



2022-23 Graduate Handbook

Biomedical Data Science and Informatics (MS)

Computer Science (PhD and MS)

Human-Centered Computing (PhD)

Masters in Applied Computing (MAC)

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.

September 7, 2022

Table of Contents

Welcome.....	1
Graduate School Policy Handbook.....	1
Graduate School Graduation Deadlines.....	1
Graduate School Admissions Requirements.....	1
International Services.....	1
Terminology.....	1
Support Services	1
Application Deadlines.....	2
Registration.....	2
Assistantships.....	2
Student Employment.....	3
Transfer Credit and Exemptions.....	3
Curricular Practical Training.....	3
MS En Route to PhD.....	3
PhD Advisory Committees.....	4
The Graduate Plan of Study (GS2 Committee Selection).....	4
The Graduate Plan of Study (GS2 Course Selection).....	5
PhD Research.....	5
The PhD Annual Review.....	5
The PhD Portfolio.....	5
The PhD Dissertation Proposal.....	6
The PhD Dissertation.....	7
The PhD Dissertation Defense.....	7
The PhD Publication Requirement.....	7
Biomedical Data Science & Informatics, Doctorate.....	8
Biomedical Data Science & Informatics, Master of Science	8
Computer Science, Doctorate.....	9
Computer Science, Master of Science.....	13
Digital Production Arts, Master of Fine Arts.....	16
Digital Production Arts, Master of Science.....	16
Human-Centered Computing, Doctorate	16
Master of Applied Computing	18

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
Prof. Carrie Russell	Master of Science, Computer Science; Master of Applied Computing
Dr. Brian Dean	Master of Science, Biomedical Data Science & Informatics; Ph.D. Biomedical Data Science & Informatics
Dr. Jacob Sorber	Ph.D., Computer Science
Dr. Eileen Kraemer	Ph.D., 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

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.

Curricular Practical Training

Students interested in curricular practical training (CPT) should review the guidelines at <https://www.clemson.edu/campus-life/campus-services/international/employment-resources/practical-training.html>. Computer Science MS and Master of Applied Computing students are encouraged to pursue CPT, particularly during the summer after the Fall and Spring semesters of their first academic year. Students entering in the Spring will need to enroll in both Spring and Summer semesters in order to qualify for CPT in the Fall.

To qualify for CPT, students must be [1] in good academic standing and [2] in compliance with all other guidelines regarding legal presence and enrollment as they relate to F1 visa requirements. Students taking more than 9 credits will be restricted to 10 hours per week of off-campus CPT.

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, and while the same course can be used to meet both an MS and PhD requirement, the University’s minimum credit requirements still apply:

Beginning Degree	Degree Earning	Non-Research Coursework	Dissertation Research	Total Credits
MS	PhD	12	18	30
BS	PhD	42	18	60

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>.

For MS Non-Thesis students, a single committee member is all that is required. For the DPA MS, that committee member is Dr. Eric Patterson. For the BDSI MS, it is Dr. Brian Dean. For the Computer Science MS and Master in Applied Computing, it is Prof. Carrie Russell.

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>.

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 Annual Review

Each program will conduct an annual review of its PhD students, with each student submitting requested materials to their respective program coordinators. The material will be reviewed by program faculty and feedback provided to the student upon completion of the review.

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 student's graduation date.

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. Attendance of the student's dissertation committee members may be remote but must be synchronous. Any committee member unable to attend the student's defense synchronously must abstain from voting. A majority vote of "pass" is required for the student to pass the defense. 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@clermson.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@clermson.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
- 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. Of the BDSI courses taught at the Medical University of South Carolina, BDSI MS students are restricted to Area I courses only.

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. Jacob Sorber, jsorber@clemson.edu, 225 McAdams Hall

Overview of Program

The objective of this program is to prepare exceptionally qualified individuals for research careers in academia and industry. The Ph.D. 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.

Ph.D. 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 Ph.D. 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 Ph.D. 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 Earning	Non-Research Coursework	Dissertation Research	Total Credits
MS	PhD	12	18	30
BS	PhD	42	18	60

For students entering with an MS, the required 12 credit hours of non-research coursework must 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 42 non-research credit hours required by the University, exclusive of CPSC 6810. Of the remaining 30 non-research credit hours, 18 must be 8000-or-higher-level courses within the School of Computing (exclusive of 8810, 95x0, 9810, 9910, and any DPA prefix). 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.

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

Ph.D. Portfolio Requirements

To pass the portfolio review for the Ph.D. 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.

For core area mastery, students are encouraged to submit courses already in the course catalogue. Occasionally, a student may request the inclusion of a special topics course with an 8810 course number. The Program Coordinator will consider these requests on a case-by-case basis. Students will be asked to submit a

syllabus from the special topics course, along with a brief statement explaining why the special topics course should be considered for a specific core area in lieu of a course already in the course catalogue.

