



Ph.D. in Computing Student Handbook

Spring 2019

Welcome

Welcome to the Computing Ph.D. Program. The Computing Ph.D. Program encompasses expertise and research opportunities across a spectrum of computing fields under a single, high-quality research doctorate. The interdisciplinary program brings together faculty members from the Departments of Biological Sciences, Chemistry and Biochemistry, Civil Engineering, Computer Science, Economics, Electrical and Computer Engineering, Geosciences, Materials Science and Engineering, Mathematics, Mechanical and Biomedical Engineering, and Physics. With this broad reach lies strength: faculty and students are able to leverage a diverse and unique set of approaches, skills, and expertise that enable and complement their research effort.

The curriculum is designed to provide students, through scholarship and research, the computational knowledge and skills to address significant technical challenges through one of four emphasis areas:

- *The Computational Science and Engineering emphasis* focus on construction of mathematical models and quantitative analysis techniques and use of computers to analyze and solve scientific and engineering problems.
- *The Computer Science emphasis* focuses on theory, design, development, and application of computer and software systems, and the development of algorithms for data search, manipulation, and analysis.
- *The Cyber Security emphasis* focuses on protection of computers, networks, programs, industrial control systems, and data from unintended or unauthorized access, change, or destruction.
- *The Data Science Emphasis* focuses on using scientific, mathematical, and statistical methods, processes, and systems to extract knowledge or insights from data.

Information regarding the application and admissions process can be found online at <http://computing.boisestate.edu/application-requirements/>.

This handbook supplements the Graduate Catalog, which details university resources, regulations and processes for students and graduate programs. Together, the Student Handbook and the Graduate Catalog articulate the academic life cycle - from admissions to degree completion. Students are responsible for understanding and following the policies and procedures outlined in the Student Handbook and the Graduate Catalog, as well as in the Boise State University Student Handbook, Boise State University Policy Manual, and the Student Code of Conduct. Specific research group and research expectations are further defined by each student's major advisor.

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People (2018-2019)

Program Support

	<p>Dr. Jodi Mead - Co-Director jmead@boisestate.edu (208) 426-2432</p> <p>Bio Dr. Jodi Mead is a professor in the mathematics department, and affiliated faculty in the Center for the Geophysical Investigation of the Shallow Subsurface at Boise State University. She graduated from Arizona State University with a Ph.D. in computational mathematics, and was a postdoctoral associate in the college of oceanographic and atmospheric sciences at Oregon State University. She has held visiting positions in the mathematics department at Arizona State University, the National Centre for Groundwater Research and Training at Flinders University in Adelaide Australia, and the computer science department at Portland State University. She was the graduate program coordinator for the mathematics department at Boise State University 2007-2017.</p>
	<p>Dr. Tim Andersen- Co-Director tandersen@boisestate.edu (208) 426-5768</p> <p>Bio Dr. Tim Andersen is currently faculty in the computer science department at Boise State University. He received his Ph.D. in Computer Science in 1999 from Brigham Young University. From 1999 to 2001 he worked as Chief Scientist at IArchives, developing proprietary OCR and image processing algorithms. In September 2001, Dr. Andersen joined the faculty in the Computer Science Department at Boise State.</p>



Keela Cooper - Program Administrator

keelacooper@boisestate.edu

(208) 426-5767

Bio

As program administrator for the Ph.D. in Computing Keela is responsible for helping the Co-Directors with the management and administrative aspects of the program. Keela supports students and faculty through advising, proposal and defense support, and serves as the first point of contact for any questions about the program. Keela earned her Bachelor's in Communication in the summer of 2012 and has worked for Boise State since fall of 2012.

Major Advisor

Your major advisor is your primary mentor and will be actively engaged in your academic, research, and professional success. Your major advisor provides guidance on your dissertation topic, guides your research efforts, provides direction on your academic plan and may provide funding support through grants or fellowships. Frequent interaction between you and your advisor is essential for you to succeed in your program of study. It is your responsibility to schedule regular meetings and communicate often with your advisor.

Supervisory Committee

Your supervisory committee is charged with the general guidance and mentorship, including design and approval of the program of study, supervision of the dissertation research, and participation at your final defense. The supervisory committee is composed of members of the graduate faculty who are approved by the Graduate College and are able to contribute to your research. Guidelines for the formation of your supervisory committee are outlined under the program requirements section of this handbook.

A complete directory of faculty and staff can be found on the Ph.D. in Computing website.

Before You Begin (Post-Admission Process)

To provide a smooth transition into the Ph.D. in Computing, please take time to do the following:

Before you arrive on campus

On your own

- My.boisestate.edu account
When your application was originally processed, you received a notification letter from the Graduate College containing your username, student ID Number, and Boise State email address. Set up your my.boisestate account by going to my.boisestate.edu using the login information provided in the letter. My.boisestate.edu is your source for all of your campus information. You can access your email, calendar, course websites, student center, and much more through this portal.
- Email
Boise State students receive email via BroncoMail. Your BroncoMail address is typically your first and last name followed by @u.boisestate.edu. As a graduate assistant, you will also receive an employee email address. Employee email addresses are typically the employee's first and last name followed by @boisestate.edu. Employee email accounts are immediately deactivated if your employment is suspended (e.g., you receive a fellowship or there is any lapse in your funding). *Thus, we recommend that you use your BroncoMail email account as your primary account and forward your employee email to your BroncoMail account. You are responsible for checking both accounts.*
- Housing
Ample housing options are available near campus. You can work with [University Housing](#) for on-campus options if you apply early. The Boise Chamber of Commerce [Relocation Page](#) has information and resources about moving to Boise that may be helpful. If you are using Craigslist or Classified Ads, common searches for housing near the university (less than 3 miles away from campus) include BSU, Downtown Boise, East End, North End, the Bench, and Southeast Boise. Peruse the bulletin boards in the Student Union Building (SUB) if you are already on campus.

