



2019-20 Graduate Handbook

Biomedical Data Science and Informatics (MS)

Computer Science (PhD and MS)

Human-Centered Computing (PhD)

Please see the Digital Production Arts website for detail on the MS and MFA in DPA.
For the BDSI PhD, please see the joint Clemson-MUSC BDSI website.

Links to both can be found with the program's heading.

October 17, 2019

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Welcome

Welcome to the School of Computing (SOC) at Clemson University. We wish you success at every stage of your academic journey.

This handbook is intended to familiarize you, as a graduate student in the School of Computing, with the requirements and policies that govern your academic program. Any inconsistencies within this handbook or between this handbook and the Graduate School Policy Handbook should be brought to the attention of the appropriate Graduate Program Coordinator. The policies and curricula listed below are specific to the School of Computing. For Graduate School policies regarding registration, transfer credits, assistantships, and other University-wide policies, please see the Graduate School Policy Handbook.

Graduate School Policy Handbook

The Graduate School of Clemson University publishes a handbook of policies and procedures annually, which is available at <https://www.clemson.edu/graduate/students/policies-procedures/index.html>.

Graduate School Graduation Deadlines

The Graduate School publishes a list of deadlines for graduation, which is available at <https://www.clemson.edu/graduate/students/deadlines.html>.

Graduate School Admissions Requirements

The Graduate School admissions requirements can be found at <https://www.clemson.edu/graduate//admissions/preparing-to-apply/supporting-materials.html>. Any additional program-specific requirements will be listed with the program.

International Services

For policies related to International Services, please see <https://www.clemson.edu/campus-life/campus-services/international/>.

Terminology

| | |
|----------------------------|---|
| Credit Hour | The semester credit hour used by Clemson University |
| Program Coordinator | The faculty member responsible for coordinating a degree program |
| Dr. Mark Smotherman | Master of Science, Computer Science |
| Dr. Brian Dean | Master of Science, Biomedical Data Science & Informatics |
| | PhD, Biomedical Data Science & Informatics |
| Dr. Rong Ge | PhD, Computer Science |
| Dr. Eileen Kraemer | PhD, Human Centered Computing |
| Major Advisor | A student's Advisory Committee Chair |

Support Services

Kaley Goodwin, Administrative Assistant, kaleyg@clemson.edu, 864-656-5403, McAdams 100E

For questions regarding student employment, registration, and room reservations

Adam Rollins, Graduate Services Coordinator, rollin7@clermson.edu, 865-656-5853, McAdams 100G

For questions regarding admissions, assistantships, and thesis and dissertation defense

Application Deadlines

| Fall Semester | Date |
|--|--------------|
| To be considered for a PhD fellowship | January 1 |
| To have full consideration for an assistantship | February 1 |
| To be considered for admission (international students) | April 15 |
| To be considered for admission (domestic & international students already in the U.S.) | May 15 |
| Spring Semester | Date |
| To have full consideration for an assistantship | September 15 |
| To be considered for admission (international students) | September 15 |
| To be considered for admission (domestic & international students already in the U.S.) | October 15 |

These are general deadlines for the School of Computing. Any program-specific deadlines will be listed under the Admissions Requirements of the program.

Registration

The Program Coordinators are the initial advisors for all new students. Students are encouraged to consult with their Program Coordinator prior to registration, and should enroll in no more than three graduate courses during their first semester. It is possible to sit in on additional courses during the first session before deciding whether to drop or add a course. International students and students with assistantships must maintain a 9 credit hour minimum during Fall and Spring semester. Students with Summer Full Term assistantships must enroll in a minimum of 6 credit hours over the full summer term. Students with Summer I or Summer II assistantships must enroll in a minimum of 3 credit hours during the Summer I or Summer II session. Other policies regarding enrollment limits can be found in the Graduate School Policy Handbook.

For detail regarding the registration process, see <http://www.registrar.clemson.edu/html/indexRegistration.html>.

Assistantships

Assistantships are awarded on a competitive basis to qualified students, both domestic and international. All qualified students are considered for assistantships when applications are processed; no separate applications are required. Students receiving an assistantship will receive an assistantship contract via Adobe Sign. These contracts can be signed electronically. Once signed, the student should schedule an appointment with Kaley Goodwin to complete their hiring paperwork.

Student Employment

Students employed by the School of Computing must make an appointment with Kaley Goodwin prior to beginning their employment. During the meeting, students will learn how to track their time and set up direct deposit. Domestic students will also complete their employment verification form (I-9), and international students without a Social Security Card will learn how to apply for one. An appointment will be scheduled with Human Resources at the close of the meeting so that the student can complete the hiring process.

