Graduate
HANDBOOK
2013-2014

SCHOOL OF COMPUTING
UNIVERSITY OF UTAH

Welcome

The School of Computing was originally founded as the Computer Science Department at the University of Utah in 1965 by David C. Evans (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 35 regular faculty members, 6 research faculty, and 20 adjunct faculty, with more than 396 CS undergraduate students, 110 CE undergrads, 94 enrolled in the M.S. program and 123 enrolled in the CS Ph.D. program.

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.

The Emphasis Areas for the Computer Science Degrees are:

- Algorithms and Computational Geometry
- Databases and Information Management
- Educational Software
- Formal Methods including verification tools, Logic, Theorem Proving and Industrial Applications
- Graphics
- Hardware systems including Architecture and VLSI
- Image Processing
- Machine Learning and Natural Language Processing
- Networking, Embedded Systems, and Operating Systems
- Programming Languages and Compilers
- Robotics
- Scientific Computing, Parallel Computing, Computational Science Applications and Software Architecture
- Visualization

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* The official copy of the handbook is the printed one on file at the SoC office, and controls if there are any differences between it and any other statement of rule or policy.

ADMINISTRATION

DIRECTOR
Al Davis
Professor

ASSOCIATE DIRECTOR
Ellen Riloff
Associate Professor

ASSOCIATE DIRECTOR
Ross Whitaker
Professor

DIRECTOR OF GRADUATE STUDIES (DGS)
Mike Kirby
Associate Professor

DIRECTOR OF GRADUATE ADMISSIONS
Matthew Flatt
Associate Professor

DIRECTOR OF BS/MS PROGRAM
Thomas Fletcher
Assistant Professor

DIRECTOR OF CES PROGRAM
Martin Berzins
Professor

TRACK DIRECTORS

COMPUTER ENGINEERING
Erik Brunvand
Associate Professor

DATA MANAGEMENT & ANALYSIS
Feifei Li
Assistant Professor

DIGITAL MEDIA
Erik Brunvand
Associate Professor

GAME ENGINEERING
Bob Kessler
Professor

GRAPHICS & VISUALIZATION
Charles Hansen
Professor

IMAGE ANALYSIS
Thomas Fletcher
Assistant Professor

NETWORKED SYSTEMS
Sneha Kasera
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ROBOTICS
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Computer architecture: clustered processors, memory hierarchy bottlenecks

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Assistant Professor
Computer graphics and animation

Martin Berzins
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Adaptive numerical methods, parallel algorithms, computational fluid & solid mechanics applications

Richard Brown
Dean of Engineering and Professor
Microprocessor design, circuits to minimize leakage, solid-state chemical sensors

Erik Brunvand
Associate Professor
Computer architecture & VLSI systems

Elaine Cohen
Professor
Computer graphics, scientific visualization, geometric modeling, mechanical design

Al Davis
Director and Professor
Embedded/multi-core architecture, auto. domain specific architecture synthesis, VLSI, asynchronous circuits

Matthew Flatt
Associate Professor
Programming languages & systems

Thomas Fletcher
Assistant Professor
Shape analysis, computer vision image analysis, image processing

Guido Gerig
Professor
Medical image analysis

Ganesh Gopalakrishnan
Professor
Formal Analysis of Concurrent Systems (MPI, GPU, Threading), Symbolic, Dynamic, and Runtime Verification Methods and Tool Frameworks

Mary Hall
Professor
Optimization, parallelization & compilers

Charles Hansen
Professor
Visualization, computer graphics, parallel computation, computer vision

Tom Henderson
Professor
Computer vision, mobile robotics

Lee Hollaar
Professor
Digital intellectual property law

John Hollerbach
Professor
Robotics, teleoperation, virtual reality, & human motor control

Chris Johnson
Distinguished Professor
Scientific computing, visualization, imaging, & problem solving environments

Sneha Kasera
Associate Professor
Computer networks/systems, mobile systems and wireless networks, network security

Bob Kessler
Professor
Systems software & software engineering

Mike Kirby
Associate Professor
Scientific computing & visualization, High Performance Computing, Concurrent Programming

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Associate Professor
Databases, large-scale data management

Miriah Meyer
Assistant Professor
Visualization & large multidimensional data

Matthew Might
Assistant Professor
*Security, parallelism, verification
& optimization*

Valerio Pascucci
Professor
*Computer graphics, computational
geometry, geometric programming,
& solid modeling*

Jeff Phillips
Assistant Professor
*Algorithms, big data analytics, geometric
data analysis*

Zvonimir Rakamaric
Assistant Professor
Formal methods & verification

John Regehr
Associate Professor
*Embedded systems, sensor networks,
static analysis, operating systems*

Rich Riesenfeld
Professor
*Computer graphics, geometric
 modeling, & design*

Ellen Riloff
Associate Professor
*Natural language processing, information
retrieval, & artificial intelligence*

William Thompson
Professor
*Visual perception, computer graphics,
virtual environments, & computer vision*

Jur van den Berg
Assistant Professor
Robotics & virtual environments

Kobus van der Merwe
Associate Professor
*Networked systems, network management,
mobile networking, network security and cloud
computing.*

Suresh Venkatasubramanian
Associate Professor
*Algorithms, computational geometry
& data mining*

Ross Whitaker
Professor
*Image processing, medical image analysis,
data analysis and visualization &
geometry processing*

Cem Yuksel
Assistant Professor
*Physically-based simulation, image synthesis,
GPU algorithms*

MASTER'S
PROGRAM

MASTER'S IN COMPUTER SCIENCE & MS IN COMPUTING

M.S. DEGREES OPTIONS

There are two Master's degree programs within in the School of Computing (SoC) at the University of Utah:

- MS in Computer Science
- MS in Computing

Degree programs may contain a thesis, project or course-only option as specified. Transfers between degree programs will be considered between semesters and will occur only once per academic year.

An MS in Computing is earned within a particular track. Students are, in part, admitted based upon the track that they have selected during the admissions process.   If students wish to switch tracks, they should seek approval from DGS and from the track director of the track to which they wish to enter. Some flexibility will be allowed in terms of switching tracks; however, to remain in good standing, a student has to reach certain due progress milestones as determined by their degree/track required course specifications.

> Master's Degrees:
> Master's in Computer Science
>
> Master's in Computing
> Tracks:
>   • Computer Engineering
>   • Data Management and Analysis
>   • Digital Media
>   • Game Engineering
>   • Graphics and Visualization
>   • Image Analysis
>   • Networked Systems
>   • Robotics

The Program of Study form should be filed with the School of Computing in the second semester of study and with the Graduate School prior to taking the qualifying examination. The Program of Study form must be submitted to the Graduate Records Office no later than the last day of the semester proceeding the semester of graduation.

The Director of Graduate Studies (DGS) is the responsible entity for all graduate degree related issues. He/she will act in consultation with the track directors for administration of the Computing Degree program. In the information that follows: statements stating that something will be done/approved by DGS should be understood to mean "DGS and/or the track directors".

REGISTRATION REQUIREMENTS

Full-time graduate students in the School of Computing are required to register for 9 hours, which includes regular courses, seminars, and research credits as appropriate. This is especially the case for students being supported via research or teaching assistantships. Students who are not being supported by the school are required to take nine hours to be classified as full-time by the graduate school.

Graduate School policy dictates that a graduate student who receives a full tuition waiver during any semester in which he or she holds an assistantship, fellowship or traineeship is required to register for at least nine semester hours, including thesis research and seminars. Students must be registered for at least three hours per semester, exclusive of summer semester, to remain in a graduate degree program. Students who do not maintain continuous registration and who have not been granted a leave of absence by the Graduate School are subject to being discharged from the degree program.

Students doing theses must be registered for at least three semester hours during the semester of the student's thesis defense. Once a student has passed the thesis defense, the student does not have to register the next term, and the student needs to turn in the final thesis draft to the thesis office within 90 days.

COURSE REQUIREMENTS

All degree programs have certain course requirements. However, these represent a necessary, rather than sufficient, set of courses for graduation. To graduate, this coursework must appear on a student's approved program of study, a customized course plan developed by the student in conjunction with their committee.

Courses that count toward graduation must be on the program of study. The following default restrictions apply to these courses:

- CS courses must have a course number of 6000 or above (CS 5470: Compiler Principles and Techniques will also be allowed)
- Non-CS courses must be a graduate level course having a course number of 5000 or above, and should be directly related to the student's degree
- A grade of C or better
- The GPA for all required courses must be at least 3.0

In the subsequent pages of this document, each degree program and/or track may specify modifications and/or additions to these restrictions. Students should also consult the Graduate School Handbook concerning any University requirements.

A student may register for CS 6020 if that student writes and publishes a peer-reviewed article based on research performed in the University of Utah School of Computing (SoC). The contribution of the student to the article should be equivalent to that conferred by first authorship. The paper should be published in a respectable outlet. It is the responsibility of the student's advisor to determine whether the student has made such a contribution, and whether the outlet is of sufficient quality. This paper must be accepted for publication prior to the end of the second year of study.

COURSE WAIVERS

A student may obtain a waiver for any of the required courses by demonstrating prior knowledge (e.g., completion of a similar course taken at another University). This waiver is obtained by petitioning the DGS. The waiver procedure should be initiated by first contacting the Graduate Coordinator. Waiving a required course does not reduce the 30 graduate credit hour requirement.

M.S. SUPERVISORY COMMITTEE

The M.S. Supervisory Committee consists of three members. At least two members must be SoC faculty. Any SoC tenured, or tenure track faculty member may serve as a supervisory committee chair. Research or adjunct faculty may chair supervisory committees if accorded that privilege by the regular faculty. All official decisions of the committee are decided by majority vote.

