CMSC-693 Guidelines

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All too often, students attempt to complete their CMSC-693 Research and Writing Skills projects in a mad last-minute rush. Some students provide their committee members an incomplete draft two or three weeks before the deadline, only to learn that the committee finds the draft inadequate. This memorandum aims to help students finish their projects in a successful and timely fashion, by explaining what it means to complete an acceptable 693 project. Specifically, this memorandum gives an overview of CMSC-693, enumerates the major steps in completing 693, describes 693 deadlines, and states necessary standards for the research, report, writing, oral defense, and final copies of the report.[1]

What is CMSC-693?

CMSC-693 is a two-credit course in which the student, under the supervision of a 693 Advisor, carries out a research project and presents the results in a technical report. 693 may be taken over one or two semesters and is required for the M.S. degree in Computer Science. Many students find the 693 requirement the biggest challenge in their M.S. program.

The Nine Steps of CMSC-693

There are nine major steps in completing a 693 project:

1. The student establishes a working relationship with a professor who agrees to supervise the project. We shall refer to this professor as the *693 Advisor*, or *Advisor* for short.

2. In consultation with the Advisor, the student chooses a project and sets reasonable goals that define completion of the project.

3. In consultation with the Advisor, the student chooses one additional UMBC professor to serve as a *Reader* on the 693 Advisory Committee. The *693 Advisory Committee*, or *Committee* for short, consists of the Advisor and one Reader. The student fills out a *Program of Study Form*, has each member of the Committee initial the form, and submits the completed form to the Department's Graduate Secretary (Kathy Flynn—henceforth called the *Graduate Secretary*). If Committee membership changes, a new form must be filed. The Committee may include more than one Reader.

4. The student carries out the research and writes a technical report. It is expected that the student maintain a close working relationship with the Advisor during this period.

5. After all Committee members agree that the written report is acceptable, the student defends the report in an oral presentation.

[1] A "necessary standard" is a standard that is required, but which is not necessarily sufficient.

6. After all Committee members agree that the oral defense and written report are acceptable, the Advisor signs the report.
7. The student duplicates the signed report according to 693 specifications.
8. The student submits three copies of the signed report to the Graduate Secretary. Do not bind the report.
9. After the student has handed in three acceptable copies of the report, the Advisor submits a grade to the Registrar.

Deadlines

The deadline to complete the 693 requirements within any given semester is the last day professors may submit grades to the Registrar for that semester. This deadline is stated in the official University calendar. To meet this deadline, the student must allow sufficient time to carry out the research, write the report, **repeat** {allow the Committee members to read the report, revise the report} **until done**, complete the oral defense, and duplicate the report. The student should allow at least two weeks to receive feedback from any Committee member on the written report or on any major revision thereof. Moreover, the student must allow for unexpected delays, including computer system failures. Start early and plan ahead: most students grossly underestimate the time required to complete their 693 project.

If the student plans to graduate within the current semester, the student should finish a "complete reasonable draft" of the written report no later than one month prior to the deadline. A draft is "complete" if and only if it is both "scientifically complete" and "complete in document," as explained in this memorandum. A draft is "reasonable" if and only if no major revisions are required.

Grading

CMSC-693 is graded on a pass/fail basis. The grade is issued by the Advisor, who will not submit a passing grade until all Committee members agree that the written report and oral defense are acceptable and until the student has submitted three acceptable copies of the report to the Graduate Secretary.

If the student takes two semesters of 693, each semester carries one credit. If the student takes one semester of 693, that semester carries two credits. The student is not allowed to register for more than two credits of 693.

For any semester during which the student is registered for 693, if the student does not complete all 693 requirements by the end of the semester, the student will receive a grade of incomplete or fail. For example, if a student registers for two semesters of 693, and if the student makes satisfactory progress during the first semester, then the student will receive an incomplete for the first semester.

Research Requirements

Although the 693 project is not required to satisfy the originality requirements of a research master's thesis, the project must nevertheless contain some identifiable original content.[2] The original contributions of the project must be clearly identified in the written report. It is helpful to describe your project in terms of some interesting question that you answer. The project must be nontrivial and appropriate for two-credits of graduate-level work. The rest of this section explains additional necessary requirements for the research.

You must have a clearly identifiable "thesis," consisting of a topic together with an attitude about the topic. The attitude is a proposition, or point of view, which is developed and defended in the report. For example, your thesis might be "chess endings can be perfectly solved using dynamic programming." A topic without an attitude is not acceptable.