YOU CANNOT BEGIN EMPLOYMENT OR RECEIVE PAY UNTIL YOU'VE BEEN THROUGH THIS PROCESS.

Paychecks will be issued twice a month, and deposited directly into the student's bank account.

Social Security Card

All employees in the United States are required to have a Social Security card (SSC). Domestic students will be asked to bring their Social Security Card to their meeting with Ms. Goodwin. International students who don't already have a Social Security Card will need to apply for one. International Employment Guidelines and the Social Security Application Procedure can be found at <http://www.clemson.edu/employment/international/>. New international students must be in the US at least 10 days before applying. We recommend that new international students arrive at Clemson 15 days before classes begin.

Transfer Credits and Exemptions

Students with graduate credit earned at another institution, or before admission to their program, must have prior work evaluated for transfer credit. With the approval of their Major Advisor and Program Coordinator, students may transfer or exempt credits for recent graduate-level course work taken at other accredited institutions prior to admission to the program. For detail regarding the University's transfer credit policy, see the Graduate School Policy Handbook.

MS en Route to PhD

Students who are currently enrolled in the Computer Science or Human-Centered Computing PhD programs and who have completed or plan to complete all requirements for an MS in Computer Science can apply for an MS en route by completing the GS2-14, found at <https://www.clemson.edu/graduate/files/pdfs/GS2-14.pdf>. These students are expected to continue in the PhD program after receiving the MS degree.

For the Computer Science MS course requirements, see pages 12-15.

The MS and PhD cannot be conferred in the same semester. Completed GS2-14s should be submitted to the Graduate Services Coordinator prior to collecting the necessary signatures, and prior to the semester the student wishes to receive the MS.

PhD Advisory Committees

The Program Coordinator is the initial advisor for all new graduate students within their program, and will serve as advisor until the student identifies an Advisory Committee. To select a committee, the student will first select a Major Advisor, who will assist the student in identifying the remaining members, and who will act as the student's Advisory Committee Chair. The Major Advisor must be a full-time faculty member at Clemson who is tenure track and has at least a 51% appointment in the School of Computing.

For PhD students, the Advisory Committee must be composed of 4 faculty members, including the Major Advisor. The remaining 3 committee members, one of whom may be from outside the SOC, will be selected by the student in consultation with the Major Advisor and with the approval of the PhD Program Coordinator. A step-by-step summary of the committee selection can be found below:

| | |
|---|--|
| 1 | The student selects a Major Advisor. |
| 2 | The student consults with his or her Major Advisor in the selection of additional committee members. |
| 3 | The student contacts the Program Coordinator to identify the final committee member. |
| 4 | The student submits the committee selection using the online GS2 |

An Advisory Committee should be selected during the student's first year. Once the committee is finalized, it will assist the student in selecting courses, approve the student's course selection, approve the dissertation proposal, and evaluate the dissertation defense.

Selection of the student's committee members, including the Major Advisor, requires the mutual consent of the student and the faculty selected. A student is free to dissolve an existing committee and form a new one at any time. Similarly, the Major Advisor is free to step down as Advisor, and committee members to leave the committee, if research interests change or relationships prove to be incompatible.

The Graduate Committee Selection (GS2 Committee Selection)

The student will document their committee selection by submitted a GS2 Committee Selection. The GS2 Committee Selection must be completed before a GS2 Plan of Study can be filed. The student's committee may be revised as necessary by submitting a new GS2.

Directions and filing deadlines for the online GS2 can be found at <https://www.clemson.edu/graduate/students/plan-of-study/index.html>, with detail regarding the committee selection at https://www.clemson.edu/graduate/files/pdfs/gs2_committee_new.pdf.

For MS Non-Thesis students, a single committee member is all that is required. For the DPA MS, that committee member is Dr. Victor Zordan. For the BDSI MS, it is Dr. Brian Dean. For the Computer Science MS, it is Dr. Mark Smotherman.

The Graduate Plan of Study (GS2 Course Selection)

The student's graduate degree curriculum will be selected in consultation with his or her Major Advisor, and documented by filing a GS2 Plan of Study. The student's curriculum may be revised as necessary by submitting a new GS2.

Students must list on their GS2 all coursework they intend to use to satisfy the minimum credit requirements for their degree program, not just graded coursework. For simplicity, students are encouraged to list only the courses necessary to satisfy these minimums, unless additional courses are needed to satisfy the GPA requirement for GS2 courses.

Directions and filing deadlines for the online GS2 can be found at <https://www.clemson.edu/graduate/students/plan-of-study/index.html>, with detail regarding the plan of study at https://www.clemson.edu/graduate/files/pdfs/gs2_plan.pdf.

