association (iPA) is an opportunity for you to meet with others who are developing for this exciting new platform. Membership is FREE, and non-students are welcome! Visit www.uofuiphone.com for more information or to join.

SoC UgSAC

The Undergraduate Student Advisory Committee (UgSAC) plays an active role in the School by coordinating the following: (1) Course and faculty teaching evaluations; (2) Representation (one student) at faculty meetings; (3) Announcements to all declared pre-majors and majors; (4) Representation on the College Student Advisory Committee; (5) Representation on the end-of-year awards committee; (6) Organization of university and high school programming contests; (7) Feedback on issues affecting students, such as scheduling, curriculum changes, and graduation requirements.

Anyone interested in joining this organization should visit csugsac.eng.utah.edu.

Student Involvement

STUDENT PARTICIPATION IN THE COLLEGE OF ENGINEERING

Women Engineers

The Society of Women Engineers (SWE), founded in 1950, is a not-for-profit educational and service organization. SWE is the driving force that establishes engineering as a highly desirable career aspiration for women. SWE empowers women to succeed and advance in those aspirations and be recognized for their life-changing contributions and achievements as engineers and leaders. For more information, visit: coe.utah.edu/swe.

Honors Programs

The College of Engineering offers an honors bachelor's degree. For information on this program, see the college web page: www.coe.utah.edu. Students may also participate in the University's honor program through Honors College. For more information, please visit: honors.utah.edu.

E-LEAP

Incoming engineering students should consider the Engineering LEAP (E-LEAP) program organized by the Office of Undergraduate Studies. It is a year-long cohort program set up to allow students to take several classes together during their first year on campus. Two of these classes are seminar courses that satisfy University General Education and Diversity requirements. The program also includes sections of writing, calculus, and physics. For more information on E-LEAP, contact the College of Engineering advisor at 801-585-7769.

Student Outreach

Engineering ambassadors represent their department on a college level and help with student recruitment and information sessions. Responsibilities may include presenting during Friday Afternoons in Engineering events, being ushers for College of Engineering Day, or visiting local high schools and junior highs. NSF representatives assist with similar outreach opportunities at college recruiting events and speaking engagements. Contact Cynthia Furse at cfurse@ece.utah.edu for more information about NSF opportunities.

Engineering Floor

The College of Engineering Living & Learning Community offers residents the opportunity to live with other students in the College of Engineering who share their academic and career goals.

Academic Support

UNDERGRADUATE ADVISING

The School of Computing undergraduate academic advisors are available to answer questions regarding schedule plans, registration for computer science classes, degree requirements, or any problems the student may be experiencing in their academic progress. Students should visit their academic advisor at least once a year to verify that they are on track for graduation. Appointments are required. The School of Computing receptionist will be happy to set up an appointment for you to meet with your undergraduate academic advisor.

The School has a faculty advisor who can also answer questions about any of the above, as well as more technical issues, such as career decisions and equivalence of transfer classes.

University College advisors are available on campus to assist students with additional majors or minors, and answer questions about general education and bachelor degree requirements. They are located in the Student Services Building, room 450. Appointments to see a University College advisor may be made by calling 801-581-8146 to set up a general advising appointment.

School of Computing Advisors

Undergraduate Advisor (A-K)
Kelly Olson
MEB 3190
kelly@cs.utah.edu
Call 801-581-8224
    for an appointment

Undergraduate Advisor (L-Z)
Vicki Jackson
MEB 3190
vicki@cs.utah.edu
Call 801-581-8224
    for an appointment

Master's Degree Advisor
Anne Carlstrom
MEB 3190
annc@cs.utah.edu
801-581-7631

Undergraduate Director
H. James de St. Germain
MEB 3190
germain@cs.utah.edu
801-585-3352

Mandatory Advising

- Freshmen & Transfer Orientation
- Freshmen Advising
- Second Year Advising
- Undeclared Advising
- Graduation Advising

Students will need to make mandatory advising appointments once during the freshmen year, the second year, and again in order to apply for graduation. It is advised to do so early to ensure timely registration. Any student who is still undeclared into a major by the completition of 60 credits will be required to meet with an advisor to declare a major or pre-major.

Academic Support

EMPLOYMENT OPPORTUNITIES

The School of Computing employs a number of junior and senior students as teaching assistants. This job involves no more than 20 hours of work per week at an appropriate hourly wage. Appointments are made each semester based on student applications, which should be submitted prior to the start of each term. These applications are available on the CS website.

General inquiries are received regularly from local industry and from University research groups for students for full or part-time employment. These opportunities are posted to the CS jobs board via the Undergraduate link on the CS home page. Project-based opportunities, such as Website development and/ or tutoring are also posted.

Students seeking employment upon graduation should contact the University Office of Career Services in order to be included on a list supplied to employers. Students not planning to work toward an advanced degree should register with Career Services during their junior year, since most companies begin interviewing during the fall semester. Each year, Career Services hosts a general career fair each semester, as well as a separate Science and Engineering Fair in the fall. Computer Science students are encouraged to attend both fairs to begin networking and interviewing with potential employers.

ENGINEERING TUTORING CENTER

First and second year engineering students frequently take a heavy class load of chemistry, physics, and calculus. Even the best students need a little help with these subjects from time to time. The College of Engineering Tutoring Center is staffed with junior and senior engineering students that offer academic help as well as experience.

Open tutoring labs are available throughout the week in WEB 1622. Schedules are posted weekly on the whiteboard in this room. More information on tutoring hours and availability can be found at www.eng.utah.edu/tutoring.

JOHN LALONDE UNDERGRADUATE LOUNGE

The School of Computing offers a Undergraduate Lounge on the third floor in the Merrill Engineering Building for undergraduate computer science students. Students are encouraged to use this space to study or relax on campus. A fridge and microwave are available.