

Computational Science and Engineering
Handbook for Students and Faculty

Computational Science and Engineering Faculty Committee

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1 Introduction

The Computational Science and Engineering (CS&E) Ph.D. Program engages faculty and students in interdisciplinary research and teaching that focuses on computational aspects of science and engineering. The CS&E program is unique in that it produces researchers who can understand both scientific and/or engineering problems and the computational theories and methods needed to implement solutions to these problems.

1.1 CS&E Mission Statement

The CS&E program's development of the procedures and policies is guided by the CS&E Mission Statement.

A Computational Science and Engineering program should be dedicated

- to preparing students to expertly use and develop computational environments and methods,
- to advancing research in new computational techniques to accurately model and solve problems in mathematics, the sciences, and engineering, and
- to advancing research in the sciences and engineering through the use of state-of-art computational techniques.

The research problems that the CS&E students will face are extremely large and complex problem that do not seem to yeild to conventional techniques. Many of these problem are at the front line of rapidly evolving disciplines.

The CS&E program at MTU stresses

- a broad and sound computational background including an understanding of system architecture, large-scale software development, analysis of algorithms, and numerical methods and
- a significant research experience in an application area including an understanding of the fundamental science and classical approaches.

MTU's CS&E program also supports interdisciplinary computational research by contributing to basic research in the sciences and engineering.

1.2 Students

Due to its interdisciplinary nature the CS&E program is demanding of students. In some ways, it is as if a student prepares to do research in two areas: computation and an application area. To ensure that students have the necessary preparation to succeed, the program requires that students have a rigorous academic background in an engineering, technological, or scientific field. Therefore, in most cases the program requires that a student have a masters degree in an engineering, technological, or scientific field to be admitted into the program.

Added to the difficulties of being in very active interdisciplinary areas, CS&E students also face the standard "problems" of being Ph.D. students. One of the purposes of this handbook is to give suggestions for making these challenges less difficult. If you, as a Ph.D. student, encounter a problem not covered here, please mention it to your advisor and/or the CS&E Director. Then, this handbook can be improved to make it even more useful for future students.

1.3 Faculty

Due to its interdisciplinary nature the CS&E program also places heavy demands on faculty members. Few CS&E faculty members are experts in both computational methods and an application area. Further, as interdisciplinary research both on and off campus continues to grow, there will be an ever increasing “mix” of “isolated” research areas. Thus, the faculty on advisory committees for CS&E students will in many cases need to actively work together to help the students reach their research goals. Further, faculty members will often need help from other faculty members as they work with CS&E students to choose relevant and meaningful courses to prepare the students for research and employment.

Thus, this handbook is also for faculty members as they work with each other and with CS&E students. If you, as a faculty member, encounter situations not covered here, please mention the situation to the CS&E Director so that this handbook may become more useful for faculty members.

1.4 Program

Although this handbook is designed to make being a CS&E student and faculty member easier and to let you know when to do what in your progression as a student or advisor, there will of course be situations in which the information contained herein is incomplete and insufficient. When you have doubts about existing rules and how they apply to your particular situation, see the Director of Admissions and Early Advising or the CS&E Director, as appropriate.

Further, in addition to this handbook students and advisors should obtain and read the MTU Graduate School publication *Keeping on Track in Graduate School*. In *Keeping on Track in Graduate School* you will find useful information regarding required procedures and deadlines set by the Graduate School. You will also find copies of all the forms students must submit to the Graduate School. In this CS&E Handbook whenever a required form is mentioned it will be followed by a “(*)”. Thus, you will see “Preliminary Program of Study(*)” for the form on which the student submits the list of courses s/he plans to take in support of her/his Ph.D. program.

2 Policies and Procedures

The CS&E Ph.D. program prepares students for research and teaching in academic, corporate, and government settings. The following policies and procedures have been established with this in mind. Questions about CS&E policies may be addressed to either the Director of Admissions and Early Advising or the CS&E Director.