Instead of undertaking an original research project, some students write a critical survey of a focused domain or a critique of two or three closely related research papers. Such projects are fine, provided they contain original content in the form of careful, thoughtful, critical analysis. It is not acceptable simply to summarize one or more research papers.

The report must be scientifically correct. All facts, proofs, and calculations must be correct. All reasoning must be logically sound.

In addition, the report must be "scientifically complete" in the following four senses. First, the report must satisfy the goals set out for the project, for example, by answering a key question underlying the research. Second, the report must address—or at least identify—all important questions that arise from the project. For example, if the report presents a new algorithm, the report must evaluate the algorithm with regard to its correctness, complexity, and implementation difficulty. Third, every claim must be justified, or clearly identified as conjecture. Finally, all results—from experimental data to mathematical theorems—must be explained: it is unacceptable to present results without interpreting them.

The report must be free from any egregious problems of scholarship (*e.g.* plagiarism, falsification of data, inadequate attribution).

Note that experimental work on human or animal subjects requires University approval.

Although the report is not required to meet the requirements of refereed scientific journals, the Department encourages students—especially those intending to pursue a Ph.D.—to adopt this standard as their personal goal.

Form, Organization, and Completeness of Document

The written report must take the form of a technical report. Sample reports are available for inspection from the Graduate Secretary.

The organization of the report should be appropriate for the type of project undertaken. For example, for projects that focus on original research, the organization should be based on the standard outline for scientific writing: motivation, methods, results, discussion. Other outlines might be more appropriate for reports that are critical surveys.

Although you are not required to follow the standard four-part scientific outline exactly, it is prudent for your outline to resemble or to embellish upon this basic outline. The introduction must succinctly identify and motivate the problem you address. In the conclusion, you should

[2] Although some departments at UMBC offer an M.S. thesis option, the Computer Science Department does not.

summarize your findings, explain their significance, discuss open questions, and explain what it all means to you. Often it is helpful to include an example immediately after the introduction to illustrate your main ideas.

If your project involves any computer work, you must include as an appendix all source code that you wrote. Doing so documents your methods so that the reader can verify your claims.

Finally, the written report must be "complete in document" in the sense that it has each of the following eight items:

1. Title page. The title page must include an informative title, author name, "693 statement" (see Figure 1), date, list of all Committee members, and a signature line for the Advisor. On formal documents, including theses and 693 reports, it is customary for the author to use her complete legal name.[3] For each Committee member, give the member's name, role in committee, and academic title. List the Advisor first, followed by all Readers in alphabetical order. The date should be the date on which the Committee approves the report.

2. Abstract page. The abstract page must include the title, author name and affiliation, date, informative abstract, and list of keywords. Choose keywords that will be helpful to researchers in finding your paper.[4] The abstract should succinctly summarize the main results of the paper, focusing on its original contributions. The date should be the same as the date on the title page.

3. List of contents.

4. List of tables and figures (optional).

5. Body. The body is a sequence of numbered sections, typically starting with "Introduction" and ending with "Conclusion."

6. Acknowledgments. A brief statement identifying the source and nature of all help you received. Be specific.

7. References. A complete and accurate list of all sources cited in the report. Follow the style used in any major computer science journal.

8. Appendices (if any).

A sample title page and abstract page appear in Figures 1–2 at the end of this memorandum. The LaTeX source code that generated these samples can be found in directory `/faculty/dept/693` on the Department's network of workstations.

Writing Requirements

The written report must satisfy the standard requirements of computer science technical reports. In particular, the report must be written in clear and grammatically correct English sentences. At all times, be informative and helpful to your reader.

[3] By contrast, for research papers, most authors use an abbreviated academic pen name.

[4] For advice on choosing keywords, see the author guidelines from refereed computer science journals.

Organize your report in paragraphs, each of which has one main idea. The main idea of each paragraph must be clearly identified in a topic sentence, which is typically the first sentence of the paragraph.

Take as your audience an 'A'-student in the core graduate course most closely related to your subject. Write in such a way that this audience will be able to understand your report without unreasonable effort.

You must provide enough detail and explanation for the audience to be able to verify with ease the correctness of each step in every argument and calculation. In those rare exceptional cases when it is permissible to leave a gap in an explanation (*e.g.* a long, straight-forward, tedious algebraic calculation), inform the reader that a gap exists and explain how the reader can bridge the gap.

If your project involves any experimental work, you must thoroughly document your procedures and experimental results in sufficient detail so that a skeptical reader can verify your claims.