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: Prof. Carrie Russell, crusse4@clemsun.edu, 212 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.

Requirements for Admission

For students to be accepted into the M.S. program, including the approval of an M.S. en route to a Ph.D. degree, they must have a background equivalent to the [MSCS Ready](#) sequence. Students without the necessary background should either first apply as non-degree students and complete the MSCS Ready sequence, or they should complete the equivalent of MSCS Ready before applying as a degree-seeking student.

With pre-approval from the Computer Science M.S. program coordinator, MATH 8650 will be accepted as a prerequisite equivalent to Module 4 of the MSCS Ready sequence but will not count toward the Computer Science MS degree requirements. Enrollment in MATH 8650 is at the discretion of the Mathematical and Statistical Sciences department and cannot be guaranteed by the School of Computing.

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, 6420, 6430, 6550, 6620*, 8420, 8430, 8450, 8470, 8480*, 8490, 8620*, 8630, 8650
Foundations and Theory	8380, 8390, 8400, 8480*, 9400
Human Centered Computing	6110*, 6120, 6140, 6150, 6160*, 6180*, HCC 6400, 6510, 8310, 8330 8410, 8500, 8510
Networks, Systems, and Security	6180*, 6200, 6240, 6280, 6440, 6620*, 6770, 6780, 8200, 8220, 8240, 8510, 8520, 8550, 8570, 8580, 8620*, 8830, 8860
Software Engineering	6160*, 6720, 8270, 8280, 8290, 8700, 8710, 8720, 8730, 8750
Visual Computing	6030, 6040, 6050, 6110*, 6160*, 6170, 6190, 8030, 8050, 8110, 8190

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

For the course titles of each course, please see [courses of instruction](#). For syllabi, please see the [syllabus repository](#).

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, 8800, or 8910; or, HCC 8880, 9500, 9910. 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. Eric Patterson, ekp@clermson.edu, Charleston-Zucker

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

Digital Production Arts, Master of Science

Program Coordinator: Dr. Eric Patterson, ekp@clermson.edu, Charleston-Zucker

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

Human-Centered Computing, Doctorate

Program Coordinator: Dr. Kelly Caine, caine@clermson.edu, 213 McAdams Hall

Overview of Program

The objective of the Ph.D. 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 Ph.D. 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 Ph.D. 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 Ph.D. 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 Ph.D. 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 Ph.D. Please see the HCC Program Coordinator for detail.

Seminars

Full-time students in the HCC Ph.D. 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.

Ph.D. 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.

Master of Applied Computing

Program Coordinator: Prof. Carrie Russell, crusse4@clemson.edu, 212 McAdams Hall

Overview of Program

The Master of Applied Computing (MAC) is designed for students without a computer science background who wish to obtain [1] the requisite computer science background relevant to graduate study in computer science and [2] a sequence of graduate-level courses in a specific area of interest. The program is intended to expand access to graduate degrees in the field of computing and to develop the student’s understanding of computer systems and their ability to make effective use of those systems. Students graduating from the program will be able to:

1. Design and test procedural and object-oriented computer programs.
2. Compare the performance and storage requirements for different data structures.
3. Identify and explain the functions and operations of the hardware and software components of a computer system.
4. Formulate requirements for a computational problem.
5. Select algorithms and programming tools appropriate to problem solution.
6. Apply and evaluate computer-based systems for problem solution.

The program is designed for Fall entry. Completion as a full-time student will normally require two academic years and the intervening summer.

Requirements for Admission

Students with a baccalaureate degree in any field may apply. However, students who want to follow the Visual Computing track should have a good background in mathematics, including linear algebra. Students who want to follow the Artificial Intelligence and Machine Learning track or the Data Science track should have a course in statistics in their background or take a statistics course at Clemson in their first semester.

Degree Requirements

The MAC program combines 12 credit hours of the School of Computing’s [MSCS Ready program](#) with 30 credit hours of advanced coursework, for a total program requirement of 42 credit hours. The MAC program is coursework only. MAC students who later become interested in thesis research should talk with the MAC Program Coordinator about a change of degree program into the M.S. in Computer Science.

Students must pick one of six tracks within the degree. Each track is 15 credit hours. Individual track requirements are given below.