With your Major Advisor and the Program Coordinator

- Coordinate your start date with your major advisor or the Program Coordinator.
Most students will start one week before the first day of classes of the designated semester. If you and your advisor determine an earlier start date, please notify the program coordinator as soon as possible.
- Discuss first semester courses & register online
You should discuss your graduate course plan with your major advisor. During orientation, the week before classes program staff will discuss how to create a

course plan. We typically recommend students take 2 graded courses per semester upon starting the program, especially if conducting research. According to Graduate College policy, domestic students with an assistantship must take at least 5 credits, while international students with an assistantship must take at least nine credits.

- To register for classes, use the student center on my.boisestate.edu. Instructions are found online on the [registrar's website](#).

After you arrive on campus

- Visit the Program Administrator
Keela Cooper is the Program Administrator for the Ph.D. in computing. Her office is located in Downtown Boise in the [City Center Plaza Building](#), room CCP 364A.

The Program Administrator can provide you with detailed information on room and building access, payroll, and resources available to you. Labs, workspace, and other resources will vary based on your area of emphasis.

- Complete your employment documents (for students on graduate assistantship)
Some items (Federal Form I-9, Employee Information Form) must be completed on or before your first day of employment. Other items (W-4 Tax Form, Direct Deposit, and Compliance Certification) must be completed immediately after you begin employment. Check the [Boise State New Employee website](#) for a complete listing of immediate action items. Please be aware that the hiring process does include a background check.

****Note:** Tax rates on paychecks will fluctuate throughout the year. During the summer (or anytime you are not enrolled as a student), taxes are withheld at a higher percentage than during periods of student enrollment.**

- Obtain your Boise State University identification, the "BroncoCard"
After completing your employment documents at Human Resources, take your Student ID # and valid photo ID to the BroncoCard office in the Student Union Building to obtain your BroncoCard. Be sure to request a proxy BroncoCard. Your BroncoCard gives you card reader access to select laboratories and study areas. You will use your BroncoCard to access the Recreation Center, purchase meal plans, and can also, optionally, make cashless purchases on campus with [Bronco Bucks](#).

[Find out more about obtaining your BroncoCard](#)

- Purchase a Parking Pass if you plan to park on campus

Parking on University Drive and other city-maintained streets is permitted without a Boise State parking permit. Signs posted on city-maintained streets describe any restrictions. Otherwise, parking on campus requires a Boise State parking permit.

[You can purchase your parking permit](#) and find out more about transportation options online.

**Students who will work in Computer Science facilities in Downtown Boise should review the specific [transportation and parking options available](#) for City Center Plaza.

Expectations

When you come to Boise State, we agree to offer our time and resources in exchange for your commitment to make your best effort. To ensure that we all know the expectations, the School, College, and University have policies in place with which you should be familiar. These policies are outlined in this handbook, the [Boise State University Student Handbook](#), [Boise State University Policies](#), [Student Code of Conduct](#), [Graduate Catalog](#) and [Standards and Guidelines for Theses and Dissertations](#). Please take the time to read and understand these policies.

If questions arise that are not addressed within this handbook or within the policies outlined by Boise State University and the Graduate College, we encourage you to first meet with your major advisor. If still unresolved, please contact the Program Coordinator for further assistance.

Safety

Most students in the Computing Ph.D. program will not work in labs with extensive safety regulations, but please consult with your major advisor and service assignment supervisor to ensure you are aware of and compliant with any applicable regulations or university policies.

Academic Integrity

Academic integrity is a core belief of the Ph.D. in Computing, participating departments, the College of Engineering, College of Arts and Sciences, Graduate College and Boise State University. Cheating, plagiarism, and academic dishonesty in the classroom or in research endeavors are serious offenses that will be addressed. All forms of academic dishonesty can lead to suspension or expulsion from the University. The University [Academic Integrity Policy](#) can be found on the registrar's website.

Interdisciplinary Program Structure

At Boise State University, interdisciplinary graduate programs are those that cross boundaries and involve faculty members from more than one program. The PhD in Computing brings together faculty members from the Departments of Biological Sciences, Chemistry and Biochemistry, Civil Engineering, Computer Science, Economics, Electrical and Computer Engineering, Geosciences, Materials Science and Engineering, Mathematics, Mechanical and Biomedical Engineering, and Physics. We encourage students to utilize the great range of resources this interdisciplinary structure makes available. Faculty from all of these programs make up the governing body for the PhD in Computing.

Resources

Program Coordinator

Keela Cooper is the Program Coordinator for the Ph.D. in Computing. Her office is located Downtown in the City Center Plaza Building, room CCP 367. You can contact her via email at keelacooper@boisestate.edu, or by phone at 208-841-1216.

Website

The Ph.D. in Computing program website: <http://computing.boisestate.edu/> contains resources for students including program specific forms, emphasis area requirements, and contact information for all participating faculty and staff.

IT Support and Supplies

IT support, office supplies, and other resources can be obtained through your major advisor's department. Please ask your advisor who to contact.

Graduate Student Association

The Graduate Student Association (GSA) is a student-run organization that aims to create a sense of community among graduate students of all disciplines at Boise State. The GSA's goal is to bring together students from diverse programs and backgrounds for networking, discussion, and collaboration. Additional information about the GSA is available online: <https://www.gradstudentboisestate.com/>

Navigating Your Degree

The Ph.D. in Computing Program staff are here to help each student navigate the academic program efficiently and effectively. To help ensure that you stay on your desired schedule for graduation, we encourage you to use the following resources. Each of the forms referenced in this section is available online.

- *Degree Plan*. This form should be completed during your first semester. It helps establish a plan for coursework and degree milestones. Forms should be completed with the help of your major advisor and should be returned to the Program Administrator.
- *Progress Report*. This report should be completed with your major advisor after every semester. Meeting with your advisor to evaluate your progress each semester is key to ensuring you are succeeding in your degree plan.