M.S. COMPREHENSIVE EXAM

For the project and thesis options of this degree, the M.S. comprehensive exam will be administered by the student's supervisory committee and can be coupled with (i.e. satisfied by) a project or thesis proposal defense, and/or meeting a specified level of performance on a set of classes.

For students not doing a project or thesis, the comprehensive exam will typically be passed by meeting the grade requirements in required courses for their degree/track, but this can be modified at the discretion of the student's committee.

M.S. TRANSFER CREDIT

A student may not count more than nine semester hours of non-matriculated graduate work toward any graduate degree unless the student's registration for more than nine semester hours is specifically approved in advance by the SoC Director and the Dean of the Graduate School. Graduate courses taken as an undergraduate at the University of Utah cannot be counted towards a degree program unless a petition for graduate credit was filed with the University's Registrar at the time the course was taken.

Students who have done graduate study at other institutions may transfer up to six semester hours to the University of Utah. The courses must be bona fide graduate level class work (e.g., independent study is excluded), with grade C or better. Students must be able to show that the course work was not used toward any other degree.

Approval of each course is granted by the student's supervisory committee and the DGS. Course appropriateness is determined by consideration of course content and the student's declared research area.

Approved courses are certified by a transfer credit form. Approval of a course taken elsewhere for transfer credit does not imply fulfillment of any specific required course.

M.S. PROJECT DOCUMENT (Project Option)

The project is done through an independent study (often formally as an independent study course) with a professor in the School of Computing. The parameters for the scope of the project is set forth at the onset of the independent study, and the defense of the project will be done before the student's entire committee plus the professor in charge of the independent study (normally with the chairperson of the committee being the professor with whom the independent study is done). The student is responsible for arranging a time and place for the defense together with the committee.

M.S. THESIS DOCUMENT (Thesis Option)

The supervisory committee must give preliminary approval of the thesis prior to the defense. The defense can be scheduled after this approval. To schedule the defense, contact the Graduate Coordinator at least two weeks prior to defense date agreed upon with the supervisory committee. A verification notice will go out to all committee members asking if the student is ready to defend. Once positive responses are received, and no later than one week prior to defense, the defense is announced to all students and faculty in the School of Computing. Students are strongly encouraged to schedule the defense during a regular colloquium slot.

The student must provide one copy of the thesis to the chair of the supervisory committee at least three weeks before the defense, and one copy to each of the other committee members at least two weeks prior to the defense. A complete draft of the thesis must be emailed as a PDF to the Graduate Coordinator two weeks prior to the announced time of defense. This copy will be made available for **public access**. Students are encouraged to place an additional copy on the **SoC web pages** at least one week prior to the announced time of defense.

After successfully defending the thesis, the student must obtain approval that the thesis is satisfactory by obtaining signatures from their committee members and the chair of the department by using the Final Reading Approval form, and the Supervisory Committee Approval form. These forms will be submitted with the final draft of the thesis manuscript to the thesis office. The majority of the signatures of the committee members are required for the thesis editors to start the format approval and the editing process. A student can defend a thesis until the day before the following semester starts. However, in order to graduate in a certain semester, please see the thesis calendar for submission deadlines on the Graduate School's website.

Students should also read the document regarding copyright notices provided by the School and declare their intentions regarding granting the School the right to photocopy the thesis before notifying the Graduate Coordinator of completion of the defense.

The student has one month after the defense to make any revisions prior to submitting the thesis to the Graduate School Thesis Editor. There will be at most two additional months to complete any changes required by the Thesis Editor before final acceptance. If either of these deadlines are not met, the candidate must redo the oral defense. The final thesis must be filed one week before the end of the semester of graduation.

Students are expected to offer each committee member a bound copy of the thesis once it is completed, and one to the School of Computing library. Detailed policies and procedures concerning the thesis are contained in "A Handbook for Theses and Dissertations" published by the Graduate School.

DEFENSE (Thesis Option)

Within three months of the thesis defense, the student must receive final reading approval from the thesis committee and the thesis editor. Failure to do so will result in probationary status and will require that the student re-defend the thesis.

RESIDENCY

At least 24 hours of the 30 M.S. course and thesis hours must be in resident study at the University of Utah. This does not refer to, or fulfill, State Residency Requirements. A full time student working on an M.S. program is expected to complete the degree requirements within two calendar years. The Graduate School limits M.S. programs to four years.

LEAVE OF ABSENCE

If a student does not plan to take classes during a Fall or Spring semester, a leave of absence must be requested. Contact the Graduate Coordinator for the proper form.

MONITORING OF PROGRESS

Annual meetings and reports: Each year the student will meet with the academic advsior for review of due progress.

Actions by the DGS and the School: In the event that a student is found not to be in good standing (a decision made by the DGS based on reports from the advisory committee) one or more actions may be taken. For example, the School may assign the DGS to counsel the student, deny opportunities to serve as departmentally funded TA, discontinue tuition waiver benefits, or remove the student from the program. In the event that a faculty member fails to meet with advisory committees and report on their students, the DGS may elect to disallow this faculty to advise new students.

GRADUATE STUDENT PROGRESS GUIDELINES FOR THE M.S. PROGRAM

Milestone	Good Progress	Acceptable Progress	Comments
Choose advisor	1 Semester	2 Semesters	
Full committee formed	2 Semesters	3 Semesters	
Program of study	2 Semesters	3 Semesters	
Complete required courses	3 Semesters	3 Semesters	Program requirement: three semesters
Defend proposal	3 Semesters	4 Semesters	U. requirement: one semester before defense
Thesis defense	4 Semesters	5 Semesters	
Final document			U. requirement: document finalized within three months of the defense

INDIVIDUAL MS TRACK SPECIFICATIONS

A student may pursue an M.S. with a (1) thesis option, or (2) a project option, or (3) a course-only option, or (4) an MS/MBA option. The M.S. program requires 30 total semester hours of graduate coursework (including thesis hours for the thesis option).

CATEGORY #1	
CS 6100	Foundations of Computer Science
CS 6150	Advanced Algorithms
CATEGORY #2	
CS 6460	Operating Systems *
CS 6480	Advanced Computer Networks
CS 7460	Advanced Operating Systems
CATEGORY #3	
CS 6710	Digital VLSI Design
CS 6720	Advanced Integrated Circuit Design
CS 6740	CAD of Digital Circuits
CS 6770	Advanced Digital VLSI Systems Design
CS 6810	Computer Architecture *
CS 6830	VLSI Architecture
CS 7820	Parallel Computer Architecture

* Suggested course

Up to six semester hours of graduate-level course may be taken outside of the School of Computing. In general, seminars cannot be used as part of the required 30 hours. The one allowable exception is CS 7930: Colloquium. This course may be taken for two credit hours at one time as part of the Program of Study.

THESIS OPTION
Students should select one course from each of the three categories. A minimum of six thesis research credits (CS 6970) are required for the thesis option, and a maximum of 10 thesis research credits can be used on the Program of Study. At least one additional CS 6000-level or higher course is required. (Excluding independent study, and seminars). Additional 6000-level courses may be needed to reach the 30 credit minimum. Independent study (CS 6950) can be included to fulfill the required 30 semester hours, but only when the project is self-contained and independent of thesis research.

PROJECT OPTION
Students should select one course from each of the three categories. A minimum of three Independent Study credits (CS 6950) are needed for the project option, and a maximum of six Independent Study credits can be used on the Program of Study. At least four non-required CS courses must be taken excluding independent study, seminars, or thesis research credit (CS 6970). Additional 6000-level courses may be required to reach the 30 credit minimum.

COURSE-ONLY OPTION
Students should select one course from each of the three categories. At least six non-required CS courses must be taken excluding independent study, seminars, or thesis research credit (CS 6970). Additional 6000-level courses may be required to reach the 30 credit minimum.

MS/MBA OPTION
Students should select one course from each of the three categories. At least three non-required CS courses must be taken excluding independent study, seminars, or thesis research credit (CS 6970). Additional 6000-level courses may be required to reach the 21 credit minimum within our College. The remaining courses needed for this option are specified by the Business School as part of the joint MS/MBA Program.

A student may pursue an M.S. with a (1) thesis option, or (2) a project option, or (3) a course-only option. The M.S. program requires 30 total semester hours of graduate coursework (including thesis hours for the thesis option).

TRACK FACULTY

Al Davis, Rajeev Balasubramonian, **Erik Brunvand (Track director),** Priyank Kalla (ECE), Chris Myers (ECE), John Regehr, Thomas Schmid (ECE), Ken Stevens (ECE)

COURSE REQUIREMENTS: M.S. IN COMPUTING, COMPUTER ENGINEERING
Required courses:

CS/ ECE 6810 Computer Architecture
CS/ ECE 6710 Digital VLSI Design

Thesis option: 2 required, 2 electives from restricted list
Project option: 2 required, 3 electives from restricted list
Course-only option: 2 required, 4 electives from restricted list

* Additional courses on the program of study must be approved by the student's committee.

ELECTIVES:
Four courses must be taken by students doing the coursework option, three courses must be taken by students doing the project option, and two courses must be taken by students doing the thesis option. Courses selected should be in an area of specialization selected by the student.