PhD Research

We encourage PhD students to involve themselves in research under the supervision of a faculty member at the earliest possible opportunity. Coursework leading to the Doctorate of Philosophy is designed to give students a comprehensive knowledge of their field of specialization and a mastery of the methods of research. The degree is not awarded solely on the basis of coursework completed, residence, or other routine requirements. The final basis of granting the degree is a student's grasp of a broad field of study, competence in planning and conducting research, and ability to adequately express the results of research in both spoken and written form.

The PhD Portfolio

To be admitted to Ph.D. candidacy, a student must pass a comprehensive examination. The form of this examination is a portfolio review that is performed by program faculty. The review is intended to certify competency in the student's core areas of study, demonstrate potential for research, and promote scholarly and professional skill.

Students are given at most two opportunities to pass this exam. A student who is denied admission to candidacy after the first attempt may, at the discretion of faculty, be given one additional chance to correct the identified deficiencies. Graduate School policy requires that a student who fails his or her comprehensive examination a second time be dismissed from the graduate program.

The student is solely responsible for the contents of the portfolio, and it is important to begin the preparation of the portfolio early, in consultation with the student's Major Advisor. Students entering with an MS should submit their portfolio before the beginning of their fourth semester; students entering without an MS, before the beginning of their sixth.

The Coordinator of the student's program will initiate the call for portfolio submission. For program-specific portfolio requirements, see Programs of Study.

The PhD Dissertation Proposal

The dissertation proposal serves several purposes. It ensures that the student has a clear grasp of a specific problem or set of problems; it provides a format for discussion of the solutions or approaches to solving the problem(s); and it provides documentation that the student has undertaken a reasonable survey of the literature related to his or her research.

The proposal itself is presented to the student's Advisory Committee. The purpose of the proposal is to inform the committee of the nature and scope of the proposed dissertation and to obtain their approval and guidance concerning the proposed research. The written proposal should include the following items:

- an outline of the included material
- a review of the state of knowledge in the general area of interest
- a description of the proposed dissertation area, along with a concise review of the state of knowledge in the specific area of the proposed dissertation

- an explanation of the problem(s) to be investigated
- a discussion of the results expected from solving the problem(s) and their impact on the state of knowledge in the general and specific areas of interest
- a bibliography

The written proposal must be presented publicly and approved by the student’s Advisory Committee. The presentation must be scheduled in consultation with the Advisory Committee, and the written document must be available to the Committee at least two weeks before the presentation occurs. The Advisory Committee will be asked to give written approval of the proposal after the presentation, and that approval will be based primarily on the written document. If the proposal is not approved, it may be repeated an indefinite number of times, subject to the consent of the Committee, but the proposal must be approved at least six months prior to the completion of the dissertation.

Students can schedule their presentation by submitting the following form:

<https://www.clemson.edu/cecas/departments/computing/resources/SoC%20Presentation%20Scheduling%20Form.pdf>

A step-by-step summary of the proposal process can be found below:

| | |
|---|---|
| 1 | Submit written proposal to Advisory Committee at least two weeks prior to expected presentation date. |
| 2 | Schedule a presentation date in consultation with Advisory Committee. |
| 3 | Reserve room with Kaley Goodwin, McAdams 100E. |
| 4 | Submit scheduling form to Adam Rollins, McAdams 100G. |

The PhD Dissertation

The research requirement is the most important aspect of PhD study. The doctoral dissertation is the written record of the research that the student has conducted and must provide evidence of the student's ability to independently perform original research leading to the discovery of new and significant knowledge. The dissertation should demonstrate the student's technical mastery of the subject, independent scholarly work, and conclusions that modify or enlarge previously existing knowledge. The dissertation is expected to:

- Identify a significant open question or problem in the student’s field of study
- Describe the current state of knowledge of the area(s) involved
- Present a solution or solutions to the problem identified
- Report on the results of the research conducted, substantiate those results, and demonstrate their originality and contribution

The format of the dissertation must conform to the current SOC and Graduate School standards. Copies of the dissertation must be delivered to the student's Advisory Committee at least two weeks prior to the final oral examination.

The PhD Dissertation Defense

PhD students will present a summary of their dissertation at a School of Computing colloquium. This presentation must include an explanation of the problem(s) addressed, a description of the results, and an

explanation of their significance. After the presentation, a brief period may be allocated for questions from the general audience. At the end of the general Q&A, the Final Doctoral Oral Examination will be conducted by the student's Advisory Committee. Members of the faculty, as well as members of GAC and the Dean of the Graduate School are invited to attend the examination. The final examination demands a broad and penetrating interpretation by the student of the research project and its conclusions. It may also include examination of the student in the major and minor fields of specialization. A student who fails the final oral examination may be allowed a second opportunity, if recommended by the Advisory Committee. Failure of the second examination will result in dismissal from the Graduate School. The Advisory Committee will submit written approval to the Graduate School upon successful completion of the defense.