Program Requirements

The program leading to the Ph.D. in Computing is a dissertation-based program. The program requires a minimum of 67 credits representing advanced coursework, a comprehensive exam (which serves as a qualifying exam for admission to candidacy), and a dissertation constituting an original and significant contribution to the discipline. Courses applied to meet the 67-credit minimum requirement must be taken for a letter grade (A-F), except for CS 691 Doctoral Comprehensive Examination which is graded P (Pass) or F (Fail), and CS 693 Dissertation which is initially graded IP (In Progress) and later graded P or F depending on the outcome of the dissertation defense. Degree requirements for the Ph.D. in Computing and associated emphases are delineated in the tables in [Appendix A](#).

Coursework Options

Selecting coursework for your graduate degree should take into account your research goals and future career plans. Beyond the required core coursework, significant flexibility is available for students to create a degree plan that meets their needs. All coursework decisions should be made in collaboration with the Major Advisor and supervisory committee.

Transfer courses

Graduate coursework can be transferred to Boise State University and applied for credit to a Ph.D. in Computing program requirement in accordance with Graduate College policy. The transfer credit policy can be found in the Graduate College Policy Manual, [Section 3: Graduate Academic Policies, Transfer Credits](#)

Students with a master of science degree in computer science, mathematics or a related field may transfer up to 21 credits toward the Ph.D. program degree requirements. For a student entering with a bachelor of science degree in a relevant field, a maximum of 9 credits of graduate coursework may be applied toward the Ph.D. program degree requirements. In all cases, the transfer credit must meet Graduate College requirements and be approved by the supervisory committee. Transfer credit accepted into the program will be applied on a course-by-course toward the degree requirements.

Transfer Credit Procedures

Students with an MS or BS from a school other than Boise State

Students must submit the [Request for Approval of Transfer Credits](#).

Students with an MS from Boise State

Students should meet with their advisor or a program co-director to determine what degree requirements have been met as part of their MS degree and should be included on the student's course plan.

MS courses from Boise State being used to meet Ph.D. degree requirements do not need to be submitted for approval through the Graduate College and are instead included on the Application for Admission to Candidacy.

Students with a BS from Boise State

The procedure is the same for students with an MS from Boise State, however, students may only apply a maximum of 9 credits of graduate coursework taken as an undergraduate.

Independent Study, Directed Study and Practicum/Internship

Upon approval by the supervisory committee and the program directors, up to three credits of Independent Study (COMPUT 596) or Directed Research (COMPUT 696) can be applied to degree requirements as elective coursework.

In exceptional cases, and upon approval by the supervisory committee and the program coordinator, a student may enroll in Practicum/Internship (COMPUT 590). Practicum/Internship credit cannot be applied toward meeting degree requirements. The practicum/internship credit, however, will be on your transcript, which provides a record of the practicum/internship experience.

College Teaching Certificate

The Graduate Certificate in College Teaching is designed to enhance teaching effectiveness of graduate teaching assistants and provide marketable skills for graduate students wishing to seek employment in higher education as instructors. The Graduate Certificate in College Teaching is open to current Boise State graduate students or others who have previously earned a graduate degree and who are considering employment in higher education. Through the required coursework, students will demonstrate skill in course design; demonstrate the ability to effectively teach a course including planning lessons/lectures and assessing student learning; and engage in ongoing faculty development through teaching workshops. Students are referred to the [Center for Teaching and Learning website](#) for additional information.

Supervisory Committee

The supervisory committee consists of your major advisor who acts as chair, and at least two, but no more than four, additional members. A majority of the committee membership

must be participating faculty in the PhD program, and at least one member must be from the chosen area of emphasis. Adjunct graduate faculty also may chair committees if they have program endorsement. In addition, at least one computer science faculty member must be on each committee. In the case of the CSE emphasis, there must also be at least one mathematics faculty and a faculty member from a science or engineering discipline.

You should form your supervisory committee through consultation with your major advisor and submit an [Appointment of Supervisory Committee form](#), available on the Graduate College website, to the Graduate College once research toward your dissertation has commenced. A change in the membership of the supervisory committee can be made after initial appointment by submitting an updated Appointment of supervisory committee form.

Comprehensive Exam

The objective of the comprehensive examination is to assess depth and breadth of knowledge in the emphasis area and readiness to undertake dissertation research. The content of the examination includes material from the 18 credits of core emphasis courses taken by the student. More information on the format of the comprehensive exam can be found in Appendix B.

Dissertation Proposal

The objective of the dissertation proposal and oral defense is to assess the suitability of a PhD student for research in a specific area and will focus on advanced coursework and research in the student's dissertation area. Satisfactory completion is required for you to become a PhD candidate. The dissertation proposal should be presented within one year of satisfactory completion of the comprehensive examination and must be approved by the supervisory committee one year before the final dissertation defense.

Please refer to Appendix C of this handbook for further details and instructions.

Admission to Candidacy

Upon completion of the dissertation proposal defense and receipt of the signed Approval/Disapproval statement from the supervisory committee, you are eligible to complete an Application for Admission to Candidacy. Once this application is accepted by the Graduate College, the student becomes a Ph.D. Candidate. The Graduate College strongly recommends that the AAC be submitted when the student has finished approximately half of the degree requirements.

Once admitted to candidacy, it is expected that the student will proceed with the research outlined in the proposal defense. Major deviation from the proposed research requires majority approval of the supervisory committee.

Dissertation

The dissertation must be the result of independent and original research and must constitute a significant contribution to the knowledge base of the focus area, equivalent to multiple peer-reviewed publications. The style and format of the dissertation are to conform to the standards of the Graduate College.