CS 6110	Formal Methods in System Design
CS 6150	Advanced Algorithms
CS 6235	Parallel Programming for GPUs/Many Cores/Multi-Cores
CS 6460	Operating Systems
CS 6470	Compiler Principles and Techniques
CS 6475	Advanced Compilers
CS 6480	Advanced Computer Networks
ECE 5325	Wireless Communications Systems
ECE 5520	Digital Communications Systems

Computer Engineering Track Elective courses: Continued	
ECE 6530	Digital Signal Processing
ECE 6531	Advanced Digital Signal Processing II
ECE 6580	Implementation of Digital Signal Processing
CS/ ECE 6720	Analog Integrated Circuit Design
CS/ ECE 6740	Computer-Aided design of Digital Circuits
CS/ ECE 6745	Testing and Verification of Digital Circuits
CS/ ECE 6750	Synthesis and Verification of Async VSLI Systems
CS/ ECE 6770	Advanced Digital VLSI Systems Design
CS/ ECE 6780	Embedded Systems Design
CS/ ECE 6785	Advanced Embedded Software
CS/ ECE 6830	VLSI Architecture
CS/ ECE 7810	Advanced Architecture
CS/ ECE 7820	Parallel Architecture

Thesis Option:
This option involves research on a thesis area and a written thesis submitted to the graduate school. A minimum of six thesis hours are required, and there must be at least 20 classroom hours in the program of study. A maximum of three hours of Independent/Special Studies (CS/ECE 6950) is permitted only when it is self-contained and not related to the thesis.

Project Option:
Similar to the coursework option with an independent/special study on a project topic required with a project report submitted to the independent/special study advisor. A minimum of three hours and maximum of six hours of Independent/Special Studies (CS/ECE 6950) are allowed.

Course-only Option:
In this option all the course requirements are fulfilled through graduate courses (no thesis hours). No more than three hours can be Independent/ Special Studies (CS/ECE 6950).

A maximum of two seminar hours will be permitted.

A student may pursue an M.S. with a (1) thesis option, or (2) a project option, or (3) a course-only option. The minimum number of credits for either option is 30 graduate level classes. A maximum of 6 project hours or 9 thesis hours is allowed to be included in the program of study for students in the project or the thesis option. A minimum of 6 hours of thesis research is required for the thesis option.

TRACK FACULTY
Tom Fletcher, Mike Kirby, **Feifei Li (Track director)**, Miriah Meyer, Valerio Pascucci, Jeff Phillips, Suresh Venkatasubramanian

COURSE REQUIREMENTS Required courses: must take 4 required courses.	
CS 6150	Advanced Algorithms
CS 6350 Machine Learning / CS 6955 Data Mining / CS 6960 Non-Parametric Statistics	
CS 6530	Database Systems
CS 6630	Scientific Visualization

A minimum of a B or greater is required for any of the required courses.

ELECTIVES Three courses from the following list are required:	
CS 6210	Advanced Scientific Computing I
CS 6220	Advanced Scientific Computing II
CS 6230	High-Performance Computing and Parallelization
CS 6235	Parallel Programming for GPUs/Many Cores/Multi-Cores
CS 6300	Artificial Intelligence
CS 6340	Natural Language Processing
CS 6640	Image Processing
CS 6964	Applications of NLP
CS 6610	Interactive Computer Graphics

In addition to the electives list, students may take any graduate-level courses taught by any track committee faculty members to fulfill the elective requirements. With approval of the supervisory committee, a student may take two elective courses at the graduate level or higher from other departments, excluding independent study, seminars and research credit. Students may place out of the above requirements by substituting or transferring courses from other institutions at the discretion of the TCF Chair.

In all three options, seminar hours cannot be included to fulfill the 30 graduate level credits requirement. Independent study credit hours can only be used on the Program of Study for students who pursue the project based degree. However, once a student enters the project or the thesis option, his/her prior indeptent study or thesis research hours can be converted into project or thesis hours whichever is applicable, if the student's advisor deems these hours relevant to the project or the thesis the student will be working on.

A student may pursue an M.S. with a(1) thesis option, or (2) a project option, or (3) a course-only option. The M.S. program requires 30 total semester hours of graduate coursework (including thesis hours for the thesis option).

Thesis option: 4 required courses (12 credits), **Project option:** 4 required courses (12 credits), **Course-only option:** 4 required courses (12 credits)

TRACK FACULTY
Roger Altizer, **Erik Brunvand (Track director),** Adam Bargteil, Craig Caldwell, Bob Kessler, Miriah Meyer, Mark van Langeveld, Cem Yuksel

COURSE REQUIREMENTS Choose two of the following MGS course sequences (each sequence=2 courses)	
EAE 6000/6010	Game Design I, II
EAE 6200/6210	Game Arts I, II
EAE 6300/6310	C++ for Game Programming / Game Engineering I

The remaining 18 credit hours (6 classes) should be 6000/7000 courses in CS, or other courses as approved by the student's committee, and can include the III class in a series above. For a course-only MS in Digital Media, at most 3 credit hours may be independent study. For a project-based MS, at least 3 and at most 6 hours should be independent study with the project being in a digital media area (as defined by the student and committee). For a thesis MS, at least 6 hours of Thesis Research (CS6970) should be included.

Theme Groupings for Electives: Students are also required to define a theme for at least three of their electives and have that theme (and those courses) approved by their committee. The theme can be negotiated between the student and their committee. The idea is to have them plan and defend how their electives fit into a coherent Digital Media theme.

Example theme groupings: Each grouping is three courses for 9 hours or half of the elective hours. Note that these are example course groupings, but it is not guaranteed that a Digital Media track student will automatically be able to take the suggested courses that are offered in other departments. Individual negotiation will be required for entry into upper division courses in other departments, and especially for courses in other colleges.

GRAPHICS	
CS 6610	Interactive Computer Graphics
CS 6620	Advanced Graphics II : Ray Tracing
CS 6640	Image Processing
EMBEDDED/ART	
CS 5789	Kinetic Art and Embedded Systems
CS 6780	Embedded System Design
ART 6420	Grad Projects, Sculpture
CHARACTER DESIGN	
EAE 6600	3D Modeling for VGA & M
EAE 6640	Digital Figure Sculpting
EAE 6665	Character Animation

HCI	
CS 6360	Virtual Reality
CS 6540	HCI
CS 6650	Perception for Graphics
ART DIRECTION	
EAE 6640	Digital Figure Sculpting
ART 6620	Grad Projects, Graphic Design
ART 6720	Grad Projects, Photo
INFO VIS	
CS xxxx	CS Special Topics: Information Visualization
CS 6630	Scientific Visualization
CS 6961	Fundamentals of Visual Computing
LIGHTING DIRECTION	
CS 6050	Perception for Graphics
FILM 6905-04	Grip and Lighting
THEATER 6xxx	Grad hour in Theatrical Lighting
COMPUTER ANIMATION	
FILM 6610	Grad Computer Animation
FILM 6810	Grad Screenwriting
FILM 6905-03	Digital Cinema Workflows
EAE 6665	Character Animation
EXPERIMENTAL MEDIA	
CS 5789	Kinetic Art and Embedded Systems
MUSIC 6360	Electronic Music Composition
ART 6xxx	Grad hours for sculpture or photo
SOUND DESIGN FOR DIGITAL MEDIA	
CS 6360	Virtual Reality
FILM 6420	Sound for Film and Digital Media
MUSIC 6538	Instrumentation
PHOTO-BASED DIGITAL MEDIA	
CS 6640	Image Processing
CS 6650	Perception for Graphics
ART 6720	Grad Projects, Photo

A student may pursue an M.S. Computing: Game Engineering with a project option only. The program requires a minimum of 43 credit hours of graduate coursework. Of those 43 credits, 6 credits are electives.

TRACK FACULTY
Roger Altizer, Adam Bargteil, Craig Caldwell, **Bob Kessler (Track director),** Mark van Langeveld, Cem Yuksel

COURSE REQUIREMENTS Required courses:	
EAE 6000	Game Design I
EAE 6011	Game Design II
EAE 6100	Rapid Proto-tying
EAE 6110	Game Projects I
EAE 6120	Game Projects II
EAE 6130	Game Projects III
EAE 6300	C++ for Game Programming
EAE 6310	Game Engineering I
EAE 6320	Game Engineering II
EAE 6330	Game Engineering II
EAE 6500	Internship (3 hours)
Elective courses (to equal 43 total credit hours):	
Graduate level CS or affiliated courses from other relevant departments as approved by your supervisory committee.	

The internship can be taken any semester after the first semester.

C++ for Game Programming should be taken by most students, however especially well prepared students may take an elective instead. Permission of the instructor must be obtained to replace the class with an elective.

A student may pursue an M.S. with a (1) course-only option, (2) a project option, or (3) a thesis option. The minimum number of credits for any option is 31 with 30 from graduate level (6000 level for CS courses) and 1 hour of either CS 7942 Visualization Seminar or CS 7933 Graphics Seminar. Seminars may not replace required or elective courses.

TRACK FACULTY

Adam Bargteil , Martin Berzins, Elaine Cohen, **Charles Hansen (Track director),** Chris Johnson, Mike Kirby, Miriah Meyer, Valerio Pascucci, Rich Riesenfeld, Bill Thompson, Cem Yuksel

COURSE REQUIREMENTS: **(COURSE ONLY OPTION)** Required courses:	
CS 6610	Interactive Computer Graphics
CS 6630	Scientific Visualization
CS 6640	Image Processing
CS 6670	Computer-Aided Geometric Design
CS 7933 Graphics Seminar (or) CS 7942 Visualization Seminar (one credit hour maximum)	
Three courses from the following list are required:	
CS 6170	Computational Topology
CS 6320	3D Computer Vision
CS 6360	Virtual Reality
CS 6540	Human/ Computer Interaction
CS 6600	Mathematics of Computer Graphics
CS 6620	Advanced Graphics II : Ray Tracing
CS 6650	Perception for Graphics
CS 6660	Physics-based Animation
CS 6665	Character Animation
CS 6680	Computer-Aided Geometric Design II
CS 6960	Computational Geometry
Elective courses (to equal 30 total credit hours):	
Graduate level CS courses and independent study (a maximum of three hours of independent study is allowed). Thesis research hours are not counted toward the degree in the course-only option.	

COURSE-ONLY OPTION

With approval of the supervisory committee, a student may take two elective courses at the graduate level or higher from other departments including 5000 or 6000 level courses, excluding independent study, seminars and research credit.