In this section requirements for earning a Ph.D. along with many suggestions for students and faculty are given. When one is only interested in the requirements or for a quick reference, one should refer to Table 1, which lists the requirements in a time line format along with the form(s) which need to

Date Done	Degree Timeframe	Time Line Event	Who Initiates Action	Grad Sch Form
	before 1st semester	Meet Director of Early Advising (DEA)	Student	
	1st semester	Pick Initial Committee	DEA, Student	D2
	1st semester	Select Courses	Committee, Student	
	1st semester	Prepare Preliminary Program	Advisor, Student	D3
	End of 2nd year	Pass Comprehensive Exams	Student	D4
		Degree Schedule	Advisor, Student	D5
	D4 + 1 year	Pass Dissertation Proposal	Student	D6
	defense - 3 mos	Research Review	Student	
	defense - 2 weeks	Submit Oral Exam Form	Student	D7
		Successfully Defend Dissertation	Student	D8
		Submit Signed Dissertation	Student	

Table 1: Time Line for CS&E Ph.D. Program Requirements

be turned in. Further, a quick view of most of the requirements can be gotten by looking in the Graduate School publication *Keeping on Track in Graduate School*.

2.1 Admissions

Applicants should have a masters degree in an engineering, technological, or scientific field before beginning in the CS&E Ph.D. program. Applications are accepted for fall, spring and summer semesters. Applicants should, however, be aware that most types of financial aid begin in the fall semester. To be ensured full consideration for financial aid, applications for fall admission should be received by February 1 of the same year.

Applications for admission may be obtained by writing the Graduate School or the Computational Science and Engineering Program at Michigan Technological University, Houghton, Michigan 49931, USA. Among other things, the application asks for official transcripts of all university work, TOEFL scores (if English is not your native language), and a Statement of Purpose. GRE (Graduate Record Examination) scores are requested though not required. It may also be helpful when your application is evaluated if you have taken a GRE subject examination.

In addition to what is asked for on the application form, the CS&E program requires that your application include three letters of reference. Reference letters may be submitted with your application, or sent separately. An application, with or without letters of reference, should be sent to the Graduate School:

Graduate School
Michigan Technological University
1400 Townsend Drive

Houghton MI, 49931
USA

If the letters of reference are sent separately, then they should be sent to the Computational Science and Engineering Program:

Computational Science and Engineering Program
Michigan Technological University
1400 Townsend Drive
Houghton MI, 49931
USA

Inquiries about the CS&E program may be made via email; the email address is `cse@mtu.edu`.

During the first semester of residence the student should turn into the Graduate School the form *Acceptance into the Doctoral Program*(*). This form must be signed by the Director and the Dean of the Graduate School.

2.2 Choosing an Advisor

An advisor should be chosen during the first year of residence. Until the advisor is chosen the student will be advised by the Director of Admissions and Early Advising. *Keeping on Track* suggests that the advisor be chosen during the first semester of residence. An advisor must be a member of the MTU Graduate Faculty.

A student and professor should know about each other before choosing to work together. The student should know the research interests of the professor and what the (potential) advisor expects of graduate students. The professor should know the work habits of the student, and the student's research interests. And each should be comfortable working with the other.

Each student will have an advisor (or supervising professor) with whom s/he will work very closely, especially when doing research. Choosing an advisor is one of the most important decisions that a Ph.D. student makes. A student's advisor helps decide what classes are taken, what research topics are investigated, and in some cases what types of financial support are made available to the student. Further, an advisor should be instrumental in helping a student obtain a position after graduation.

Although *choosing an advisor* is a common expression, it is somewhat misleading. The *choosing* is two way. The student chooses the professor, but the professor must also choose the student. Even if you as a student want to work with a certain professor, s/he may not choose or be able to work with you. There are many reasons a professor may decide not to work with a student – the professor may be advising too many students to give adequate supervision and support to you at this time; the professor may not feel qualified to supervise work in the research area in which you are interested; the professor may feel that you would not work well together; The point is that although the expression *choosing an advisor* is used, both students and faculty must be

realize that each party must choose the other. Just as choosing an advisor is an extremely important decision for a student, it is also important for a professor. Professors commonly give a student considerable help in finding a research problem; often the problem is one that the professor already knew about and would perhaps have been working on in the near future. Thus, in some cases, the future research of not only the student but also the faculty member depends on the student's work. Though Ph.D. students are usually bright and capable of doing high quality research, they need time and training to become capable researchers. Much of this time and training will come at the expense of their advisor's time. A faculty member needs, therefore, to consider many things before choosing to be an advisor for a Ph.D. student.