Dissertation Defense

A public defense of the dissertation is scheduled after the supervisory committee has reviewed a draft that is considered to be a nearly final version. The date of the defense is determined jointly by the supervisory committee and the student and must be consistent with any guidelines provided by the Graduate College. The first part of the defense will be a public oral presentation of the dissertation. The second part will be an oral exam administered by the supervisory committee who will decide whether the student passes or fails the defense. A student who fails the defense may be permitted to try again but failure a second time will result in dismissal from the PhD program.

If the defense is completed with a result of pass, the supervisory committee prepares a statement describing final requirements such as additions or modifications to the dissertation and any additional requirements such as archival of data. When these requirements have been met to the satisfaction of the supervisory committee, the approval page of the dissertation is signed by the members of the committee.

Program Timeline

Your advisor and supervisory committee determine your program timeline. The Ph.D. program is expected to take between 4 and 6 years, but this can vary based on student background, research project, and any number of other variables. All program requirements must be started and completed within a single continuous interval of no more than ten years.

Program flowcharts specific to each emphasis can be found on the program website.

The following table summarizes recommended milestones for full-time PhD students who are admitted with a Bachelor's degree.

Year		Milestone
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<u>Year 1</u>	<u>Semester 1</u>	Complete a degree plan and submit it to the Program Administrator. Include credits of graduate courses that are being requested to be applied to the Ph.D. program degree requirements
		Select an Advisor
	<u>Semester 2</u>	Complete provisional requirements for regular admission status, if applicable
<u>Year 2</u>	<u>Semester 3</u>	Submit the Appointment of Supervisory Committee Form.
	<u>Semester 4</u>	Complete the majority of coursework
		Take and pass the Comprehensive Examination
<u>Year 3</u>	<u>Semesters 5 & 6</u>	Conduct research and prepare Dissertation Proposal
		Successfully defend the dissertation proposal
		Get recommended for Admission to Candidacy by Supervisory Committee and complete the Application for Admission to Candidacy Form

<u>Year 4 +</u>	<u>Semesters 7 & 8+</u>	Conduct research and prepare dissertation
		Take and pass the dissertation defense
		Submit final approved dissertation

The following table summarizes recommended milestones for full-time Ph.D. students who have earned a Master of Science in a related field.

Year		Milestone
<p style="text-align: center;"><u>Year 1</u></p>	<u>Semester 1</u>	Complete a degree plan and submit it to the Program Administrator. Include credits of graduate courses that are being requested to be applied to the Ph.D. program degree requirements
		Complete provisional requirements for regular admission status, if applicable
		Select an advisor
	<u>Semester 2</u>	Complete the majority of coursework
		Submit the Appointment of Supervisory Committee Form
<p style="text-align: center;"><u>Year 2</u></p>	<u>Semester 3</u>	Take and pass the Comprehensive Examination
		Conduct research and prepare Dissertation Proposal
	<u>Semester 4</u>	Successfully defend the dissertation proposal

		Get recommended for Admission to Candidacy by the Supervisory Committee and complete the Application for Admission to Candidacy Form
<u>Year 3/4</u>	<u>Semester 5+</u>	Conduct research and prepare Dissertation
		Take and pass the dissertation defense
		Submit final approved dissertation

Changing Your Course of Study

Moving between emphasis areas is possible, however, admission to one emphasis area does not guarantee admission to any of the other emphasis areas. Admission decisions are emphasis area specific. The later in the program of study this is done, the bigger impact it will have in terms of delaying graduation. This decision should be based on curriculum and research topic alignment.

It is very important to understand that program GA funding that was granted upon admission to one emphasis area is not guaranteed to follow the student to the new emphasis area.

The student must take responsibility for applying to be admitted to an alternate emphasis area. Students must submit the request via the [Change of Emphasis Request form](#). The request will be reviewed by the co-directors of the program and follow the regular admissions procedures for the specific emphasis area. Students must complete all fields on the form and upload an updated statement of purpose.

Changing from the Ph.D. in computing to an M.S. degree program is not recommended and should be undertaken only after multiple consultations with your major advisor and the program Co-directors. To initiate a change into a new degree program, students will need to reapply to the appropriate program via graduate admissions.

The Unexpected

As you pursue your graduate degree, it is likely you will encounter something, either major or minor, that is not addressed in this handbook. As you encounter these unexpected moments, we encourage you to meet with your advisor, the Program Coordinator, or Program Co-Directors as appropriate and as soon as possible. We will work with you to find the solution, experience, or opportunity that best fits your unique situation.

Graduate Assistantship

Unless supported through other means, all full-time Ph.D. students are financially supported by a graduate assistantship. A student is compensated for an average of 20 hrs per week (for a total of 1000 hours per year). Effort above and beyond the 20 hours is considered professional and academic development for things such as dissertation research and writing and coursework.

A Graduate Assistant (GA) is a Ph.D. student financially supported by a graduate assistantship under the mentorship of a major advisor. Part of a GA's professional development includes assisting their major advisor with research responsibilities (i.e. a research assistant). Research responsibilities will vary based on advisor and project. GAs are also expected to serve the University on average for 10 hrs per week in a capacity such as assisting a course in their area of expertise (i.e. a teaching assistant). Graduate assistantships are governed by [University Policy 7170](#).

Assistantship Termination or Reduction

To maintain your Graduate Assistantship you must comply with all policies, procedures and timelines outlined in this handbook, your assistantship contract, and the policies of Boise State University and the Graduate College. A Graduate Assistantship may be terminated or reduced at any time by the program for just cause such as unsatisfactory performance of assigned duties, dereliction of duties, insubordination, unsatisfactory academic performance, unsatisfactory progress toward the degree, a felony conviction, or for any other cause of similar magnitude as determined by the graduate program and the Graduate Dean.

Vacation

Vacation must be approved by your major advisor and work assignment supervisor, if applicable. Make requests for vacation in accordance with the requirements provided to you by your major advisor and work assignment supervisor, if applicable.