COURSE REQUIREMENTS:
(PROJECT OPTION) Required courses:

CS 6610	Interactive Computer Graphics
CS 6630	Scientific Visualization
CS 6640	Image Processing
CS 6670	Computer-Aided Geometric Design

CS 7933 Graphics Seminar (or) CS 7942 Visualization Seminar (one credit hour maximum)

Three courses from the following list are required:

CS 6170	Computational Topology
CS 6320	3D Computer Vision
CS 6360	Virtual Reality
CS 6540	Human/ Computer Interaction
CS 6600	Mathematics of Computer Graphics
CS 6620	Advanced Graphics II : Ray Tracing
CS 6650	Perception for Graphics
CS 6660	Physics-based Animation
CS 6665	Character Animation
CS 6680	Computer-Aided Geometric Design II
CS 6960	Computational Geometry

Elective courses (to equal 30 total credit hours):

Students must take at least 3 and up to 6 credits (no more than 6 credits) of independent study for their MS project. Thesis research hours are not counted toward the degree in the project option.

PROJECT OPTION
With approval of the supervisory committee, a student may take two elective courses at the graduate level or higher from other departments including 5000 or 6000 level courses, excluding independent study, seminars, research credit.

COURSE REQUIREMENTS:

(THESIS OPTION)
Minimum 21 hours classroom courses and six hours of thesis research are required. Three of the following regular courses are required in addition to the seminar:

CS 6610	Interactive Computer Graphics
CS 6630	Scientific Visualization
CS 6640	Image Processing
CS 6670	Computer-Aided Geometric Design

CS 7933 Graphics Seminar (or) CS 7942 Visualization Seminar (one credit hour maximum)

Three courses from the following list are required:

CS 6170	Computational Topology
CS 6320	3D Computer Vision
CS 6360	Virtual Reality
CS 6540	Human/ Computer Interaction
CS 6600	Mathematics of Computer Graphics
CS 6620	Advanced Graphics II: Ray Tracing
CS 6650	Perception for Graphics
CS 6660	Physics-based Animation
CS 6665	Character Animation
CS 6680	Computer-Aided Geometric Design II
CS 6960	Computational Geometry

Elective courses (to equal 30 total credit hours):

For the thesis option, students can take up to 9 thesis hours and no independent study.

A minimum of six hours of thesis research (CS 6970) is required.

THESIS OPTION
With approval of the supervisory committee, a student may take two elective courses at the graduate level or higher from other departments including 5000 or 6000 level courses, excluding independent study, seminars, research credit.

A student may pursue an M.S. with a (1) thesis option, or (2) a project option, or (3) a course-only option. The minimum number of credits for either option is 30 graduate level classes. A maximum of 6 project hours or 9 thesis hours is allowed to be included in the program of study for students in the project or the thesis option. A minimum of 6 hours of thesis research is required for the thesis option.

TRACK FACULTY
Tom Fletcher (Track director), Guido Gerig, Tom Henderson, Marcel Prastawa, Tolga Tasdizen, Bill Thompson, Ross Whitaker

COURSE REQUIREMENTS
Required courses:

CS 6640	Image Processing
CS 7640	Advanced Image Processing
Students are also required to complete two out of the following three courses:	
CS 6150	Algorithms
CS 6320	3D Computer Vision
CS 6350	Machine Learning

The Program of Study must be courses at the 6000 level or above and research credits. Independent studies should not be included. Of the required 30 semester hours, up to 24 credit hours must be graduate courses within the School of Computing or on the following list of recommended electives.

ELECTIVES
Recommended elective courses within the School of Computing and other departments are listed below:

IMAGING, VISUALIZATION & GRAPHICS		
CS 6630	Scientific Visualization	
CS 6650	Perception for Graphics	
CS 6670	Computer-Aided Geometric Design I	
BIOEN 6330	Principles of Magnetic Resonance Imaging	
BIOEN 6330	Mathematics of Imaging	
COMPUTATIONAL METHODS		
CS 6160	Computational Geometry	
CS 6170	Computational Topology	
CS 6210	Advanced Scientific Computing	
CS 6220	Advanced Scientific Computing II	
CS 6550	Foundations of Algorithms in Computer Graphics and Visualization	
STATISTICS & LEARNING		
CS 6300	Artificial Intelligence	
CS 6560	Computational Statistics	
CS 6957	Probabilistic Modeling	
ECE 6540	Estimation Theory	

Students may place out of required courses or electives by substituting or transferring courses from other institutions. Substitute courses must be regular classes with exams and/or assignments, not seminar, readings, or independent study classes, and they must be approved by the Track Director. Up to 12 approved credit hours may be transferred from other institutions.

A student may pursue an MS with (1) a course-only option, (2) a project option, or (3) a thesis option. The minimum number of credit hours required for all the three options is 30. These credit hours must be from graduate level courses only (6000 level and above, or 5000 level courses that are considered graduate level by the respective departments). Students must take all four required courses listed below, and any three courses from the elective list below.

Students selecting the thesis option must include a minimum of 6 MS Thesis Research (CS 6970) credits in their program of study, and may include up to a maximum of 9. Students selecting the thesis option may include at most 3 credits of Independent Study (CS 6950) on their program of study, and may only do so if the work done in the IS does not overlap with the student's thesis work, as determined by the student's supervisory committee. If work done for an independent study turns into thesis work, it is possible to convert the IS credits to MS Thesis Research (CS 6970) credits.

For students selecting the project option, exactly 6 credits of Independent Study (CS 6950), covering the student's project work, must be included in the program of study.

For students selecting the coursework option, Independent Study (CS 6950) can be included in the program of study for at most 3 hours.

TRACK FACULTY

Eric Eide, Ganesh Gopalakrishnan, Mary Hall, Feifei Li, **Sneha Kasera (Chair),** Neal Patwari, John Regehr, Robert Ricci, Jacobus van der Merwe, Suresh Venkatasubramanian

COURSE REQUIREMENTS	
The following 4 courses are required:	
CS 6480	Advanced Computer Networks
CS 6490	Network Security
CS 6956	Wireless and Mobile Networks
CS 6963	Evaluating Network Systems

A minimum of a B or greater is required for any of the required courses.

ELECTIVES	
At least 3 elective courses must be taken from the following list:	
CS 6110	Formal Methods in Systems Design
CS 6150	Advanced Algorithms
CS 6235	Parallel Programming for GPUs/Many Cores/Multi-Cores
CS 6460	Advanced Operating Systems
CS 6530	Database Systems
CS 6810	Advanced Computer Architecture

A student may pursue an M.S. with a thesis option, a project option, or a course-only option. The minimum number of credits is 30. Three courses are required, plus an additional three courses from a restricted selection as described in Robotics Track Courses.

Two additional elective courses, directly related to the student's degree, at the 6000-level or higher (not including independent study, seminars, or thesis research hours) from any department are required. Depending on whether a student is pursuing a course-only M.S., a project M.S., or a thesis M.S., additional 6000-level or higher courses can be chosen, this time including independent study, seminars, and research credit, in order to reach a 30-credit minimum.

TRACK FACULTY
Jake Abbott (ME), Tom Henderson, **John Hollerbach (Track director),** Steve Mascaro (ME), William Provancher (ME), Jur van den Berg, Ross Whitaker

COURSE REQUIREMENTS The following three courses are required:	
CS 6310 / ME EN 6220	Introduction to Robotics
CS 6370 / ME EN 6225	Geometric Computation for Motion Planning
CS 6960 / ME EN 6230	Introduction to Robot Control (pre-requisite for CS 7310 & CS 7320)
CS 7939 / ME EN 7960-001*	Robotics Seminar (Fall semester & Spring semester)
One course from each of these three areas are required:	
PERCEPTION	
CS 6320	3D Computer Vision
CS 6640	Image Processing
COGNITION	
CS 6300	Artificial Intelligence
CS 6350	Machine Learning
ACTION	
ME EN 6240	Advanced Mechatronics
CS 6360	Virtual Reality
CS 7310 / ME EN 7230	Robot Mobility and Manipulation
CS 7320 / ME EN 7220	System Identification for Robotics
ME EN 7960-07	Haptics
Two additional 6000-level courses are required (excluding independent study, seminars, or thesis research credit).	

* The fall session deals with research: current student and faculty presentations, readings, and enrollee presentations. The spring session deals with professional development.

PHD
PROGRAM
PHD IN COMPUTER SCIENCE & PHD IN COMPUTING

PHD DEGREES OPTIONS

There are two PhD degree programs within in the School of Computing (SoC) at the University of Utah:

- PhD in Computer Science
- PhD in Computing

Transfers between degree programs will be considered between semesters and will occur only once per academic year.

A Ph.D. in Computing is earned within a particular track. Students are, in part, admitted based upon the track that they have selected during the admissions process. If students wish to switch tracks, they should seek approval from DGS and from the track director of the track to which they wish to enter. Some flexibility will be allowed in terms of switching tracks; however, to remain in good standing, a student has to reach certain due progress milestones as specified.

> **Ph.D. Degrees:**
> Ph.D. in Computer Science
>
> Ph.D. in Computing
> Tracks:
>   • Computer Engineering
>   • Data Management and Analysis
>   • Graphics and Visualization
>   • Image Analysis
>   • Networked Systems
>   • Robotics
>   • Scientific Computing

The Director of Graduate Studies (DGS) is the responsible entity for all graduate degree related issues. He/she will act in consultation with the track directors for administration of the Computing Degree program. In the information that follows: statements indicating that something will be done/approved by DGS should be understood to mean "DGS and/or the track directors".

REGISTRATION REQUIREMENTS

Full-time graduate students in the School of Computing are required to register for 9 hours, which includes regular courses, seminars, and research credits as appropriate. This is especially the case for students being supported via research or teaching assistantships. Students who are not being supported by the school are also required to take nine hours to be classified as full-time by the graduate school.