Artificial Intelligence and Machine Learning track

At least three courses selected from:	CPSC 6300: Applied Data Science; CPSC 6420: Artificial Intelligence; CPSC 6430: Machine Learning: Implementation and Evaluation; CPSC 8420: Advanced Machine Learning; CPSC 8430: Deep Learning; CPSC 8650: Data Mining
Additional courses needed to meet the five-course track can be selected from:	AUE 8240: Autonomous Driving Technologies; ECE 6420: Knowledge Engineering; ECE 8560: Pattern Recognition; ECE 8720: Artificial Neural Networks; MATH 8710: Machine Learning I; MATH 8720: Machine Learning II

Cybersecurity track

At least four courses selected from:	CPSC 6180: Usable Privacy and Security; CPSC 6200: Computer Security Principles; CPSC 6240: System Administration and Security; CPSC 8570: Security in Advanced Networking Technologies; CPSC 8580: Security in Emerging Computing and Networking Systems; CPSC 8830: Malware Reverse Engineering; CPSC 8860: Distributed Denial of Service (DDoS) Attacks
Additional courses needed to meet the five-course track can be selected from:	ECE 6490: Computer Network Security; PADM 8540: Cybersecurity

Data Science track

Required:	CPSC 6300: Applied Data Science; CPSC 8650: Data Mining
Additional courses needed to meet the five-course track can be selected from:	CPSC 6030: Data Visualization; CPSC 6420: Artificial Intelligence; CPSC 6430: Machine Learning: Implementation and Evaluation; CPSC 6620: Database Management Systems; CPSC 8030: Scientific Visualization; CPSC 8420: Advanced Machine Learning; CPSC 8430: Deep Learning; CPSC 8470: Introduction to Information Retrieval; CPSC 8480: Network Science; STAT 6020: Introduction to Statistical Computing; STAT 8010: Statistical Methods I; STAT 8020: Statistical Methods II

Human Computer Interaction track

Required:	CPSC 6140: Human and Computer Interaction; at least two additional graduate-level HCC courses
Additional courses needed to meet the five-course track can be selected from:	CPSC 6120: Eye Tracking Methodology and Applications; CPSC 6150: Mobile Device Software Development; CPSC 6180: Usable Privacy and Security; IE 6880: Human Factors Engineering OR IE 8000, Human Factors Engineering (but not both); IE 8010: Design and Analysis of Human-Machine Systems; IE 8020: Design of Human-Computer Systems; PSYC 8350: Advanced Human Factors Psychology

Software Engineering track

Required:	CPSC 8710: Foundations of Software Engineering
At least two courses from:	CPSC 8700: Software Design; CPSC 8720: Software Specification and Design Techniques; CPSC 8730: Software Verification, Validation and Measurement; CPSC 8750: Software Architecture
Additional courses needed to meet the five-course track can be selected from:	CPSC 6140: Human and Computer Interaction; CPSC 6150: Mobile Device Software Development; CPSC 6720: Software Development Methodology; HCC 6400: Measurement and Evaluation of Human-Centered Computing Systems; HCC 8310: Fundamentals of Human-Centered Computing; HCC 8500: The Science of Teamwork and Technology

Visual Computing track

Required:	CPSC 6040: Computer Graphics Images; CPSC 6050: Computer Graphics
Additional courses needed to meet the five-course track can be selected from:	CPSC 6030: Data Visualization; CPSC 6110: Virtual Reality Systems; CPSC 6160: 2-D Game Engine Construction; CPSC 6170: 3D Game Programming: Algorithms and Techniques; CPSC 6190: Physical Modeling and Animation; CPSC 8030: Scientific Visualization; CPSC 8050: Advanced Computer Graphics; CPSC 8110: Technical Character Animation; CPSC 8190: Physically Based Visual Effects

For the course description of each course, please see [courses of instruction](#). For syllabi, please see the [syllabus repository](#).

Credit hours:

- 12 of the 42 total credit hours for the degree must be the MSCS Ready modules.
- At least 21 of the 42 total credit hours must be at the 8000-level.
- At least 27 of the 42 credit hours must be taken as CPSC and HCC courses.

Courses outside the School of Computing: Courses offered by other departments must be preapproved by the MAC Program Coordinator to be applied to the MAC degree. The courses appearing in the tables above are already preapproved. Please note that courses offered by other departments may have field of study restrictions and/or prerequisites that individual instructors may not wish to override. Therefore, we cannot guarantee enrollment in the courses offered by other departments to our MAC students. Please note that each track can be fulfilled by taking CPSC and HCC courses only.

Transfer Credits: Students may include up to 9 credits of approved computing courses transferred from another university. Transfer courses will be listed as CPSC 6999 or 8999 on the GS2.

Course Exclusions: Of the 42 credits of approved courses required for graduation, students may not include credits for CPSC 6890, 74xx, 8880, 8910 95x0, 9810, 9910; DPA 6000-6030, 6810-6830, 8600, 8800, 8910; or HCC 8880, 9500, 9910. Additionally, only six credits of CPSC 6820 or CPSC/DPA/HCC 8810 can be included.

Assessment

Each student must submit three course-related artifacts and accompanying self-reflection prior to the approval of their GS2-committee selection.