Leave of Absence for Graduate Assistants

You must be continually enrolled in the program and making satisfactory progress to maintain your Graduate Assistantship. You may apply to the department for an official leave of absence if you cannot maintain continuous enrollment in any given semester. Official leaves of absence will be reviewed on a case-by-case basis. Your assistantship may be affected by an official leave of absence. Although we cannot guarantee availability, we will attempt to provide you an assistantship upon your return.

Appendix A - Degree Requirements

Computational Science and Engineering

Degree Requirements

Course Number and Title	Credits
COMPUT 601 – Introduction to Graduate Studies	1
Required Core Courses CS 565/MATH 565 Numerical Methods I CS 566/MATH 566 Numerical Methods II CS 507 Computing Foundations for Computational Science COMPUT/ME 571 – Parallel Scientific Computing	12
Domain Science Courses Pre-approved domain science courses can be found in the student handbook .	6
Elective Courses Must be approved by the supervisory committee and Computing Program directors. Pre-approved electives and specific requirements are given in the student handbook .	15
COMPUT 691 Doctoral Comprehensive Examination	1
COMPUT 693 Dissertation	33
<i>Total</i>	68

Computational Science and Engineering

Pre-approved Elective and Domain Science Courses - By Focus Area

- Algebra and Analysis: (Does not satisfy Domain Science Courses)
 - MATH 503 Linear Algebra
 - MATH 515 Real and Linear Analysis
 - MATH 526 Complex Variables
- Bioinformatics:
 - BIOL 546 Bioinformatics
 - BIOL 548 PERL For Bioinformatics Applications
- Biomechanics:
 - ME 520 Advanced Biomechanics
- CFD and Finite Elements:
 - ME 536 Computational Fluid Dynamics
 - ME 570 Finite Element Methods
- Differential Equations: (Does not satisfy Domain Science Courses)
 - MATH 527 Introduction to Applied Mathematics for Scientists and Engineers
 - MATH 533 Ordinary Differential Equations
 - MATH 536 Partial Differential Equations
 - MATH 567 Numerical Methods for Differential Equations
- Earthquake Seismology:
 - GEOPH 520 Geophysical Applications of Digital Signal
 - GEOPH 677 Earthquake Seismology
- Geophysics:
 - GEOPH 501 Properties and Processes in Geophysics I
 - GEOPH 502 Properties and Processes in Geophysics II
 - GEOPH 605 Inversion Theory and Geophysical Applications
- Geotechnical Engineering and Hydrology:
 - CE 502 Computational Techniques
 - CE 510 Engineering Hydrology
 - GEOPH 610 Geophysical Methods for Geotechnical Engineers
- High Performance Computing: (Does not satisfy Domain Science Courses)
 - CS 530 Parallel Computing
 - CS 564 Visualization Techniques
- Hydrogeology:
 - CE/GEOS/GEOPH 512 Hydrogeology
 - CE/GEOS/GEOPH 623 Advanced Hydrogeology
 - CE/GEOS/GEOPH 624 Applied Hydrogeology
- Materials Science:
 - MSE 564 Computational Materials Science
- Optimal Design and Control:
 - ME 561 Control Systems
 - ME 582 Optimal Design
- Quantum Chemistry and Mechanics:
 - CHEM 521 Quantum Chemistry
 - CHEM 523 Chemical Kinetics
- Snow and Ice Physics:
 - GEOPH 566 Snow and Ice Physics

Computer Science

Degree Requirements

Course Number and Title	Credits
COMPUT 601 – Introduction to Graduate Studies	1
Required Core Courses CS 521- Design and Analysis of Algorithms OR CS 561- Theory of Computation CS 552 – Operating Systems CS 573 - Advanced Software Engineering	9
Elective Courses Must be approved by the supervisory committee and Computing Program directors. Pre-approved electives and specific requirements are given in the student handbook .	24
COMPUT 691 Doctoral Comprehensive Examination	1
COMPUT 693 Dissertation	33
<i>Total</i>	68

Computer Science

Pre-approved Elective Courses - By Focus Area

- Artificial Intelligence and Machine Learning:
 - CS 533 Introduction to Data Science
 - CS 534 Data Science and Analytics
 - CS 535 Data Science and Analytics
 - CS 557 Artificial Intelligence
 - CS 576 Social Media Mining
 - CS 633 Deep Learning
- Computer Engineering
 - ECE 530 Digital Hardware Design
 - ECE 533 Embedded and Portable Computing Systems
 - ECE 630 Digital Systems Verification
 - ECE 632 Advanced Computer Architecture
- Databases:
 - CS 510 Databases
 - CS 512 Advanced Topics in Databases
- High Performance Computing:
 - CS 530 Parallel Computing
 - CS 555 Distributed Systems
 - CS 564 Visualization Techniques
 - CS 542 Quantitative Computer Architecture
- Human Computer Interaction:
 - CS 535 Large-scale Data Analysis
 - CS 538 Recommender Systems and Online Personalization
 - CS 539 Social Media Mining
 - CS 569 Human Computer Interaction
- Information Retrieval:
 - CS 537 Introduction to Information Retrieval
 - CS 538 Recommender Systems and Online Personalization
 - CS 637 Information Retrieval
- Networking:
 - CS 525 Computer Networks
 - CS 622 Adv Network Security
- Programming Language Translation:
 - CS 531 Advanced Programming Languages
 - CS 550 Programming Language Translation
 - CS 551 Advanced Topics In Compilation
- Quantum Computation and Communication:
 - CS 541 (ECE 532) Computer Architecture
 - CS 561 Theory Of Computation