Graduate School policy dictates that a graduate student who receives a full tuition waiver during any semester in which he or she holds an assistantship, fellowship or traineeship is required to register for at least nine semester hours, including dissertation research and seminars. Students must be registered for at least three hours per semester, exclusive of summer semester, to remain in a graduate degree program. Students who do not maintain continuous registration and who have not been granted a leave of absence by the Graduate School are subject to being discharged from the degree program.

Students doing dissertations must be registered for at least three semester hours during the semester of the student's thesis defense. Once a student has passed the thesis defense, the student does not have to register the next term, and the final dissertation should be turned in, within the 90-day period.

COURSE REQUIREMENTS

All degree programs have certain course requirements. However, these represent a necessary, rather than sufficient, set of courses for graduation. To graduate, this coursework must appear on a student's approved program of study, a customized course plan developed by the student in conjunction with their committee.

Courses that count toward graduation must be on the program of study. The following default restrictions apply to these courses:

- CS courses must have a course number of 6000 or above (CS 5470: Compiler Principles and Techniques will also be allowed)
- Non-CS courses must be a graduate level course having a course number of 5000 or above, and should be directly related to student's degree
- A grade of B or better
- The GPA for all required courses must be at least 3.5

In the subsequent pages of this document, each degree program and/or track may specify modifications and/or additions to these restrictions. Students should also consult the Graduate School Handbook concerning any University requirements.

A student may register for CS 6020 if that student writes and publishes a peer-reviewed article based on research performed in the School of Computing at the University of Utah. The contribution of the student to the article should be equivalent to that conferred by first authorship. The paper should be published in a respectable outlet. It is the responsibility of the student's advisor to determine whether the student has made such a contribution, and whether the outlet is of sufficient quality. This paper must be accepted for publication prior to the end of the second year of study.

RESIDENCY

At least one year (i.e., two consecutive semesters) of the doctoral program must be spent in full-time academic work at the University of Utah. When a student proceeds directly from an M.S. degree to a PhD degree with no break in the program of study (except for authorized leaves of absence), the residency requirement may be fulfilled at any time during the course of study.

CREDIT FOR PREVIOUS COURSES

PhD students may count some hours of coursework from other graduate degrees toward the coursework requirements associated with the program of study. Unlike for the MS programs, credit for previous courses for PhD students is administered by the DGS so these courses do not need to be officially transferred to the University. The number of hours is specified on a track/program basis. Each track/program determines the number of hours allowed that may count. Approved courses are certified by inclusion of the appropriate SoC form in the student's file. All coursework on the program of study is subject to approval by the student's supervisory committee and the DGS.

Ph.D. students with a masters-level degree in a closely related discipline should work with their initial committee to create a program of study that can include graduate courses taken as part of their previous degree program. Unless explicitly specified by a degree/track, the program of study can include up to twenty total hours to be counted toward their Ph.D. requirements, and can be used to satisfy some or all of the Ph.D. required courses. Like all programs of study, it must then be approved by the DGS and the graduate school.

A student who has been accepted by the Graduate School is formally admitted to candidacy for the PhD by the University at the recommendation of the student's supervisory committee. Admission to candidacy occurs after the student:

- forms a supervisory committee,
- files an approved Program of Study form,
- completes the core course requirements,
- passes the written portion of the qualifying examination, and
- passes the oral portion of the qualifying examination (i.e. proposal defense).

An application for candidacy must be submitted to the Graduate School no later than two months prior to the semester of graduation. For the degree to be conferred, the approved Program of Study form must be completed and the dissertation completed and publicly defended.

A PhD Supervisory Committee conducts the student's written qualifying examination, oral qualifying examination, and dissertation defense. This committee consists of five faculty members, at least three of whom must be from the SoC, and at least one member from outside the SoC. Any SoC regular faculty member may serve as a supervisory committee chair. Research or adjunct faculty may chair supervisory committees if accorded that privilege by the regular faculty. Individuals who are not faculty members may serve on supervisory committees if nominated by the regular faculty on the committee, and endorsed by the Graduate Studies Committee and School Director. For Computing degrees, further restrictions on committee makeup may apply. All official decisions of the committee are decided by majority vote.

QUALIFYING EXAMINATION

All PhD students must pass a Qualifying Examination, as specified by the Graduate School. The Qualifying Exam consists of a written part, to be conducted first, and an oral part. The written part of the Qualifying Examination will cover the candidate's general area of specialization in sufficient depth to demonstrate their preparation for conducting PhD level research. Each internal member of the student's supervisory committee will contribute one or more questions to this exam. The external member(s) of the committee can provide question(s) if they wish to. The supervisory committee will provide a written evaluation of this part of the exam, including an indication of whether or not the student will be allowed to proceed to the oral part of the Qualifying Examination. More details on the procedures for the written part are available on the Graduate School web page.

The oral part comprises the dissertation proposal defense. At the supervisory committee's option, it may also include follow-up questions relating to the written part of the exam. A majority of the supervisory committee should certify that the proposal is ready to be defended prior to conducting the oral part of the Qualifying Exam.

PHD DISSERTATION

The supervisory committee must give preliminary approval of the dissertation prior to the defense. The defense can be scheduled after this approval. To schedule the defense, contact the Graduate Coordinator. Students are strongly encouraged to schedule the defense during a regular colloquium slot.

The student must provide one copy of the dissertation to the chair of the supervisory committee at least three weeks before the defense, and one copy to each of the other committee members at least two weeks prior to the defense. A complete draft of the dissertation must be delivered to the Graduate Coordinator two weeks prior to the announced time of defense. This copy will be made available for **public** access. **Students are encouraged to place an additional copy on the School of Computing web pages at least one week prior to the announced time of defense.**

After successfully defending the dissertation, the student must obtain approval that the thesis is satisfactory by obtaining signatures from their committee members and the chair of the department by using the Final Reading Approval form, and the Supervisory Committee Approval form. These forms will be submitted with the final draft of the thesis manuscript to the thesis office. The majority of the signatures of the committee members are required for the thesis editors to start the format approval and the editing process. The Dean of the Graduate School signs the Final Reading Approval form after all editing is completed and at before the thesis release. While a student can defend a thesis until the day before the following semester starts, in order to graduate in a certain semester, please see the thesis calendar for submission deadlines on the Graduate School's website.

Students should also read the document regarding copyright notices provided by the School and declare their intentions regarding granting the School the right to photocopy the dissertation before notifying the Graduate Coordinator of completion of the defense.

The student has one month after the defense to make any revisions prior to submitting the dissertation to the Graduate School Thesis Editor. There will be at most two additional months to complete any changes required by the Thesis Editor before final acceptance. If either of these deadlines are not met, the candidate must redo the oral defense. The final dissertation must be filed one week before the end of the semester of graduation.

Students are expected to offer each committee member a bound copy of the dissertation once it is completed. Detailed policies and procedures concerning the dissertation are contained in "A Handbook for Theses and Dissertations" published by the Graduate School.

The completed dissertation must be published either in its entirety (through a legitimate publisher of the student's choice or through University Microfilms) or as one or more articles accepted for publication in approved scholarly journals. An abstract of each dissertation must be published in University Microfilms' Dissertation Abstracts International.

STUDENT PROGRESS: TERMINOLOGY

Initial committee: This consists of two University of Utah faculty members and an advisor, who must meet the School of Computing requirements for advising. The initial committee is different from the full committee, who will ultimately administer the qualifier and evaluate the dissertation. The full committee must be chosen to conform to program requirements. The initial committee is automatically dissolved when the student forms a full committee, however, the full committee may consist of the same faculty members as the initial committee.

Good versus acceptable progress: Students completing milestones within the time frame denoted as "good" are generally considered to be in good standing in the program. Students completing milestones within the time frame denoted as "acceptable" are considered to be making acceptable progress in the program and are encouraged to continue on and attempt to meet successive milestones within the time frames denoted as "good."

Students may or may not be considered in good standing, depending upon evaluation of the director of graduate studies (DGS) with input from their advisor and advisory committee. Students not completing milestones within the time frame denoted as "acceptable" are not considered in good standing.

GRADUATE STUDENT PROGRESS GUIDELINES FOR THE PH.D. PROGRAM

Milestone	Good Progress	Acceptable Progress	Comments
Choose advisor and initial committee	1 Semesters	2 Semesters	
Program of study approved by advisor and initial committee	4 Semesters	5 Semesters	
Complete required courses	5 Semesters	6 Semesters	
Full committee formed	6 Semesters	7 Semesters	
Program of study approved by committee	6 Semesters	7 Semesters	U. requirement: one semester before defense
Written qualifier	5 Semesters	6 Semesters	U. requirement: one semester before defense
Oral qualifier (proposal)	7 Semesters	8 Semesters	U. requirement: After written qualifier and one semester before defense
Dissertation defense	10 Semesters	12 Semesters	
Final document			U. requirement: document finalized within three months of the defense

At least 50 hours of graduate coursework is required for the Ph.D. degree in computer science. This must be composed of at least 27 hours of regular graduate coursework, and at least 14 semester hours of dissertation research. Independent study and seminars cannot be used as part of the required 50 hours. The one allowable exception is CS 7930: Colloquium. This course may be taken for one credit hour as part of the Program of Study. Of the required 27 semester hours of regular courses, up to six hours may be graduate-level courses outside of the School of Computing. Up to 20 hours of coursework taken elsewhere or counted toward previous degrees can be counted toward the 27 hour regular course requirement with the approval of the Track director. Ph.D. students must demonstrate core knowledge in computer science by fulfilling the following requirements:

COURSE REQUIREMENTS: PH.D. IN COMPUTER SCIENCE Students should select one course from each of the three categores.	
CATEGORY #1	
CS 6100	Foundations of Computer Science
CS 6150	Advanced Algorithms
CATEGORY #2	
CS 6460	Operating Systems *
CS 6480	Advanced Computer Networks
CS 7460	Advanced Operating Systems
CATEGORY #3	
CS 6810	Computer Architecture *
CS 6710	Digital VLSI Design
CS 6720	Advanced Integrated Circuit Design
CS 6740	CAD of Digital Circuits
CS 6770	Advanced Digital VLSI Systems Design
CS 6830	VLSI Architecture
CS 7820	Parallel Computer Architecture

* Suggested course

Students must show proficiency in the three fundamental categories. This can be accomplished by taking one course from each category, or with the approval of the Track director, a student may replace one or more of these courses with a more advanced course offered by the School of Computing in the same or related subject areas. Substitute courses must be regular classes with exams and/or assignments, not seminar, readings, or independent study classes. Each advanced course can be offered as a substitute for only one required course. Additional 6000-level courses and above may be required to reach a 50-credit hour minimum (excluding independent study, seminars, or dissertation research credit hours).