2.3 Advisory Committee

Working together, the student and advisor will decide on an Advisory Committee. An Advisory Committee consists of a minimum of four faculty, including the advisor. All MTU members must also be members of the MTU Graduate Faculty. There must be faculty from at least two university departments. It is suggested that one advisory committee member be a non-MTU faculty member, chosen with the explicit intent of providing research expertise. This person, who does not need to be involved with advisory activities until the research discussions/activities begin, will have adjunct faculty status – limited to serving on the Advisory Committee of the given Ph.D. student. Requests for an adjunct faculty appointment should be made to the Graduate Dean in the form of a memo accompanied by a résumé of the proposed committee member. As is the case with *choosing* a major professor, so it is with *choosing* members of an Advisory Committee; the members must also agree to be on the Advisory Committee.

The Advisory Committee becomes official by having each member sign the *Recommended Advisory Committee*(*) form. As this form must also be signed by the Director and the Dean of the Graduate School, these two persons, in effect, approve the Advisory Committee. As noted in *Keeping on Track*, the *Recommended Advisory Committee*(*) form should be turned in during a student's first semester of residence.

The Advisory Committee

- approves the courses that the student will take,
- approves the components of the comprehensive examinations,
- has the final decision regarding pass/fail of the comprehensive examinations,
- approves the dissertation proposal,
- works with the student and advisor in advising, encouraging, and approving the dissertation research,

- attends the research review,
- approves the scheduling of the final oral examination,
- has the final decision regarding pass/fail of the oral dissertation defense, and
- has the final decision regarding the acceptance of the dissertation.

Because these activities are important steps in earning a Ph.D, students should take care in choosing Advisory Committee members; the members should have an interest and expertise in the planned research.

It should be noted that although the above list is given as a list of activities which an Advisory Committee approves some of the activities must also be approved by the Dean of the Graduate School and/or the CS&E Director.

Most of the activities in the above list are relatively common in any Ph.D. program. However, given the interdisciplinary nature of CS&E research, it may be that a CS&E Advisory Committee will need to be more active in “promoting and approving the research” than might be the case in a Ph.D program in a single discipline. Further, because it may be common for the proposed research to include subareas in which the advisor is not an expert, it will be especially important to choose Advisory Committee members with expertise in these subareas who are willing to be actively involved in the research.

Any non-MTU Advisory Committee member will be involved only in those above-listed activities related to the research. Further, though the non-MTU member would certainly be welcome to attend the presentation of the dissertation proposal and the final oral examination, attendance is not mandatory. Her/his vote will, of course, be required for the approval of the dissertation proposal and for the final dissertation.

2.4 Courses

The rules for the minimum number of credit hours one must accumulate for the CS&E program must also satisfy the Graduate School requirements. The minimum number of credits one must take are as follows:

- at least 12 hours of course work at the 5000 level or above,
- at least 18 hours of course work at the 4000 level or above, and
- at least 30 hours of course work or research credit.

Notice the subset containment inherent in these requirements. These courses must be approved by the Advisory Committee on the *Preliminary Program of Study** form. They will form the basis for the computational part of the comprehensive exams.

The Advisory Committee approves the required courses by signing first the *Preliminary Program of Study(*)* and then later the *Degree Schedule(*)*. It is requested in *Keeping on Track* that the *Preliminary Program of Study(*)* be turned in during the second semester of residence.

2.5 Comprehensive Examinations or Prelims

The comprehensive examinations, sometimes called *prelims*, consist of two basic parts: a computational part and a speciality part. The comprehensive exams serve to show that CS&E students have

1. the intellectual potential to do doctoral research,
2. the computational background to do CS&E doctoral research, and
3. the special area background to do doctoral research in the chosen speciality area.

Items one and two are verified by the computational exams and items one and three are verified by the specialty exams.

To ensure some uniformity while allowing for meaningful variations the format of the computational examination must be approved by the CS&E Director and the CS&E faculty committee.

2.5.1 Computational Examinations

The computational part covers the computational background needed to do research in the area chosen by the student and advisor. The computational examination will usually consist of three exams that cover course work. The Advisory Committee will determine the specific courses to be covered in the exam. The Advisory Committee working with the faculty writing and grading the exams will determine if the computational exams will cover only the course materials or also extra materials. Typically, each exam is three hours long and covers only course material. If extra materials are covered, they should be explicitly known to the student at least eight weeks in advance of the exam.