- MATH 503 Linear Algebra
- MATH 505 Abstract Algebra
- PHYS 512 Intermediate Quantum Mechanics
- PHYS 515 Solid State Physics
- ECE 651 Information and coding Theory
- ECE 652 Advanced Communications Theory
- Signals/Computer Vision:
 - ECE 557 Digital Image Processing
 - ECE 556 Pattern Recognition and Machine Learning
 - ECE 564 Robotics and Automated Systems
 - ECE 650 Stochastic Signals and Systems
 - ECE 657 Information and Coding Theory
- Software Engineering:
 - CS 572 Object-Oriented Design Patterns
 - CS 573 Advanced Software Engineering
 - CS 574 Advanced Software Quality
 - CS 575 Software Security
 - CS 577 Software Maintenance And Evolution
- Systems:
 - CS 525 Computer Networks
 - CS 554 Advanced Operating systems
 - CS 555 Distributed Systems
 - CS 622 Adv Network Security
 - CS 623 Cyber Physical Systems
- Theory of Computation:
 - CS 521 Design And Analysis Of Algorithms
 - CS 561 Theory Of Computation

Cyber Security

Degree Requirements

Course Number and Title	Credits
COMPUT 601 – Introduction to Graduate Studies	1
Required Core Courses CS 546 - Computer Security CS 575 - Software Security OR CS - 622 Advanced Network Security One (1) of the following: CS 567 - Applied Cryptography MATH 508 - Advanced Public Key Cryptology MATH 509 - Symmetric Key Cryptology	9
Elective Courses Must be approved by the supervisory committee and Computing Program directors. Pre-approved electives and specific requirements are given in the student handbook .	24
COMPUT 691 Doctoral Comprehensive Examination	1
COMPUT 693 Dissertation	33
<i>Total</i>	68

Cyber Security

Pre-approved Elective Courses - By Focus Area

- Computer/Software Security:
 - CS 546 Computer Security
 - CS 575 Software Security
- Cryptography and Cryptanalysis:
 - MATH 505 Abstract Algebra
 - MATH 507 Advanced Number Theory
 - MATH 508 Advanced Public Key Cryptology
 - MATH 509 Symmetric Key Cryptology
 - CS 567 Applied Cryptography
 - Math 585 Cryptology
 - CS/MATH 667 Advances in Applied Cryptography
- Network Security:
 - CS 525 Computer Networks
 - CS 622 Adv Network Security
- Physical Systems and Infrastructure:
 - CS 524 Cyber Security of Critical Infrastructures
 - CS 623 Cyber Physical Systems
 - ECE 510 Digital Integrated Circuit Design
 - ECE 530 Digital Hardware Design
 - ECE 533 Embedded and Portable Computing Systems
 - ECE 554 Digital Signal Processing
 - ECE 557 Digital Image Processing
 - ECE 570 Electric Machines
 - ECE 631 Digital System Testing and Testable Design
 - ECE 636 Hardware/Software Codesign
- Computability, Computational Complexity, and Formal Verification
 - MATH 502 Logic and Set Theory
 - MATH 581 Logic
 - MATH 584 Computational Algebra
 - MATH 585 Cryptology
- Coding and Information Theory
 - MATH 505 Abstract Algebra
 - MATH 506 Advanced Algebra
 - MATH 507 Advanced Number Theory
 - MATH 508 Advanced Public Key Cryptology
 - MATH 509 Symmetric Key Cryptology
 - ECE 651 Information and Coding Theory
 - ECE 652 Advanced Communications Theory
 - ECE 635 System on a Programmable Chip

- MATH 582 Topology
- MATH 584 Computational Algebra
- MATH 585 Cryptology
- Quantum Computations and Post-Quantum Security
 - CS 541 Computer Architecture
 - CS 561 Theory of Computation
 - ECE 629 Quantum Effects in MOS Devices
 - MATH 503 Linear Algebra
 - MATH 505 Abstract Algebra
 - MATH 509 Symmetric Key Cryptology
 - MATH 515 Real and Linear Analysis
 - MATH 574 Linear Models
 - MATH 582 Topology
 - MATH 585 Cryptology
 - PHYS 512 Intermediate Quantum Mechanics

Data Science

Degree Requirements

Course Number and Title	Credits
COMPUT 601 – Introduction to Graduate Studies	1
Required Core Courses CS 533 – Introduction to Data Science CS 534 – Machine Learning MATH 562 – Probability and Statistics II MATH 572 – Computational Statistics	12
Data Science Elective Courses 3 credits must be in CS and 3 must be in MATH. Pre-approved data science electives can be found in the student handbook .	6
Additional Elective Courses Must be approved by the supervisory committee and Computing Program directors. Pre-approved electives and specific requirements are given in the student handbook .	15
COMPUT 691 Doctoral Comprehensive Examination	1
COMPUT 693 Dissertation	33
<i>Total</i>	68

Data Science

Pre-approved Elective and Data Science Elective Courses

Pre-approved Data Science Electives in Computer Science

- CS 510 Databases
- CS 535 Large-scale Data Processing and Analysis
- CS 536 Natural Language Processing
- CS 573 Introduction to Information Retrieval
- CS 538 Recommender Systems for Online Personalization
- CS 539 Social Media Mining
- CS 557 Artificial Intelligence
- CS 633 Deep Learning
- CS 637 Advanced Topics in Information Retrieval

Pre-approved Data Science Electives in Math

- MATH 503 Linear Algebra
- MATH 515 Real and Linear Analysis
- MATH 527 Introduction to Applied Math for Scientists and Engineers
- MATH 566 Numerical Methods I
Numerical Methods II
- MATH 571 Data Analysis
- MATH 573 Time Series Analysis
- MATH 574 Linear Models