A Ph.D. student must either already have an M.S. degree or complete all of the requirements for a course, project, or thesis-based M.S. degree in CE. The supervisory committees may require additional coursework hours above that required for the M.S. degree. Also, all students must complete at least 7 hours of coursework at the University of Utah. All students must complete at least 14 hours of dissertation research (CS or ECE 7970). At least one year (i.e. two consecutive semesters) of the doctoral program must be spent in full-time academic work at the University of Utah. A student must be registered for at least 3 hours of credit in the semester that they defend their dissertation.

All students must complete at least seven hours of coursework at the University of Utah. All students must complete at least 14 hours of dissertation research (CS 7970).

TRACK FACULTY
Al Davis, Rajeev Balasubramonian, **Erik Brunvand (Track director),** Priyank Kalla (ECE), Chris Myers (ECE), John Regehr, Thomas Schmid (ECE), Ken Stevens (ECE)

COURSE REQUIREMENTS

Required courses for students not already having an M.S. degree:
Same as the requirements for the M.S. in Computer Engineering listed on Page 12 of this handbook.

Required courses for students who already have an M.S. degree:
At least 7 hours of coursework at the University of Utah determined in consultation with the student's committee.

Each CE graduate student must form a supervisory committee whose members approve the student's program of study and guides the student's research program. A PhD committee consists of five members. The majority of the committee must consist of CE faculty from either ECE or SoC. PhD students are strongly encouraged to have a member of the committee who is outside the University of Utah whenever it is feasible. The committee should be formed by the end of the second semester of enrollment in the graduate program, although a committee may be revised later by petition to the CE committee.

Any ECE or SoC regular faculty member may serve as a supervisory committee chair. Auxiliary faculty may chair supervisory committees if accorded that privilege by the regular faculty and the Dean of the Graduate School. Individuals who are not faculty members may serve on supervisory committees if nominated by the regular faculty on the committee, and endorsed by the CE Committee. The Dean of the Graduate School must grant final approval of all supervisory committees. **A maximum of two seminars hours will be permitted.**

Course work listed on the approved Program of Study form must comprise at least 50 semester hours of graduate course work and dissertation research, exclusive of independent study. At least 14 semester hours of dissertation research (CS 7970) and 24 semester hours of graduate course work must be included. Up to 12 hours of graduate level course work already applied to other degrees may be used in the program of study as approved by the track director.

TRACK FACULTY

Tom Fletcher, Mike Kirby, **Feifei Li (Track director)**, Miriah Meyer, Valerio Pascucci, Jeff Phillips, Suresh Venkatasubramanian

COURSE REQUIREMENTS Required courses: must take 4 required courses.	
CS 6150	Advanced Algorithms
CS 6350 Machine Learning / CS 6955 Data Mining / CS 6960 Non-Parametric Statistics	
CS 6530	Database Systems
CS 6630	Scientific Visualization

A student must take five elective courses (fifteen hours) which involve the areas related to information, or are directly applicable to the student's dissertation research. Up to three courses (nine hours) may be taken from other departments at the University of Utah. All elective courses on the Program of Study must be taught at the graduate level. For those classes taken within the School of Computing, the students needs to take 6000 level courses and above when available/appropriate. In addition to the following electives, other 6000 level and above classes taught by track faculty are also allowed as electives. All courses taken by a track student to fulfill the elective requirements must be approved by the student's committee and the track director.

ELECTIVES Three courses from the following list are required:	
CS 5610	Interactive Computer Graphics
CS 6210	Advanced Scientific Computing I
CS 6220	Advanced Scientific Computing II
CS 6230	High-Performance Computing and Parallelization
CS 6235	Parallel Programming for GPUs/Many Cores/Multi-cores
CS 6300	Artificial Intelligence
CS 6340	Natural Language Processing
CS 6610	Interactive Computer Graphics
CS 6640	Image Processing
CS 6964	Applications of NLP

ADDITIONAL ELECTIVES

- MATH 5010 Introduction to Probability
- MATH 5080 Statistical Inference I
- MATH 5090 Statistical Inference II
- MATH 5250 Matrix Analysis
- MATH 6010 Linear Models
- MATH 6020 Multilinear Models
- MATH 7870 Methods of Optimization
- ECE 5510 Random Processes
- ECE 6540 Estimation Theory
- ECE 6520 Information Theory and Coding
- ECE 6551 Survey of Optimization Techniques
- IS 6481 Data Warehousing
- IS 6482 Data Mining
- BMI 6010 Foundations of Medical Informatics
- BMI 6020 Foundations of Bioinformatics and Genetic Epidemiology
- BMI 6105 Statistics for Biomedical Informatics
- BMI 6300 Medical Decision-Making

Course work listed on the approved Program of Study form must comprise at least 50 semester hours of graduate course work and dissertation research, exclusive of independent study. Graduate course work applied toward an M.S. degree may be included. At least 14 semester hours of dissertation research (CS 7970) and 30 semester hours of graduate course work must be included. Up to 20 hours of graduate level course work already applied to other degrees may be used in the program of study.

PhD students must demonstrate core knowledge in computer graphics and visualization by passing four required courses, prior to the start of their fifth semester of study, with grades of B or better in each course and an overall GPA in the required courses greater than 3.5.

TRACK FACULTY

Adam Bargteil , Martin Berzins, Elaine Cohen, **Charles Hansen (Track director),** Chris Johnson, Mike Kirby, Miriah Meyer, Valerio Pascucci, Rich Riesenfeld, Bill Thompson, Cem Yuksel

COURSE REQUIREMENTS
Required courses:

CS 6610	Interactive Computer Graphics
CS 6630	Scientific Visualization
CS 6640	Image Processing
CS 6670	Computer-Aided Geometric Design

Substitute courses must be "regular" classes with exams and/or assignments, not seminar, readings, or independent study classes. Satisfactorily completing the four courses as described constitutes completion of the Comprehensive exam; this must be completed by the end of the fourth semester.

ELECTIVE COURSES

School of Computing Computer Science courses on the Program of Study must be at the 6000 level or above, excluding independent study, and research credits. Of the required 30 semester hours, up to nine credit hours may be graduate courses outside of the School of Computing. Admissible elective courses within the School of Computing are the following:

CS 6170	Computational Topolgy
CS 6210	Advanced Scientific Computing I
CS 6220	Advanced Scientific Computing II
CS 6320	3D Computer Vision
CS 6360	Virtual Reality
CS 6540	Human/ Computer Interaction
CS 6600	Mathematics of Computer Graphics
CS 6620	Advanced Graphics II : Ray Tracing
CS 6650	Perception for Graphics
CS 6660	Physics-Based Animation
CS 6680	Computer-Aided Geometric Design II
CS 6960	Computational Geometry
CS 7650	Realistic Image Synthesis

Courses not on the list above must be approved by the student's committee to count toward the elective requirements. Independent study (CS 6950 and CS 7950) can not be included in the Program of Study for the PhD degree.

A minimum of 50 credits is required, of which at least 27 credits must be graduate course work, and at least 14 credits must be dissertation research (CS 7970). Graduate course work applied toward an M.S. degree may be included. **Seminars may be used as part of the required 50 hours, but independent study cannot.**

TRACK FACULTY
Tom Fletcher (Track director), Guido Gerig, Tom Henderson, Marcel Prastawa, Tolga Tasdizen, Bill Thompson, Ross Whitaker

COURSE REQUIREMENTS	
Required courses:	
CS 6640	Image Processing
CS 7640	Advanced Image Processing
Students are also required to complete two out of the following three courses:	
CS 6150	Advanced Algorithms
CS 6320	3D Computer Vision
CS 6350	Machine Learning

ELECTIVES	
Computer Science courses on the Program of Study must be courses at the 6000 level or above and research credits. Of the required 27 semester hours, up to 12 credit hours may be graduate courses outside of the School of Computing. Recommended elective courses:	
IMAGING, VISUALIZATION & GRAPHICS	
CS 6630	Scientific Visualization
CS 6650	Perception for Graphics
CS 6670	Computer-Aided Geometric Design I
BIOEN 6330	Principles of Magnetic Resonance Imaging
BIOEN 6330	Mathematics of Imaging
COMPUTATIONAL METHODS	
CS 6120	Advanced Scientific Computing
CS 6160	Computational Geometry
CS 6170	Computational Topology
CS 6220	Advanced Scientific Computing II
CS 6550	Foundations of Algorithms in Computer Graphics and Visualization
STATISTICS & LEARNING	
CS 6300	Artificial Intelligence
CS 6560	Computational Statistics
CS 6957	Probabilistic Modeling
ECE 6540	Estimation Theory

Students may place out of required courses or electives by substituting or transferring courses from other institutions. Substitute courses must be regular classes with exams and/or assignments, not seminar, readings, or independent study classes, and they must be approved by the Track Director. Up to 12 approved credit hours may be transferred from other institutions, and up to 20 credit hours may be used from a previous M.S. degree at the University of Utah.