The dissertation defense should be scheduled following the same procedure as the dissertation proposal.

The PhD Publication Requirement

Prior to graduation, each PhD student must publish, or have accepted for publication, results of the research leading to their dissertation. The paper must be fully refereed, and either published in a peer-reviewed journal or accepted in the proceedings of a conference. The paper may be co-authored with the student's Major Advisor.

Programs of Study

Biomedical Data Science & Informatics, Doctorate

Program Coordinator: Dr. Brian Dean, bcdean@clemson.edu, 205 McAdams Hall

For program details for the Doctorate in Biomedical Data Science & Informatics, please see <https://www.cs.clemson.edu/bdsi/>.

Biomedical Data Science & Informatics, Master of Science

Program Coordinator: Dr. Brian Dean, bcdean@clemson.edu, 205 McAdams Hall

Overview of Program

The BDSI-MS is an interdisciplinary program that leverages the broad strengths of a Tier 1 Research University, spanning the fields of computing, engineering, mathematics, biology, and public health. The objective of the program is to produce the next generation of data scientists, prepared to manage and analyze big data sources from mobile sensors to genomic and imaging technologies. Graduates will possess the necessary skills for informatics careers in biology, medicine, and public health, with a focus on the development of prescriptive analytics derived from large fields of data.

Graduates of the program will be able to:

1. Manage and analyze data, developing prescriptive analytics from large data sets.
2. Apply technological approaches in a biomedical context.
3. Identify the principles and limitations of public health programs as they relate to epidemiological problems.

Courses can be taken at The Medical University of South Carolina, the University Center of Greenville, and the Zucker Family Graduate Education Center at CURI campus, North Charleston, in addition to the courses offered at Clemson's main campus.

Typical time to completion is two years. The program is not available online.

Admission Requirements

The BDSI-MS program is designed for students with undergraduate computer science, math, engineering, or biomedical sciences experience who wish to make a contribution to biomedical sciences and individual and societal health. Admission requirements include:

- A bachelor's degree in biomedical or health sciences, computing, mathematics, statistics, engineering, or related discipline
- The general GRE
- One year of calculus
- One year of college biology
- Computer programming coursework (e.g., at least one advanced programming course) or substantial experience in industry

The following experiences are recommended, but not required:

- Competency in a second area—biomedical or health sciences, computing, mathematics, statistics, or engineering—beyond the bachelor's degree, as demonstrated by completion of a major, minor or certificate
- Relevant research or work experience
- Coursework in multivariate calculus, linear algebra, probability and statistics, and biostatistics
- One year of computer science coursework that focuses on the fundamentals of computer science and software engineering principles, including abstraction, modularity, and object-oriented programming

The annual deadline for complete applications is April 15.

Degree Requirements

Each student will work with the Program Coordinator to construct a program of study that conforms to the following 32-34 hour requirement:

- Area I – Biomedical Informatics Foundations and Applications (12 hours)
- Area II – Computing/Math/Stats/Engineering (12 hours)
- Area III – Health Systems, Quality, and Safety (5-6 hours)
- Area IV – Domain Biology/Medicine (3-4 hours)

Specific courses that are either required for these areas or approved to satisfy these areas are maintained in an online curriculum grid linked from <https://www.cs.clemson.edu/bdsi/>. As this list may evolve over time, students may choose any single version of the curriculum grid that is in effect during their tenure in the program as a basis for their coursework requirements.

In cases where the student comes to the program with prior coursework in a required area, or in other situations deemed necessary (e.g., if a student wants to take a relevant “special topics” course not on the curriculum grid), the Program Coordinator may approve a substitution. In cases where a student lacks pre-requisites for a required course, the student will be asked to complete both the pre-requisite coursework and the required course. A student may also be asked to complete additional pre-requisite coursework as part of their admission requirements.

Combined Bachelor's/Master's

The BDSI-MS offers several combined BS-MS course plans. Partner departments include Bioengineering, Computer Science, Computer Engineering, Mathematics, Health Science, and Genetics and Biochemistry. These course plans allow Clemson undergraduates to apply up to 12 hours of graduate coursework to both their BS and MS degrees.

To qualify for a combined BS/MS course plan, students are required to have a minimum 3.4 GPA, and to have completed at least 90 credit hours upon entry.

Computer Science, Doctorate

Program Coordinator: Dr. Rong Ge, rge@clemson.edu, 209 McAdams Hall

Overview of Program

The objective of this program is to prepare exceptionally qualified individuals for research careers in academia and industry. The PhD degree is viewed as a certification by the faculty that the student has a solid foundation in computer science and has performed original research in the area.