Additional Electives by Focus Area

- Anthropology
 - ANTH 504 Statistical Methods in Anthropology
- Biometry:
 - BIOL 601 Biometry
 - BIOL 603 Advanced Biometry
- Ecology, Evolution and Behavior:
 - EEB 607 Quantitative Methods for Population and Habitat
 - EEB 621 Advanced Ecological Data Analysis
- Econometrics:
 - ECON 521 Mathematical Statistics and Introduction to Advanced Econometrics
 - ECON 522 Advanced Econometrics
- Electrical Engineering:
 - ECE 556 Pattern Recognition and Machine Learning
- Geoscience:
 - GEOS 505 Introduction to Numerical Methods for the Geosciences
 - GEOS 661 Advanced Image Processing
- Geostatistics:
 - GEOPH 522 Data Analysis and Geostatistics
 - GEOPH 575 Geophysical Applications of Digital Signal Processing
- Hydrology and Hydrogeology:
 - CE 630 Vadose Zone Hydrology
 - CE 633 Contaminant Hydrology
- Materials Science:
 - MSE 563 Materials Modeling

Appendix B - Comprehensive Exam Guide for Students

Explanation

The purpose of the comprehensive exam is to determine the preparedness of students to perform tasks composing the scientific research process in the field of computing. This includes having knowledge in core areas of their specific emphasis, understanding relevant scientific literature, designing and writing software components, and presenting technical information both orally and in writing.

Elements

The comprehensive exam comprises four elements:

1. **Emphasis core courses:** The purpose of this requirement is for the students to have a breadth of knowledge and practical understanding in their particular emphasis area.
2. **Synthesis manuscript:** The purpose of this requirement is to prepare the students early on their scientific reading and writing abilities.
3. **Computing artifact:** As the program grants a PhD in Computing, the purpose of this requirement is that students who graduate from this program will be able to make a contribution in their respective emphasis areas through computation.
4. **Oral presentation:** This is a presentation of the content of the synthesis paper and a formal examination on advanced knowledge necessary for the synthesis paper and computing artifact.

Procedure

Registration and Exam Committee

Your comprehensive exam committee will be the same as your dissertation committee, plus one external evaluator appointed by the program co-directors.

You must request a permission number from the program administrator to enroll in COMPUT 691. Prior to requesting a permission number you must form your committee and submit the [Appointment of Supervisory Committee form](#).

Emphasis Core Courses

Before taking the comprehensive exam you must **must earn a B or better** in the courses listed for your emphasis below. These courses must be completed prior to enrolling in COMPUT 691- Comprehensive Exam.

The courses for each emphasis area are as follows:

- **Computational Science and Engineering:**
 - MATH/CS 565 Numerical Methods I
 - MATH/CS 566 Numerical Methods II
 - CS 507 Computing Foundations for Computational Science
 - COMPUT/ME 571 Parallel Scientific Computing
- **Computer Science:**
 - CS 521 Design and Analysis of Algorithms or CS 561 Theory of Computation
 - CS 552 Operating Systems
 - CS 573 Advanced Software Engineering.
- **Cyber Security:**
 - CS 567 Applied Cryptography or MATH 508 Advanced Public Key Cryptology or MATH 509 Symmetric Key Cryptology
 - CS 575 Software Security or CS 622 Advanced Network Security
 - CS 546 Computer Security
- **Data Science:**
 - CS 533 Introduction to Data Science
 - CS 534 Machine Learning
 - MATH 562 Probability and Statistics II
 - MATH 572 Computational Statistics

Synthesis Manuscript

The synthesis manuscript should show critical thinking about the reviewed papers and propose several possible research questions. Your advisor, with input from your exam committee, will provide a set of at least 4 scientific papers. You should use these papers as a starting point and perform a literature search to better cover the breadth of existing related work.

You may receive feedback from your major advisor prior to formal submission of the manuscript. However, the synthesis should be your own work. You will be asked to sign an affirmation that confirms that the work is your own and does not reflect an act of plagiarism. The affirmation form can be found on the program website at <http://computing.boisestate.edu/academic-forms/>

No specific format is required for this manuscript. You should discuss format expectations with your advisor.

Your Dissertation Proposal and Dissertation should use the template and format required by the Graduate College, so for consistency you may wish to use this format for your synthesis manuscript. The Graduate College template and format guidelines can be found here: <https://graduatecollege.boisestate.edu/success/standards-and-guidelines/>

Computing artifact

The computing artifact element of the comprehensive exam can be a separate project or an extended class project. The artifact will contain program(s) and output that must be well tested and documented. Your examination committee should determine the minimum requirements for the artifact and notify you of these evaluation criteria within one month of accepting to serve on the committee.

Oral Presentation

The Oral Presentation should be scheduled for two weeks after you submit your synthesis paper and computing artifact for review by your committee. If your full committee is not available within two weeks, schedule for the next earliest date.

It is your responsibility to schedule the presentation date with your committee members and reserve a room. Presentations must be scheduled to occur at least 1 week prior to when grades are entered.

Print a copy of the Comprehensive Exam Approval Form and take it with you. The form can be found on the program website at <http://computing.boisestate.edu/academic-forms/>

Oral Presentation Format

The format of the oral examination consists of a 30-minute public presentation of your synthesis paper and computing artifact, including a public question and answer session.

The public question and answer session will be followed by a closed-door period of questioning by the examination committee based on content in the synthesis paper and computing artifact. Only the committee members may attend the closed-door session.

After the examination, you will be asked to leave, and your committee will discuss and vote on your performance on the synthesis paper, computing artifact, and oral presentation.

Your committee will complete the Comprehensive Exam Approval Form and present it to you for review and your signature. Please return the completed form to the Program Coordinator.

Failure of the Comprehensive Exam

Per the graduate student catalog, students that fail their first attempt at any element of the comprehensive exam may be granted a second attempt of that element. Students who fail any portion of the comprehensive exam must submit the Report of Failure of Comprehensive Examination form - found on the Graduate College website: <https://graduatecollege.boisestate.edu/forms/> within 5 working days of being notified of their failure.

If retaking any portion of the exam students must submit the Request to Retake the Comprehensive Exam form, found on the program website <http://computing.boisestate.edu/academic-forms/> within 5 working days of being notified of their failure.