It is often the case that a computational exam corresponds to a prelim exam given in the ‘home’ department. For example, many CS&E students take a computational exam that covers the algorithms course offered in the Computer Science department. In this case, the corresponding CS&E exam must be taken at the same time as the departmental exam. Usually it will be the case that the faculty who prepare the departmental exam will prepare and grade the corresponding CS&E exam. The Advisor should coordinate with the respective departments to arrange for a reasonable exam schedule for the CS&E student.

After all parts of the computational exams are taken and graded, the Advisory Committee will meet to decide which of the following three possible exam outcomes is appropriate.

pass A *pass* means that, based on the exam results, the Advisory Committee judges that the student has the intellectual potential and the computational background to do CS&E doctoral research in her/his chosen area. Having the “computational background” does not mean that the student knows all that needs to be known to do the research. It does, however, mean that the student has mastered enough preparatory material so that

the research can begin in the near future. It also means that the student will be able to reach the necessary computational maturity in time to do the research.

conditional pass A *conditional pass* means that, based on exam results, the student though seemingly having the potential is nevertheless lacking in some significant area. Thus, the *conditional pass* allows the student to make up this deficiency. The student will be given explicit written instructions as to what needs to be done to obtain a *pass* on the computational exam, and will be given adequate time to satisfy those requirements. The deadline for meeting the requirements of a *conditional pass* must be given in writing to the student. After the student has completed the required work for the *conditional pass* or after the deadline has passed, the Advisory Committee will decide if the requirements have indeed been met. If they have been, the student will receive a *pass*; if not, the student has failed the computational exam. In deciding *pass* or *conditional pass*, an Advisory Committee vote of 75% is required.

fail A *fail* means that, based on the exam results, the Advisory Committee either judges the student has not demonstrated the intellectual potential to do doctoral research or has not shown the necessary computational background to do research in the chosen area.

2.5.2 Speciality Examinations

The Advisory Committee determines the format and makeup of the speciality exam. This exam tests the student's intellectual potential and knowledge in her/his chosen area of research. Possible formats for this exam are a written or oral exam over selected research papers or the writing of a critical summary of selected research papers. The speciality exam is often combined with the dissertation proposal described below. In this case, the student makes a public presentation of the proposed dissertation research, followed by a closed session in which advisory committee administers the exam and provides detailed comments on the plans for the dissertation.

Again, as with the computational exam, the Advisory Committee will review the results of the speciality exam and decide on a *pass*, *conditional pass*, or *fail*, and again a vote of 75% is required for a *pass* or *conditional pass*. In the case of a *conditional pass*, the actions of the Advisory Committee parallel those outlined above for the computational exam.

The computational exam should be taken by the end of the second year of residence; the speciality exam should be taken within one academic year of passing the computational exam. Though a CS&E student is not required, for example, to take the computational exam until the end of the second year, s/he is advised to take it as soon as feasible.

Each exam—the computational and the speciality—may be taken twice. If either is not passed by the second try, the student will be dismissed from the

CS&E program. A student may take the speciality exam before the computational exam. However, the computational exam should still be taken by the end of the second year of residency in the program.

After each part of the comprehensive examinations, the Advisory Committee may, if it wishes, meet with the student to discuss the results and/or contents of the examination. The Advisory Committee may wish to meet with the student before determining the outcome, i.e., *pass*, *fail*, or *conditional pass*, of an exam.

After successfully completing the comprehensive examinations, the form *Report on the Comprehensive Examination*(*) should be filled out and turned in to the Graduate School. The student is now said to have obtained Doctoral Candidacy.

2.6 Dissertation Proposal

The dissertation proposal marks the beginnings of the doctoral research and the dissertation itself. The dissertation proposal and the speciality exam serve different purposes. They should be thought of as separate activities, even though they are often executed concurrently. The purposes of the dissertation proposal are:

- for the student to isolate and formulate a particular problem or a small set of particular, related problems whose solution is important to the research community and whose solution is significant enough to merit being called doctoral research,
- for the student to assimilate background information to demonstrate understanding of the research that has been done on the problem(s) and how to proceed,
- for the Advisory Committee to decide if the student has done the first two items sufficiently well,
- for the Advisory Committee to make suggestions as to
 - additional background information which should be considered
 - how the research problem(s) should be modified, and/or
 - how the proposed methods of investigation should be modified,and
- for the Advisory Committee to verify that, if the proposed research goes as planned, results will be worthy of doctoral research.