Graduates of the program will be able to:

1. Draw on a broad background of computing knowledge to address advanced computing problems.
2. Be able to perform original research, including formulation of problems and solutions, implementation and analysis, and communication of results.
3. Possess the skills necessary to sustain successful careers and leadership roles in both academia and industry.

PhD in CS students may study in either Clemson, at McAdams Hall, or in Charleston, at the Zucker Family Graduate Education Center.

Because the curriculum will be tailored to each student, the time needed to complete the degree will vary, but in general, it is expected that students can complete the degree in five years or less.

The program cannot be completed online.

Admission Requirements

The program is designed for students who offer evidence of exceptional scholastic ability, intellectual creativity, and research motivation. The expected background includes:

- Programming (CPSC 1010 and 1020)
- Discrete math (CPSC 2070)
- Data structures (CPSC 2120)
- Computer organization (CPSC 2310)
- Operating Systems (CPSC 3220)
- Programming systems and paradigms (CPSC 3520)
- Algorithm analysis and theory (CPSC 3120 or CPSC 3500)

Students who are admitted with substantial deficiencies in these background areas may be requested, as a condition of admission, to take additional coursework (e.g., an undergraduate or higher course in algorithms and data structures) during their graduate studies, as part of their graduation requirements.

Admission is available for both fall and spring semesters. The GRE exam is required, but there are no other program-specific materials required as part of the application.

Degree Requirements

The PhD in Computer Science includes coursework requirements, a portfolio examination, a written dissertation—which includes a proposal and defense—and a publication requirement. Program-specific coursework and portfolio requirements can be found below. For information on dissertation and publication requirements, see pages 5-7.

Coursework Requirements

Coursework requirements for the PhD vary depending on whether the student enters with a BS or MS degree. Courses are intended to demonstrate breadth in computer science as well as experience in research. All PhD students are required to complete:

- 1 credit of New PhD Student Seminar (a CPSC 9500 offered in your first semester, formerly called Introduction to Faculty Research)
- at least 6 additional credits of PhD seminar courses (CPSC 9500)
- at least 21 credits of research hours (CPSC 9910, CPSC 8880, or CPSC 9500), at least 18 of which must be Doctoral Research (CPSC 9910)

For research hours, students typically register for Research Experience (CPSC 8880) for focused research projects early in their studies, prior to selecting an Advisory Committee; this can be a good mechanism for testing the waters with a prospective advisor. For students who have identified their Advisory Committee and who are performing research towards their ultimate dissertation, Doctoral Research (CPSC 9910) is appropriate.

In addition to the requirements above, students must meet the minimum credit hours for graded coursework and for total credit hours as defined by the University:

| Beginning Degree | Degree(s) Earning | Graded Coursework | Total Credits |
|------------------|--------------------|-------------------|---------------|
| MS | PhD | 12 | 30 |
| BS | PhD (direct entry) | 30 | 60 |

For students entering with an MS, the required 12 credit hours of graded coursework may be satisfied by taking four 8000-or-higher-level courses within the School of Computing (exclusive of 8810, 95x0, 9810, 9910, and any DPA prefix). One 3-credit 8000-or-higher-level course not meeting these restrictions may be included in the 12 credit hours with the approval of both the student's Major Advisor and the Program Coordinator.

For students entering with a BS, up to 12 credit hours of 6000-or-higher-level coursework at Clemson may be counted toward the minimum 30 credit hours required by the University. Any credit from courses external to the School of Computing must be approved by the Graduate Program Coordinator. Up to 6 credit hours of 8810 may also be counted. In exceptional cases, a higher amount may be approved by the Graduate Program Coordinator. The GS2 is the mechanism for obtaining approval for any exceptional requests, as this requires approval by the Graduate Program Coordinator. Transfer of credit for courses external to Clemson is also

possible, subject to approval of the Graduate Program Coordinator and all requirements and restrictions set forth by the University Graduate School Policies and Procedures manual.

If a student wishes to receive an MS en route during their doctoral studies, they must also satisfy all requirements for the MS degree in addition to those for the PhD. The two degrees do not interfere in any way, in that obtaining an MS en route has no impact on one's progress toward satisfying the coursework requirements for the PhD. Note, however, that both degrees cannot be conferred in a single semester.

In addition to the requirements above, students should also plan their coursework to satisfy the requirements for the PhD Portfolio's demonstration of core competencies, as outlined in the following section.