Course work listed on the approved Program of Study form must comprise at least 50 semester hours of graduate course work and dissertation research. Up to 3 credit hours of an Independent Study (CS 6950) can be included in the Program of Study. At least 14 semester hours of dissertation research (CS 7970) and 24 semester hours of graduate course work must be included. Up to 12 hours of graduate level course work already applied to other degrees may be used in the program of study as approved by the TCF Chair.

TRACK FACULTY
Eric Eide, Ganesh Gopalakrishnan, Mary Hall, Feifei Li, **Sneha Kasera (Chair),** Neal Patwari, John Regehr, Robert Ricci, Jacobus van der Merwe, Suresh Venkatasubramanian

COURSE REQUIREMENTS The following 4 courses are required:	
CS 6480	Advanced Computer Networks
CS 6490	Network Security
CS 6956	Wireless and Mobile Networks
CS 6963	Evaluating Network Systems

Ph.D. students must demonstrate core knowledge in networked systems by passing four specied courses, prior to the start of their fth semester of study, with grades of B or better in each course and an overall GPA in the specied courses of at least 3.5.

A student must take five elective courses (fifteen hours) which are related to the general area of networking or are directly applicable to the student's dissertation research. Up to two courses (six hours) may be taken from other departments at the University of Utah. All elective courses on the Program of Study must be taught at the graduate level. For those classes taken within the School of Computing, it is advised that students take 6000 level courses and above when available/appropriate. All courses taken by a track student to fufilll the elective requirements must be approved by the student's committee and the TCF Chair.

ELECTIVES At least 3 elective courses must be taken from the following list:	
CS 6110	Formal Methods in Systems Design
CS 6150	Advanced Algorithms
CS 6235	Parallel Programming for GPUs/Many Cores/Multi-Cores
CS 6460	Advanced Operating Systems
CS 6530	Database Systems
CS 6810	Advanced Computer Architecture
Additional graduate level courses may be required to meet the 50 credit hour program of study requirement.	

A minimum of 50 credits is required, of which at least 27 credits must be graduate course work, and at least 14 credits must be dissertation research. Of the graduate course work, three are required courses, plus an additional three courses from the restricted electives as described in Robotics Track Courses.

Two additional elective courses at the 6000-level or above (not including independent study, seminars, or thesis) from any department are required. Remaining credits to fill the 50-credit minimum may be chosen from other 6000-level or higher courses or from seminars or dissertation research, but not independent study.

TRACK FACULTY
Jake Abbott (ME), Tom Henderson, **John Hollerbach (Track director),** Steve Mascaro (ME), William Provancher (ME), Jur van den Berg, Ross Whitaker

COURSE REQUIREMENTS Required courses:	
CS 6310 / ME EN 6220	Introduction to Robotics
CS 6370 / ME EN 6225	Geometric Computation for Motion Planning
CS 6960 / ME EN 6230	Introduction to Robot Control (pre-requisite for CS 7310 & CS 7320)
CS 7939 / ME EN 7960-001*	Robotics Seminar (Fall semester & Spring semester)
One course from each of these three areas are required:	
PERCEPTION	
CS 6320	3D Computer Vision
CS 6640	Image Processing
COGNITION	
CS 6300	Artificial Intelligence
CS 6350	Machine Learning
ACTION	
ME EN 6240	Advanced Mechatronics for Mechanical Engineers
CS 6360	Virtual Reality
CS 7310 / ME EN 7230	Robot Mobility and Manipulation
CS 7320 / ME EN 7220	System Identification
ME EN 7960-07	Haptics

* The fall session deals with research: current student and faculty presentations, readings, and enrollee presentations. The spring session deals with professional development.

50 hours of graduate coursework is required, composed of at least 24 hours of regular graduate coursework, and at least 14 semester hours of dissertation research. Of the required 24 semester hours of regular courses, up to six hours may be graduate courses outside of CS. Up to 12 hours of coursework taken elsewhere or counted toward previous degrees can be counted toward the 24 hour regular course requirement with the approval of the track director.

TRACK FACULTY

Adam Bargteil, Martin Berzins, Guido Gerig, Mary Hall, Chuck Hansen, Tom Henderson, Chris Johnson, **Mike Kirby (Track director),** Valerio Pascucci, Ross Whitaker

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COURSE REQUIREMENTS: PH.D. IN COMPUTING, SCIENTIFIC COMPUTING TRACK
The following four courses are required:

CS 6210	Advanced Scientific Computing I
CS 6220	Advanced Scientific Computing II
CS 6230 CS 6235	High-Performance Computing and Parallelization and/or Parallel Programming for GPUs/Many Cores/Multi-Cores
CS 6630	Scientific Visualization

In addition, a student must take four elective courses which involve the themes of scientific computing or are directly applicable to the student's dissertation research. The following is the list of those classes which will apply. Students can possibly take other 6000-level and above courses within the School of Computing as electives; advising and permission of the track director (or mentor and committee) is necessary in such cases.

CS 6100	Foundations of Computer Science
CS 6530	Database Systems
CS 6650	Image Synthesis
CS 6610	Interactive Computer Graphics
CS 6810	Advanced Computer Architecture
CS 7120	Information-Based Complexity
CS 7210	Advanced Topics in Scientific Computing
CS 7450	Simulation Methods

Additional 6000-level and above courses may be required to reach a 50-credit minimum (excluding independent study, seminars, or dissertation research credit hours).

MASTER'S
PROGRAM
FORMS

School of Computing MS to PhD APPLICATION

MS students (in either Computer Science or Computing) may seek to be admitted to the PhD program, and they can do so through an off-cycle admissions process outlined here. Students may switch from MS to PhD if (1) they have a letter from their advisor (regular faculty within the SoC) supporting the transition and agreeing to fund the student for two full semesters as an RA (the advisor is not required to agree to any funding if the student has been admitted with TA funding or if the student is self-funded); (2) they obtain a second letter of recommendation from another SoC faculty member; and (3) they submit a brief statement describing why they would like to switch. Unless promised funding in the MS admission offer letter, the student would not be eligible for TA support in their first year. Very importantly, the student is required to meet all Due Progress requirements of the PhD program. The deadline for spring is November 1st, and for fall, it's May 1st.

Today's date:_____

Student Name: _____
                          Last   First

Student ID#:_____

Term Admitted for MS:_____ Current GPA:_____

Student's Current Degree: _____ Emphasis Area/Track:_____

Student seeking PHD in: Degree: _____Emphasis Area/Track:_____

Student Signature: _____

Initial Advisor (funding):_____
                                    Print   **Signature**

Funding offered:_____

Recommendation Faculty Member:_____
                                              Print   **Signature**

For Graduate Advisor only:
GPA verified: _____ LoRs received: _____
CGC submitted (date)_____

Admitted by:_____Date:_____
                    Director of Admissions – School of Computing

REPORT OF THE PROPOSAL DEFENSE EXAMINATION
FOR THE MASTER DEGREE
(Comp Exam)
Please type information before printing out

Today's Date: _____

Student Name:_____ Student ID #_____

Degree: Computer Science ☐ Computing ☐   Track:_____

Date of Examination: _____ ☐ Passed   ☐ Failed

Name:_____Signature:_____Date:_____
            Chairperson

THE STUDENT WILL NOT BE CLEARED FOR THE
AWARDING OF THE DEGREE UNTIL THIS
FORM HAS BEEN FILED IN THE
GRADUATE TRACKING RECORDS SYSTEM.

Program of Study for MS

(Application for Admission to Candidacy for the Master's Program.
Due at least 2 months preceding semester of graduation)
* Please type information before printing out. *

Today's Date: _____

Full legal name: _____ UofU ID#: _____
               Last   First   Middle

Date of Admission_____ Handbook Year Used_____

Degree(s) previously received (BS, BA, MS, etc.): _____ Institution: _____ Year:_____

Request for admission to candidacy for the degree: Computer Science ☐ Computing ☐   Track_____

This degree is expected to be completed at the end of: _____ Year: _____ Thesis _____ Project _____ Course_____

Proposed thesis title: _____

Human Subjects Committee Clearance Required? (if Yes, attach a copy of approval form): _____

> **If work from another university is to be included in the course work listed below, please check with Admissions to verify that official transcripts have been evaluated and recorded on the University of Utah record.**
> **List chronologically work required by the Committee for the proposed degree being sure to include thesis hours in the quarter/semester taken. Graduate work that might be counted toward a doctorate but that is not required for the Master's degree should NOT be listed.**

Institution	When Registered	Department and Course No.	Course Title		Qtr/Sem Hours	Grade
U of XXXXXXX	Sem 1999	Acct-XXXX	Example Course Title		3	A
		-	Required Courses for Degree			
		-				
		-				
		-				
		-				
		-				
		-				
		-				
		-				
		-				

		-	**Additional Courses for Degree Completion**			
		-				
		-				
		-				
		-				
		-				

The program of study as outlined has been approved by the applicant's supervisory committee listed below:

Name: _____ Signature: _____Date_____
                  Chairperson

Name: _____ Signature: _____Date_____

Name: _____ Signature: _____Date_____

Report of The Final Examination
For the Master Degree
Please type information before printing out

☐ THESIS   ☐ NONTHESIS PROJECT   ☐ NONTHESIS COURSEWORK   Today's Date _____

Return on copy signed by committee to:
Graduate Advisor

Student Name:_____ Student ID #_____

Degree: Computer Science ☐   Computing ☐   Track: _____

Date of Examination _____

If thesis, the student's thesis was evaluated as follows by the committee:

Passed ☐   Failed ☐

The student's coursework was evaluated by the committee:

Passed ☐   Failed ☐

The student's examination/project was evaluated as follows by the committee:

Passed ☐   Failed ☐

Project Advisor _____   Date_____

Signatures of supervisory committee:

Name:_____Signature:_____
(Chair)

Name:_____   Signature:_____

Name:_____   Signature:_____

THE STUDENT WILL NOT BE CLEARED FOR THE
AWARDING OF THE DEGREE UNTIL THIS
FORM HAS BEEN FILED IN THE
GRADUATE TRACKING RECORDS SYSTEM

THE UNIVERSITY OF UTAH- SCHOOL OF COMPUTING

CHANGE OF DEGREE PROGRAM AND/OR TRACKS

This document allows students to switch between degree programs (Computer Science to/from Computing) at the same degree level (between MS degrees or between PhD degrees) or to switch between tracks within the Computing degree at the same degree level (between MS degrees or between PhD degrees). Students seeking to "upgrade" their degree rank from MS to PhD will need to file a different form as dictated by DGS and the Director of Admissions.