Requests to retake the comprehensive exam must be submitted by the student in writing to the PhD in Computing steering committee and must be made within 5 business days of being notified of his or her failure of the exam.

If the request to retake is approved, then the second attempt of the failed elements of the exam must be submitted before the end of the following semester, not including summer, after receiving the exam results.

If the student does not submit a second attempt prior to the end of the semester following the initial failure, or if the student fails the second attempt, then a grade of (F) is assigned to COMPUT 691, and the student will be dismissed from the university by the Graduate College. Any extension of the time limit on the second attempt must be approved by the Program Directors and by the Dean of the Graduate College.

Comprehensive Exam Checklist

Semester before:

- Meet with advisor and confirm that all course requirements will be met before enrolling in COMPUT 691.
- Work with advisor to select members of supervisory committee.
- Submit the [Appointment of Supervisory Committee form](#).
- Request a permission number from the Program Administrator and enroll in COMPUT 691.

Beginning of semester:

- Meet with advisor and supervisory committee, we suggest you put all agreed upon expectations in writing and save a copy:
 - Set deadline for when seed papers will be given to the student.
 - Agree upon expectations for the computing artifact.
 - Agree upon expectations for the synthesis paper.
 - Agree upon expectations for the oral presentation.
 - Agree upon the amount of feedback the student can expect from their advisor and committee.
 - Set due date for submission of computing artifact and synthesis manuscript.
 - Schedule the oral presentation. Reserve a room with the Program Administrator. (At least 1 week before grades are due)

Prior to submitting artifact and synthesis paper to committee:

- Complete the [Affirmation of Original Work](#) and submit it to the Program Administrator.

Presentation day:

- Print the [Comprehensive Exam Approval](#) form and take it with you to your presentation.
- After your presentation return the Comprehensive Exam Approval form to the Program Administrator.
- Email a digital copy of your synthesis manuscript to the Program Administrator.

Appendix C - Dissertation Proposal Defense Guide

Dissertation Proposal

The dissertation proposal is normally completed within one year of completing the comprehensive exam and approved by your supervisory committee at least one year prior to the dissertation defense. It is a comprehensive statement about proposed research that will contribute to the knowledge base of your focus area in the Computing program. Normally one-third of the research has already been completed.

Forms to Complete

- **Prior to your proposal (and before the comprehensive exam)** complete or update the [Appointment of Supervisory Committee Form](#). (if not done prior to comprehensive exam).
- **The day of your defense:** print the [Proposal Acceptance Form](#) and take it with you.
- **After your defense:** After successfully proposing your dissertation you may work with your advisor to complete the [Application for Admission to Candidacy](#).

Preparing your written proposal

Boise State dissertation templates may be used for formatting the proposal:
<https://graduatecollege.boisestate.edu/success/standards-and-guidelines/>.

The proposal should be clear, concise, compelling and a maximum of 15 single-spaced pages excluding references. At a minimum the proposal should include:

- Title
- A concise statement of purpose/research objective (similar to an abstract)
- A literature review
- Motivation and expected contributions
- Preliminary results
- The scope and overall framework or methodology in which the research will be pursued and interpreted, including metrics you will use to evaluate the success of your work
- A proposed timeline to complete publications and dissertation chapters
- Bibliographic references

Oral Defense Scheduling

- With the permission of your advisor, schedule the time and date of your proposal defense with your committee members. Schedule for at least 2 hours.

- Once you've determined a time, contact the program administrator to reserve a room.
 - Once complete, please include a short abstract from your proposal. Proposals are open to the public and an email notice will be sent to current computing students and faculty.
- The final draft of the proposal must be approved by the dissertation advisor before submitting it to the supervisory committee at least two weeks before you plan to present your oral defense. (You may need to make changes.)
- Within one week of receiving your written proposal your supervisory committee will contact you and your advisor and either:
 - Request that you make changes, resubmit and possibly reschedule your oral defense.
 - Give their approval to proceed with the scheduled oral defense.
- After the proposal defense the supervisory committee will determine if the proposed research constitutes doctoral research. They will also make suggestions regarding additional background that should be considered and how the research problem or methods should be modified.

Oral Defense Format

The proposal defense consists of a 45-minute public presentation of your dissertation proposal, including a public question and answer session, followed by a closed-door period of questioning by your supervisory committee.

The supervisory committee will conduct a closed-door oral examination based on the proposal and on relevant background from your program of study. Only the committee members may attend the closed-door session.

After the examination, you will be asked to leave, and the committee will discuss and vote on your performance in the oral examination. Majority approval of the supervisory committee is required to pass the defense.

Failure

If a student fails the proposal defense, he or she may be allowed to reinitiate the dissertation proposal **once** with the approval of the supervisory committee. Students who fail a second time or do not receive approval to re-submit the proposal will be administratively withdrawn from the program.

Dissertation

The dissertation must be the result of independent and original research and must constitute a significant contribution to the knowledge base of the focus area, equivalent to multiple peer-reviewed publications. The style and format of the dissertation are to conform to the standards of the Graduate College.

Dissertation Defense

A public defense of the dissertation is scheduled after the supervisory committee has reviewed a draft that is considered to be a nearly final version. The date of the defense is determined jointly by the supervisory committee and the student and must be consistent with any guidelines provided by the Graduate College. The first part of the defense will be a public oral presentation of the dissertation. The second part will be an oral exam administered by the supervisory committee who will decide whether the student passes or fails the defense. A student who fails the defense may be permitted to try again but failure a second time will result in dismissal from the PhD program.

If the defense is completed with a result of pass, the supervisory committee prepares a statement describing final requirements such as additions or modifications to the dissertation and any additional requirements such as archival of data. When these requirements have been met to the satisfaction of the supervisory committee, the approval page of the dissertation is signed by the members of the committee.