The first two items are, of course, interrelated. A student needs to do background studies to isolate and formulate research problem(s) and learn which research methods are appropriate to potentially (help) solve the proposed research problems.

From the perspective of a student beginning Ph.D. studies the thought of doing good and appropriate background studies may seem overwhelming. For some research questions there is, after all, a great deal of relevant background material, and, indeed, background studies for some research questions could be overwhelming, especially if a student had to do these without guidance. However, the advisor and other members of the Advisory Committee can help make this task of assimilating the appropriate background materials doable, exciting, and rewarding.

The dissertation proposal involves preparing a written document and then presenting it orally in a public forum. The written document should include:

- background material,
- a well defined research problem,
- a plan for solving the research problem, and
- criteria for determining that the problem has been adequately solved.

The background material should be adequate so that the final three parts of the dissertation proposal can be fully understood and evaluated. In addition to the above listed items, students are encouraged to provide both a timeline for completion of the research and dissertation and an outline of the proposed dissertation chapters. One goal of the proposal should be to describe the research and dissertation in as much detail as possible so that both student and committee have a clear view of the proposed work.

The date and time of the proposal shall be announced at least two weeks in advance, and the final version of the written proposal must be given to all Advisory Committee members at least two weeks in advance of the oral presentation. Further, at least two weeks in advance of the oral at least one copy of the proposal shall be available in the department office of the advisor and at least one copy in the department office of the CS&E Director.

After the dissertation proposal is presented, the Advisory Committee must decide if the student is prepared to proceed to the dissertation research project. Thus, the Advisory Committee must decide if the proposed research project is doable and whether the proposed work would be sufficient for a dissertation. A 75% vote of *pass* is required for the student to pass the proposal. However, it is in the student's best interest to work with the Advisory Committee on the written proposal until everyone on the committee feels comfortable voting *pass* because then each Advisory Committee member is in favor of the proposed research activities from the beginning. This reduces the likelihood of committee concerns about developments during the research process.

Following the proposal defense, the Advisory Committee may recommend changes and/or ask for additions to be made to the dissertation proposal. Depending on the magnitude and importance of the recommended changes and/or additions, the Advisory Committee may require a second public dissertation proposal presentation, may ask the student to make the changes/additions in writing and submit them to the Advisory Committee for their approval, or may

simply ask the student to make note of their suggestions. After passing the dissertation proposal, the student must turn in to the Graduate School the form *Approval of Dissertation Proposal*(^{*}).

Ideally, a student preparing for the dissertation proposal informs the Advisory Committee about progress. Thus, after obtaining most of the information needed for the dissertation proposal, the student could make a short outline of research plans and send this outline to the committee asking for comments and feedback. Further, the student, upon giving the written proposal to committee members, should ask for a meeting with each committee member in about a week or ten days to discuss any comments, suggestions, or questions regarding the proposal. The intent of maintaining close ties with the Advisory Committee is to avoid major surprises at an oral presentation. The Advisory Committee members should know what the student is doing and the student should know what the committee members think about the proposal. Then, at the oral presentation, the committee members can work together to see how the proposal can be improved which is what the student wants.

2.7 Dissertation Research

After successfully presenting a research proposal, the next step is to do the research itself. There are many different methods and approaches to research. For some types of research, especially theoretical research, the research is done in incremental steps. For other types of research, especially experimental research, the experiments are planned and executed, and then, results are evaluated to see if new research results can be concluded from the experimental results.

For most students, the first research results will be obtained by working closely with the advisor. As students learn how to do the research and learn what types of results are considered research results, they will often design and implement their own experiments to obtain original results. In this manner, students become researchers in their own right and make original contributions to their field.

As many CS&E students are working on interdisciplinary projects and as many faculty are not fully trained as interdisciplinary researchers, it may often be the case that several members of an Advisory Committee will become actively involved in making suggestions regarding the student's research. However, although many committee members may become actively involved in research advising, it should be clear that the advisor directs the student's research.