PhD Portfolio Requirements

To pass the portfolio review for the PhD in Computer Science, students must demonstrate superior mastery in three of six core areas of computing. These core areas are identical to the six core areas stated in the description of the MS requirements. A grade of A in an 8000-or-higher level course listed in each chosen core area or a strong letter of support from the course instructor is expected (an A grade generally provides much stronger evidence of mastery of the area, so students should exercise caution if considering submission of a portfolio without A grades in their chosen core courses). Up to two of these courses may come from another university, in which case the approval of the Program Coordinator is required. Another mechanism for demonstrating mastery includes a strong research publication record in a given area.

Students must also demonstrate potential for research. A research paper in which a significant component of the writing was done by the candidate must be included. The paper should be of sufficient quality to indicate that the student has the ability to conduct original research and make an acceptable written presentation of the results. Although not required, students are strongly encouraged to submit the paper to a journal, conference, or workshop. For such submissions, the student may be the sole author or may be a co-author with other faculty and/or other students. However, if the paper has joint authorship, the other authors must submit written documentation identifying those sections of the paper that were written by the candidate. The paper should exhibit the scope and quality of a publication-worthy paper, but it does not have to be accepted or published to be included in a successful portfolio. Although a published paper provides more convincing evidence for research potential, a rejected submission, along with peer reviews, can also be used to evaluate potential. The paper may or may not be related to the student's eventual dissertation area. A candidate's MS research paper, thesis, or a derivative thereof may be used to satisfy this requirement.

Additionally, the student must provide:

- A statement of purpose
- A brief curriculum vitae
- Two supporting letters of recommendation from School of Computing faculty

Optional material may be included at the discretion of the student, and in consultation with the student's Major Advisor. This material may include:

- Significant accomplishments - An informal statement of the two or three things that the student is most proud of in this period. Examples include earning an "A" in a difficult course, finishing an M.S. research paper, or having a peer-reviewed paper accepted.
- Honors and awards, such as awards of competitive fellowships and induction into honor societies.
- Presentations - Typical categories include seminars, professional presentations, and tutorials. Workshop, class, and conference presentations may be included.

- Proposals in preparation, in review, and accepted - Include fellowship applications, grant applications, applications to industrial affiliates, requests for travel money from conference organizers, etc. Note the status of the proposal: in preparation, under review, accepted, rejected, or under revision.
- Professional Reviewing - Include reviewing for journals, conferences, workshops, and book prospecti. Significant internal reviewing may also be included; for example, if more than a few hours were spent reviewing drafts of papers or proposals for faculty members.
- Service - Include University and School of Computing service other than research and teaching. Examples include service on standing and ad hoc School of Computing committees or as a graduate student representative.

Computer Science, Master of Science

Program Coordinator: Dr. Mark Smotherman, mark@clemson.edu, 100H McAdams Hall

Overview of Program

The Master of Science program in Computer Science prepares individuals for a PhD program, research careers in industry, or advanced technical positions in industry and government. The Student Outcomes are:

1. Students can frame a real-world problem such that it can be addressed computationally.
2. Students can evaluate multiple computational approaches to a problem and choose the most effective one. The different approaches may involve different algorithms and/or different software tools.
3. Students can apply reasoning and technical skills to solve a computational problem with minimal guidance.

Completion of the MS program normally requires from one and one-half years to two years beyond the undergraduate degree, but may require additional time for students whose undergraduate degree is in an area other than computer science. For students receiving assistantships, two academic years are usually required for the completion of the degree.

The program is currently available in both Clemson and Charleston. Some courses are available on-line, but the program cannot be completed online.

Admission Requirements

The MS program is designed for students who already have a background in computer science and who offer evidence of above average scholastic ability at the undergraduate level. The expected background includes:

- Programming (which corresponds to CPSC 1010 and 1020 at Clemson)
- Discrete math (CPSC 2070)
- Data structures (CPSC 2120)
- Computer organization (CPSC 2310)
- Operating systems (CPSC 3220)
- Programming systems and paradigms (CPSC 3520)
- Algorithm analysis or theory (CPSC 3120 or CPSC 3500)

Students without a computer science background can apply as second baccalaureate students in order to take prerequisite courses. In some cases, students can take CPSC 8270 and either 8390 or 8400 to satisfy the final two areas listed above while also applying these graduate courses toward the master's degree.

Admission is available for both fall and spring semesters. The GRE exam is required, but there are no other program-specific materials required as part of the application.

Degree Requirements

The requirements for the MS are based on 30 credits, which may be obtained through either:

- 30 credits of coursework
- 24 credits of coursework and 6 credits of MS thesis research (CPSC 8910).

The Coursework-Only Option: In this option, a student is required to complete ten approved courses. There is no thesis presentation or comprehensive examination required for the degree.

The Thesis Option: The thesis option is designed for students who have a strong interest in research and who can complete an original and creative research project. The quality of the research and presentation should be such that the thesis or a derivative work is acceptable for publication in a refereed conference proceeding or archival journal.