For concise advice on writing style, see Sherman [2] and Strunk and White [3]; for detailed technical rules on writing and typography, see [1].

The rest of this section lists detailed necessary requirements for the writing.

1. Every sentence must be expressed in clear and reasonably smooth standard American technical English.

2. Every sentence must be complete and grammatically correct.

3. Every paragraph must have exactly one main idea, and this idea must be identified in the topic sentence.

4. There must be no errors in spelling, punctuation, capitalization, or typography.

5. Every symbol and term must be defined.

6. Every free variable must be quantified (do not leave it up to the Reader's imagination whether you mean "for *some* integer x" or "for *all* integers x").

7. Every figure and table must have a number and a caption. The caption must explain the figure or table.

The Department recommends that the student ask a friend to read drafts of the report for feedback on grammer, clarity, and style.

The Oral Defense

The oral defense consists of three parts: a presentation by the student, a period during which the student answers questions posed by Committee members, and feedback from the Committee. Although the duration of the oral defense is left to the advisor's discretion, typical times are 30 minutes for the presentation and 15 minutes for the question-and-answer period. The oral defense is not allowed to take place until the written report has been completed and approved.

To begin the defense, the student presents a seminar-style research talk in English. During this talk, the student must convey the major ideas and results of the written report. The student should use overhead transparencies or some other visual aid. It is not acceptable to read or to recite a prepared speech. At the Advisor's discretion, the talk may be open to the public.

The talk must be clear and well-organized, and it must not exceed the time limit specified by the Advisor. During the talk, explain what you did, why you did it, what you found, and why the findings are significant. It is helpful to go over a simple example to illustrate your results and methods.

During and after the talk, the student must demonstrate understanding of the project by answering questions posed by Committee members.

The Advisor shall chair the oral defense. At the Advisor's discretion, the Advisor may require people not on the Committee to refrain from asking questions.

The Department recommends that each student attend at least one oral defense prior to giving her own.

The Copies

The student must submit three copies of the report to the Graduate Secretary. Each copy must satisfy the following eleven requirements:

1. The Advisor's signature, or a xerographic copy thereof, must appear on the title page.

2. The paper must be white, $8\frac{1}{2} \times 11$ inch paper. Although not required, if you would like your copy to last more than 15 years, you should use acid-free paper.

3. Each page must contain writing on one side only. (Exception: long appendices may be two-sided.)

4. The text must be clear and easy to read. Xerographic copying is fine, provided the quality is good. Poor-quality copies are unacceptable.[5]

5. The document must be capable of producing good-quality xerographically copies. For example, do not make subtle distinctions in figures with shading or line thickness, unless such distinctions copy well.

6. Every page must have a margin of at least 1 inch around every edge. I recommend using a $1\frac{1}{4}$ inch margin on the binding edge (left side) and a 1 inch margin on the other three edges. (This requirement does not apply to oversized items in appendices.)

7. Every page must be numbered with an Arabic numeral. The pages must be numbered consecutively, beginning with the title page as page 1. The page numbers may appear within marginal areas.

8. The front cover must be transparent and the title page must be readable through the cover.

9. The font must be at least 11 points in size. (Exception: long appendices may be printed in smaller font.)

[5] Be aware that the UMBC Bookstore often produces poor-quality copies.

10. If the document is typed, then it must be "double-spaced." However, if the document is prepared with a document preparation system (*e.g.* LaTeX), there is no such requirement. With a document preparation system, the student should use a scientific journal (*e.g. Siam Journal on Computing*) as a model of typography.

References

[1] *The Chicago Manual of Style*, University of Chicago Press (Chicago, 1982).

[2] Sherman, Alan T., "How to solve and write up homework problems," unpublished document (February 1990).

[3] Strunk, William Jr.; and E. B. White, *The Elements of Style*, Macmillan (New York, 1972).

Figure 1: Sample 693 title page.

Figure 2: Sample 693 abstract page.

A Greedy Algorithm for Solving the Traveling Salesperson Problem in Polynomial Time

Benjamin Philip Bitdittle

A paper submitted to the
Computer Science Department
in partial fulfillment of the requirements for
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at the University of Maryland Baltimore County

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CMSC-693 Advisory Committee:

Alan T. Sherman (Advisor), Assistant Professor of Computer Science
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Certified by____

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Abstract

Informative abstract goes here. Do not begin your abstract with the boring phrase "This paper."

Keywords. Discrete algorithms, graph algorithms, greedy algorithms, NP-completeness, polynomial-time algorithms, structural complexity theory, traveling salesperson problem (TSP).