In order to assess a student's progress, the student and Advisory Committee should plan to meet at least once each semester after the dissertation proposal has been approved. Prior to these meetings, the student should prepare a summary of research activities since the last meeting (or since the dissertation proposal.) The level of detail in these summaries depends on the student's recent research activities and the requests of the members of the Advisory Committee. However, the student should always be prepared to go into detail during these meetings. The non-MTU Advisory Committee member will be sent copies of the summaries.

2.7.1 Research Review

At least three months before the (planned) final oral defense or examination, the student and the Advisory Committee will meet for the research review. The research review is an opportunity for the student to present Ph.D. dissertation research to the committee. Though the student may very well obtain additional research results between the research review and the oral defense, research presented at the research review should be sufficient for a Ph.D. dissertation. The purposes of the research review are to:

- force the student to bring all the research together in a unified form,
- allow the Advisory Committee to see the research as a unified whole,
- give the Advisory Committee members the opportunity to make suggestions for good ways of organizing and presenting the results in the dissertation, and
- give the Advisory Committee the opportunity to raise any concerns they have regarding the research and proposed presentations in the dissertation.

In preparation for this review the student should prepare an outline of the research accomplishments. This outline should be given to all committee members at least one week prior to the research review. The primary focus of the research review is to anticipate potential difficulties, hence the Advisory Committee should make every effort to identify any potential problems at the research review.

The research review does not guarantee that the student will pass the oral examination. Since the passing or failing of the final examination may in part be determined by the presentation of the research, the student and Advisory Committee should discuss the dissertation format and how the research will be presented in the dissertation during the research review.

Questions of the dissertation format are important ones. The traditional format of a dissertation presenting background and new results in an unified whole is being replaced in some departments and in some cases by a collection of research papers with a unifying introduction. At least by the time of the research review questions of format need to be resolved. In fact, if a student or a major professor would prefer a dissertation consisting of a collection of papers, this decision should probably be addressed relatively early in the student's Ph.D. program, especially if it would be required that some of the papers be published or accepted for publication before the dissertation may be defended.

There is no passing or failing of the research review, but the student should try to ensure that each committee member is satisfied with the student's research. Any questions in the student's mind should be resolved with the appropriate committee member(s). Further, any committee questions concerning the research should be resolved with the student at this time. Questions from both the student's side and the committee members' sides should be resolved before the student prepares the final drafts of the dissertation. If there are questions,

the best way to resolve them may be for the student to meet individually with the concerned committee members, or the Advisory Committee may feel that the research review should be repeated. This repeat of the research review could come after the student meets individually with some of the committee members.

In summary, it is expected that Advisory Committee members will raise research and/or presentation questions as much as possible in advance of the final defense. However, whenever questions are raised, the student has primary responsibility for resolving any issues or concerns.

2.7.2 Writing the Dissertation

After the research review the student's main efforts should be directed towards writing the dissertation itself. The level of Advisory Committee involvement should be agreed upon by the Advisory Committee and the student at the research review. In some cases, the student may send drafts of individual chapters to each Advisory Committee member. In others, the student may share several complete dissertation drafts with the advisor, incorporating the advisor's suggestions and comments, *before* the rest of the Advisory Committee sees any part of the dissertation. No matter what model of interaction is agreed upon, however, the student should realize that substantial time might be required to incorporate the suggestions and comments of the Advisory Committee.

2.7.3 Scheduling of the Final Oral Examination

Once the dissertation is finished and the Advisory Committee's suggestions and comments have been incorporated by the student, it is time for the final oral examination. Four weeks prior to the final oral defense or examination, the student must give each member of the Advisory Committee (including a non-MTU member) a copy of the final dissertation. This will allow the Advisory Committee two weeks to review the final dissertation before signing the *Scheduling of Final Oral Examination*(*) form. After each committee member has reviewed a copy of the dissertation and has determined that the copy is of oral exam quality, then each should sign the *Scheduling of Final Oral Examination*(*) form. This form is due in the Graduate School office two weeks before the final oral examination. In scheduling the final oral the student should also keep in mind that faculty members have many commitments and often travel. Thus, a student should start planning for the oral defense several weeks in advance.