If the change of degree/tracks involves changing between the Computer Science and the Computing degrees and visa versa, this form must be submitted no later than **one month** prior to the term at which this change should take effect. If not submitted on time, the change will not be effective until the next semester and can jeopardize the student's graduation date.

If the change of tracks pertains solely to changes within the Computing Degree, this form must be submitted no later than the first week of classes of the term the change should take effect.

It is the **student's responsibility** to stay within the degree/track to which they are admitted and to fulfill the course requirements for that degree/track accordingly. The feasibility of changing degree/tracks depends on what courses the student has already completed, and the feasibility of completing the degree in a satisfactory amount of time. The change requires the authorization and the signature by the track director of the track/degree to which the student is transferring in addition to the authorization and signature of DGS.

Return a copy signed by all required parties to:
Graduate Advisor

Today's date:_____

Student Name:_____
                    Last   First

Student ID#:_____

Term Admitted:_____ **Term Graduating**:_____

Student's Current Degree: _____ **Track**:_____

Student's New Degree:_____ **Track**:_____

Student Signature:_____

**New Track
Director**:_____**Signature**:_____**Date**:_____

DGS:_____**Signature**:_____**Date**:_____

For Graduate Advisor use only:

PoS verified_____ CGC required: _____ CGC submitted (date):_____

Admissions application required if changed more than once per graduatecareer:_____ Submitted (date)_____
Please see policy in the SoC Handbook

PHD
PROGRAM
FORMS

PHD Written Portion of Qualifying Exam
School of Computing
(5th Semester)
Please type information before printing out

Today's Date:_____

Student Name:_____ Student ID #_____

Degree: Computer Science ☐   Computing ☐   Track_____

Exam Date(s):_____ _____

Exam Format:_____ ___

Written Questions:

Name:_____Signature:_____Date:_____
        Chairperson (typed)

Name:_____Signature:_____Date:_____

Name:_____Signature:_____Date:_____

Name:_____Signature:_____Date:_____

Name:_____Signature:_____Date:_____

Narrative Appraisal and Recommendations:

Overall Grade:_____

Name:_____Signature:_____Date:_____
        Chairperson (typed)

Name:_____Signature:_____Date:_____

Name:_____Signature:_____Date:_____

Name:_____Signature:_____Date:_____

Name:_____Signature:_____Date:_____

Report of the Qualifying Examination for the PHD or MPhil Degree
and Recommendation for Admission to Candidacy
School of Computing
(7th semester or due at least 2 months preceding semester of graduation)
please type information before printing

Today's Date:_____

Student Name:_____ Student ID #_____

Degree: Computer Science ☐   Computing ☐   Track_____

The student's performance on written and oral qualifying examinations was voted as follows by the supervisory committee:

Written Qualifying Exam   Passed ☐   Failed ☐   Date_____

Oral Proposal   Passed ☐   Failed ☐   Date_____

☐ Recommended for Candidacy   ☐ Not recommended for Candidacy

Will your research involve living human subjects? (Circle one)

Yes   (Institutional Review Board approval required)   No   Pending (submit upon approval)

This degree is expected to be completed at the end of _____semester: 20_____

Name:_____Signature:_____Date:_____
   Chairperson (typed)

Name:_____Signature:_____Date:_____

Name:_____Signature:_____Date:_____

Name:_____Signature:_____Date:_____

Name:_____Signature:_____Date:_____

Post Report: Date of Committee Meeting with student

Report on Research provided to each member of the committee:
Each member should sign this report

We, as a Supervisory Committee, do certify that this student is continuing to make satisfactory progress towards his/her dissertation

Today's Date:_____

Student Name**:** _____Student ID #_____Date:_____

Degree: Computer Science   Computing
Track:_____

Name:_____Signature:_____Date:_____
        Chairperson Printed

Name:_____Signature:_____Date:_____

Name:_____Signature:_____Date:_____

Name:_____Signature:_____Date:_____

Name:_____Signature:_____Date:_____

List of publications:

Program of Study & Full Committee for PhD
School of Computing
(6th semester)
please type information before printing

Date: _____

Full legal name: _____UofU ID#: _____

Last   First   Middle

Degree: Computer Science ☐ Computing ☐ Track_____

Date of Admission_____ Handbook Year used_____

Human Subjects Committee Clearance Required? (if Yes, attach a copy of approval form): _____

> If work from another university is to be included in the course work listed below, please check with Admissions to verify that official transcripts have been evaluated and recorded on the University of Utah record.
> List chronologically work required by the Committee for the proposed degree being sure to include thesis hours in the quarter/semester taken. Graduate work that might be counted toward a doctorate but that is not required for the Master's degree should NOT be listed.

Institution	When Registered	Department and Course No.	Course Title	Qtr/Sem Hours	Grade
U of XXXXXXX	Sem 2010	CS - XXXX	Example Course Title	3	A
			Required Courses for Degree		

			Additional Courses for Degree Completion		
			Additional Courses for Degree Completion		

The program of study as outlined has been approved by the applicant's supervisory committee listed below:

Name: _____Signature: _____Date_____

Chairperson

Name: _____ Signature: _____Date_____

Name: _____Signature: _____Date_____

Name: _____Signature: _____Date_____

Name: _____Signature: _____Date_____

Name: _____Signature: _____Date_____

Track Director

Initial Program of Study for PhD
School of Computing
(4th Semester or earlier)
Please type information before printing out

Date: _____

Full legal name: _____UofU ID#: _____
<div align="center">Last   First   Middle</div>

Degree: Computer Science ☐   Computing ☐   Track_____

Date of Admission_____ Handbook Year Used_____

Human Subjects Committee Clearance Required? (if Yes, attach a copy of approval form): _____

If work from another university is to be included in the course work listed below, please check with Admissions to verify that official transcripts have been evaluated and recorded on the University of Utah record.
List chronologically work required by the Committee for the proposed degree being sure to include thesis hours in the quarter/semester taken. Graduate work that might be counted toward a doctorate but that is not required for the Master's degree should NOT be listed.

Institution	When Registered	Department and Course No.	Course Title	Qtr/Sem Hours	Grade
U of XXXXXXX	Sem 2010	CS - XXXX	Example Course Title	3	A
			Required Courses for Degree		

			Additional Courses for Degree Completion		

The program of study as outlined has been approved by the applicant's chair and/or track director listed below:

Name: _____Signature: _____Date_____
<div align="center">Chairperson</div>

Name: _____Signature: _____Date_____
<div align="center">Track Director</div>

PhD Initial Committee Form
School of Computing
3rd Semester
Please type information before printing

Today's Date_____

Student Name_____StudentID#_____

Degree: Computer Science ☐   Computing ☐   Track:_____

Committee

Name:_____Signature:_____
          Chairperson

Name:_____Signature:_____

Name:_____Signature:_____

THE FINAL ORAL EXAM

FOR Ph.D. ☐   M.Phil. ☐

(10th semester)
Please type information before printing out

Today's Date _____

Return one copy signed by committee to:
Graduate Advisor

Student Name:_____ Student ID# _____

Degree: Computer Science ☐   Computing ☐   Track_____

Date of Examination _____

The student's examination was evaluated as follows by the committee:

Passed ☐   Failed ☐

The student's dissertation was read and evaluated as follows by the committee:

Passed ☐   Failed ☐

Signatures of supervisory committee:

Name:_____Signature:_____Date:_____
          Chairperson (typed)

Name:_____Signature:_____Date:_____

Name:_____Signature:_____Date:_____

Name:_____Signature:_____Date:_____

Name:_____Signature:_____Date:_____

Due Progress Advisory Document for Ph.D. Degree

Submit 3rd week of October

please type information before printing

Today's Date:_____

Student Name**:** _____Student ID _____#_____

Degree: Computer Science ☐   Computing ☐   Track:_____

Advisor: _____   Semester Admitted_____

Committee:_____   # of semesters in the program_____

_____

_____

_____

Activity	Good Progress	Acceptable Progress	Completed Semester
Identify Advisor	**Within 1 semester**	**Within 2 semesters**	
Approved Program of Study and Advisor and *initial committee* form	**Within 4 semesters with advisor**	**Within 5 semesters**	
Complete required courses	**Within 5 semesters**	**Within 6 semesters**	
Committee formed	**Within 6 semesters**	**Within 7 semesters**	
Program of Study	**Within 6 semesters**	**Within 7 semesters**	
Written qualifier	**Within 5 semesters**	**Within 6 semesters**	
Oral qualifier/Proposal	**Within 7 semesters**	**Within 8 semesters**	
Final defense	**Within 10 semesters**	**Within 12 semesters**	
Final document		**Within 4 months of final defense**	

1. Has the student met due progress requirements?

2. Describe the progress the student has made during the past year.

_____ _____
Student Signature   Date

_____ _____
Advisor signature   Date