The final examination is an oral examination conducted by the student's Advisory Committee. The student is expected to demonstrate an in-depth understanding of both the research results presented and the pre-existing body of knowledge that the results extend.

Of the 30 credits required for graduation, the thesis-option student must have 6 credits of CPSC 8910. The student must also meet the Concentration and Breadth Requirements as defined below in the remaining 24 credits of coursework. A student may take more than six credits of CPSC 8910, but only six credits may be applied toward the degree.

Concentration and Breadth

During the MS program, the student will choose a concentration of study in one of six core areas and will choose courses in at least two other core areas for breadth:

- Data Science and Informatics
- Foundations and Theory
- Human Centered Computing
- Networks, Systems, and Security
- Software Engineering
- Visual Computing

Concentration Requirement: Each student must take at least three courses in one core area. These courses can be selected from the courses listed in the table below or from approved CPSC 8810 special topics courses in that area.

Breadth Requirement: Each student must take one course in at least two other core areas.

| MS Core Area | Courses |
|------------------------------|--|
| Data Science and Informatics | 6300, 6550, 6620*, 6630*, 8100, 8450, 8470, 8480*, 8490, 8620*, 8630, 8650, 8770 |

| | |
|---------------------------------|--|
| Foundations and Theory | 8380, 8390, 8400, 8480*, 9400 |
| Human Centered Computing | 6110*, 6120, 6140, 6150, 6160*, 6180*, HCC 8310, HCC 8330 |
| Networks, Systems, and Security | 6180*, 6200, 6240, 6280, 6440, 6620*, 6630*, 6770, 6780, 8200, 8220, 8240, 8300, 8510, 8520, 8530, 8540, 8550, 8570, 8580, 8620* |
| Software Engineering | 6160*, 6720, 8270, 8280, 8290, 8700, 8710, 8720, 8730, 8750 |
| Visual Computing | 6040, 6050, 6110*, 6160*, 8040, 8050, 8110, 8170, 8190 |

* CPSC 6110, 6160, 6180, 6620, 6630, 8480, and 8620 span core areas but will count in only one core area each

Course Selection

There are three other considerations in selecting courses for an MS program or study.

6000/8000/9000-Level Credits: For the coursework-only option, at least 18 of the 30 credits must be at the 8000 or 9000 level. For the thesis option, level at least 21 of the 30 credits must be at the 8000 or 9000 level (note: six of these 8000/9000-level credits will be CPSC 8910).

Courses Outside the School of Computing: Students in the coursework-only option may include up to 12 credits of approved courses from outside the School of Computing. Students in the thesis option may include up to 9 credits of approved courses from outside the School of Computing.

Transfer Credits: Students in either option may include up to 9 credits of approved computing courses transferred from another university. Transfer courses will be counted among the approved courses outside the School of Computing but will listed as CPSC 6999 or 8999 on the GS2.

Course Exclusions: Of the 30 credits of approved courses required for graduation, the student may not include credits for CPSC 6810, 6890, 74xx, 8880, or 95x0, 9810, 9910, or DPA 6000-6030, 6810-6830, 8600, or 8800. Additionally, only six credits of CPSC 6820 or CPSC/DPA/HCC 8810 can be included. Coursework-only students may not include credits for CPSC 8910.

The MS Advisory Committee

The MS Program Coordinator is the initial advisor of all new graduate students. At the end of the first semester of study, each MS student pursuing the thesis option should form an Advisory Committee of three members. Coursework-only students will continue to be advised by MS Program Coordinator solely.

The chair of a thesis-option MS Advisory Committee serves as the student's Major Advisor. The Major Advisor must be a tenured or tenure-track faculty member in the School of Computing. The student selects two additional members for a thesis-option Advisory Committee, one of whom may come from outside the School of Computing.

Selection of the thesis-option Major Advisor and the additional two members of the thesis-option Advisory Committee is by mutual consent of the student and the faculty members. A student is free to dissolve an existing thesis-option Advisory Committee and form a new one at any time. Likewise, the Major Advisor is free to dismiss a student. If a student is unable to find a thesis-option Major Advisor, the student should follow the coursework-only option and will be advised by MS Program Coordinator solely.

The MS Thesis Defense

The defense should be scheduled in concert with the student's Advisory Committee, and the following form submitted to the Graduate Services Coordinator:

<https://www.clemson.edu/cecas/departments/computing/resources/SoC%20Presentation%20Scheduling%20Form.pdf>.