After the *Scheduling of Final Oral Examination*(*) form has been signed and at least two weeks before the final oral, a copy of the dissertation must be available in the main office of the advisor and in the main office of the CS&E Director. This copy of the dissertation will most likely not be the final copy; there will likely be changes made after the final oral. However, this copy is the one upon which the passing or failing of the final oral is determined.

In an effort to meet deadlines, students sometimes are tempted to give committee members a copy of the dissertation which is incomplete, with plans to make further changes before the oral itself. This should not be done, and after

signing the *Scheduling of Final Oral Examination*(*) form, committee members are free to not accept any subsequent copy of the dissertation until after the oral. Of course, if mistakes or major problems are discovered, it is good for the student to make these known to the committee members. However, the committee members are free to consider these changes as possible post-oral changes. The draft of the dissertation which the committee members have when they sign the *Scheduling of Final Oral Examination*(*) form is the draft of record for the final oral examination.

2.7.4 Final Oral Examination

The final oral examination or defense is a public presentation of the student's research and research results. The presentation should contain general background information understandable by other Ph.D. students in the CS&E program. Then, the presentation should focus on the new research results. The details of the dissertation research may be fully understandable only by those familiar with the research area, but the candidate should make every effort to make this material equally understandable by her/his audience.

After the presentation, anyone in the general audience including members of the Advisory Committee may ask questions. Then, the general audience will be excused; those remaining will be Advisory Committee members or CS&E Faculty. Anyone in this restricted audience may ask questions. Finally, everyone is excused except the Advisory Committee and the student. Members of the Advisory Committee may ask whatever questions they wish concerning the research and the student's Ph.D. program.

Finally, the student is excused, and the Advisory Committee must decide if the student passes or fails the final examination. A student passes the final oral examination if no more than one member of the Advisory Committee dissents and if the student addresses the dissenting member's concerns (given in writing) to the satisfaction of the committee chair and the Dean of the Graduate School. (This last statement essentially comes from the *Report of Final Oral Examination*(*.) The committee may make its passing contingent upon certain changes being made in the dissertation.

If the student fails, s/he may take the final examination a second time. After a second failure the student is dropped from the program.

After passing the oral examination, the student submits to the Graduate School the *Report on Final Oral Examination*(*).

2.8 Teaching Portfolio

Since a major objective of this Ph.D. program is to prepare students for academic careers, provisions will be made to assist students in preparation for careers in academia. Thus, students in the CS&E Ph.D. program will be strongly encouraged to prepare a *teaching portfolio* during their studies. To complete a teaching portfolio, a student is expected to teach at level(s) and in subject area(s) selected by mutual agreement with the CS&E Director and the student's

advisor. Some students will fulfill this teaching requirement through their responsibilities as a Graduate Teaching Assistant. For others, the student's advisor is responsible for arranging for the student to teach an appropriate course. Prior to the student's teaching assignment, the student, advisor and CS&E Director (or someone whom s/he designates, for example, the leader of the teaching working group – see below) will determine what training the student should receive in preparation for instructional duties. In addition to teaching experience, a student will prepare a portfolio of written materials that includes at a minimum: a personal teaching philosophy statement and course materials generated while teaching. In addition, a student might include such additional materials as seems appropriate, including, but not limited to:

- A complete curriculum plan for an undergraduate or graduate program either in CS&E, or some subdiscipline studied within the broad field of CS&E.
- Detailed notes on some novel approach to teaching a particular course or courses.
- Detailed plans for a Teaching Assistant training program.
- Description of effective teaching evaluation methods.

3 Financial Support

The CS&E program endeavors to support all students who need financial support using a combination of external and internal funding. Since CS&E is an interdisciplinary degree program, the funding opportunities are quite varied and cross disciplinary boundaries. The CS&E admissions committee will endeavor to find funding opportunities for each incoming student appropriate to that student's background. All applicants to the CS&E program will be automatically considered for financial support, but it would be wise to indicate relative preferences for fellowship, GTA, or GRA assignments.

Decisions on financial support and contract offers for the upcoming academic year are typically made in the spring semester.

Applicants for GTA positions are asked to submit two documents:

- A statement describing their interest and background in teaching (if any). This statement should include details about their teaching experience including training, tutoring, counseling. Since the CS&E program spans several traditional departments, this statement should also include detailed discussion of what course(s) the student feels qualified to teach.
- Letter(s) of recommendation about their teaching potential and/or skills.

Applicants for GRA positions should submit a current vita emphasizing their research qualifications.

The CS&E program often offers doctoral fellowships funded in whole or in part by the Graduate School Office. Some are full fellowships and some require work on a specific research project or in teaching.

4 Conferences and Travel Support

It is important for students to attend conferences in their area of research. Often travel support will be available through various research grants, but students should not depend upon this. Students should be aware that limited travel funds are available from the Graduate Student Council (GSC). An application form with instructions is found in *Keeping on Track*.

5 Grievance Procedures

Faculty or students who have concerns or complaints about the behavior of other faculty or students in professional situations (other than questions of plagiarism) or about interpersonal relationships between faculty and students (other than those related to sexual discrimination or sexual harassment) should voice those concerns or complaints through the grievance procedures described below. These procedures are designed to protect the rights and privacy of both faculty and students and to equitably adjudicate conflicts among faculty and students.

¹

Faculty and students should avoid as much as possible discussing their complaints with their colleagues. Questions of plagiarism should be handled in concert with the Dean of Students. Faculty or students who feel they have been subjected to discrimination based on sex or sexual harassment, suspect an unfounded discrimination complaint may be filed against them, or have been threatened with the filing of such a complaint should notify the Affirmative Action Officer as soon as possible.

5.1 Student Complaints

Students have the right to fair and equal treatment by administrators and to expect professional behavior from other faculty and students. Professional behavior includes such matters as a respect for expertise, individual beliefs, and personal privacy. Students should be aware that the campus provides an ombudsperson, whose duties are described in the Graduate Student Bulletin; one of the functions of the ombudsperson is to process student complaints. Students who have complaints about administrators, faculty, or other students should first discuss their complaints with the person concerned, if possible. If the complaint cannot be resolved in this way, they should discuss the complaint with the Director of Admissions and Early Advising who will discuss the complaint

¹This section is taken almost literally from the grievance procedures listed in the RTC graduate student handbook.

with the administrator, faculty or student in question, attempt to resolve the problem, and report to the CS&E Director. If resolution is not possible at this level, the complaint will be referred to the Dean of the College of Engineering. Grievance procedures for students who wish to appeal their dismissal from the program are described in the Graduate School Bulletin.

5.2 Faculty Complaints

Faculty have the right to fair and equal treatment by administrators and to expect professional behavior from other faculty and students. Professional behavior includes such matters as a respect for expertise, individual beliefs, and personal privacy. Faculty who have complaints about administrators or other faculty should first discuss their complaints with the person concerned, if possible. If the complaint cannot be resolved in this way, faculty should discuss the complaint with the CS&E Director, or the Dean of the Engineering College, or if that is not possible or resolution cannot be attained, they should contact the ombudsperson. Faculty who have complaints about graduate students should first discuss their complaints with the person concerned, if possible. If the complaint cannot be resolved in this way, they should discuss the complaint with the Director of Admissions and Early Advising, who will discuss the complaint with the student, attempt to resolve the problem, and report to the CS&E Director. If resolution is not possible at this level, the complaint will be referred to the Dean of the Engineering College. Faculty members should be aware that the campus provides an ombudsperson, whose duties are described in the “Handbook for Academic Faculty”; one of the functions of the ombudsperson is to investigate faculty complaints.

6 CS&E Courses

The interdisciplinary nature of the CS&E program means that core courses from a variety of departments will be useful to the Ph.D. students. Listed here are only those courses that specifically appear under the “CSE” course designation. There is also a wealth of other courses offered by departments throughout the university which will be appropriate for students to consider. Naturally, the courses taken will be decided on an individual basis by each student in consultation with her/his advisory committee.

CSE 5091 CS&E Seminar From time to time, depending on student demand, a seminar will be offered on current topics in computational science and engineering.

CSE 6091 CS&E Seminar From time to time, depending on student demand, a seminar will be offered on current topics in computational science and engineering.

CSE 6990 Doctoral Research By arrangement with the instructor directing the PhD dissertation.

CSE 6999 Doctoral Reading and Research Individual reading and research on current topics in computational science and engineering.