The e-Portfolio

To assess the attainment of the three Student Outcomes, each student must submit one course-related artifact per Student Outcome and accompanying self-reflection prior to the program of study being approved. A review of the submissions will be based on each artifact's fit with a Student Learning Outcome and the level of reflection demonstrated in the self-reflection; in particular, the acceptability of a submission is not based on the instructor's previous scoring of the artifact. For more details about the submission format, please see <http://www.clemson.edu/cecas/departments/computing/academics/graduates/programsofstudy/msincsassessment.html>.

Combined Bachelor's/Master's

A combined Bachelor's degree in Computer Science and Master's degree in Computer Science is available. The complete Bachelor's/Master's process will typically take five and a half years. The School of Computing currently allows up to nine credit hours to apply to both degree programs

Digital Production Arts, Master of Fine Arts

Program Coordinator: Dr. Victor Zordan, vbz@clemson.edu, 308 McAdams Hall

For program details for the Master of Fine Arts in Digital Production Arts, please see <https://www.cs.clemson.edu/dpa/>.

Digital Production Arts, Master of Science

Program Coordinator: Dr. Victor Zordan, vbz@clemson.edu, 308 McAdams Hall

For program details for the Master of Science in Digital Production Arts, please see <https://www.cs.clemson.edu/dpa/>.

Human-Centered Computing, Doctorate

Program Coordinator: Dr. Eileen Kraemer, etkraem@clemson.edu, 312 McAdams Hall

Overview of Program

The objective of the PhD in Human-Centered Computing is to prepare our graduates for advanced research positions in industry and the academy. The program is designed for students who offer evidence of exceptional scholastic ability, intellectual creativity, and research motivation. The HCC PhD degree is viewed as a certification by the faculty that the student has a solid foundation in human-centered computing and has performed original research in the area.

Graduates of the program:

1. Will possess a deep knowledge of computing, people, and research methods, as well as a cognate or specialty area.
2. Will have extended, by way of innovative research, the frontier of knowledge in at least one area of computing as it relates to a human condition or concern.
3. Will be able to express ideas adequately and professionally in spoken and written language.

The HCC PhD program will typically require two to four years beyond the MS degree, and includes opportunities for interdisciplinary and interdepartmental research.

This program cannot be completed online.

Requirements for Degree

The PhD in Human-Centered Computing includes coursework requirements, a portfolio examination, a written dissertation—which includes a proposal and defense—and a publication requirement. Program-specific coursework and portfolio requirements can be found below. For information on dissertation and publication requirements, see pages 5-7.

Coursework and Seminar Requirements

The requirements for the PhD in Human-Centered Computing include:

| Coursework | Credits |
|---|------------|
| Fundamentals of HCC | 3 credits |
| Graduate Level Computer Science Courses | 12 credits |
| Courses in People/Human Condition/HCI | 6 credits |
| Research Methods courses | 6 credits |
| Cognate or Specialty Area Approved by Advisor | 9 credits |
| Research | Credits |
| Pre-dissertation Research (pre-portfolio, HCC 8880) | 6 credits |
| Dissertation Research | Credits |
| Dissertation Research | 18 credits |

Entering With or Without a Master's Degree

At least 12 credits of coursework beyond the Master's Degree must be taken at Clemson. There is also an option for direct-entry students without an MS to obtain a Master's degree en route to the HCC PhD Please see the HCC Program Coordinator for detail.

Seminars

Full-time students in the HCC PhD program are encouraged to take one seminar (HCC/CPSC 95x0 /9810) per semester until passing the comprehensive exam, and one per year until completion of the program.

PhD Portfolio Requirements

- Transcripts – a minimum GPA of 3.5 on courses taken at Clemson and appearing on the program of study is expected
- Writing Sample – A research paper in which a significant component of the writing was done by the candidate must be included. The paper should be of sufficient quality to indicate that the student has the ability to conduct original research and make an acceptable written presentation of the results. Although not required, students are strongly encouraged to submit the paper to a conference or workshop. For such submissions, the student may be the sole author or may be the first co-author with other faculty and/or students. If the paper has joint authorship, the other authors must submit written documentation identifying those sections of the paper that were written by the candidate. The paper does not have to be accepted or published to be included in a successful portfolio. Although a published paper provides more convincing evidence for research potential, a rejected submission, along with peer reviews, can also be used by the Graduate Affairs Committee to evaluate potential. The paper may or may not be related to the student's eventual dissertation. A candidate's MS research paper, thesis, or a derivative thereof may be used to satisfy this requirement.
- Statement of Purpose – A one page description of research interests and intended topics of study.
- Plan of Study – The plan of study should be consistent with the student's statement of purpose and include a list of courses the student has taken or plans to take.
- Major Advisor's Letter of Support – The portfolio should be submitted under the direction of the student's advisor, with the advisor providing a letter of support.
- Student Curriculum Vitae.

Portfolios are reviewed each semester by a committee of HCC tenured and tenure-track faculty.