Guidelines for Writing a Successful MSc Thesis Proposal

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1. Why are thesis proposals necessary?

The purpose of having thesis proposals is threefold. First, it is to ensure that you are prepared to undertake the work that you are proposing. Second, it is to ensure that the work being proposed is of appropriate scope for an MSc degree and has value to the computing community. These first two points are designed to prevent catastrophic problems late in a student's degree. Your proposal must ensure that these two points are clearly addressed so that the committee can approve your proposal. The third purpose of the submission and review of thesis proposals is to help guarantee the quality of the MSc program as a whole and, thus, the reputation of the department. It is this reputation that, in large part, determines the "value" of the degree you receive and this has an impact on your future options (e.g. employment and PhD program choices).

2. What is the role of the Graduate Studies Committee (GSC)?

In the MSc program, students do not have advisory committees as they do in the PhD program. In essence, the GSC acts as your advisory committee at the MSc level. This is done both to ensure uniformity of treatment between MSc students and to avoid the logistical problems associated with having to form many advisory committees (since there are many more MSc students than there are PhD students).

The GSC is charged with ensuring that the three purposes of MSc proposals are met. That is, they must verify that your topic is sound and of appropriate scale, that you are prepared to do the work and that the work seems to be of interest to the Computer Science community and therefore reflects well on the Department of Computer Science as a whole. To ensure this, members of the GSC carefully read and review your proposal making comments intended to help you to address any perceived deficiencies in your proposal and/or proposed studies.

3. What is the role of your advisor and of you, the student?

The role of your advisor in the development of your thesis proposal is primarily to advise and proofread. Your advisor should, of course, guide you to a specific, well-defined thesis topic and will typically also suggest some initial background reading you should do. Your advisor may also suggest a structure to follow in writing your thesis proposal (if not, a structure suggested by the GSC is provided later in this document) and, at the MSc level, your advisor may also propose one or more potential solution strategies/methodologies for the work you will propose.

It is your responsibility to do the necessary background reading to be able to clearly and concisely summarize the work related to your proposal. You must ensure that this summary is complete and that all work discussed in it is relevant to your proposal. Your proposal should be written by you (with your advisor's input if you want it). Your advisor should proofread what you write and may suggest changes in everything from structure to grammar and spelling. It is your responsibility to make these changes. Typically, the process of refinement and review is iterative. Your goal is to take your advisor's advice and incorporate it to ensure that your proposal document is as close to perfect as possible. Please resist the urge to submit a proposal before it has been carefully reviewed by your advisor. Remember that review by your advisor is always faster than review by the GSC, which typically takes up to a month from time of submission until you have the report returned to you. Multiple reviews of your proposal by your advisor prior to submission is the norm.

Ultimately, what goes in your proposal is your decision and responsibility though your advisor should assist you in putting it together. Do a good job and take pride in your proposal document. Remember that the quality of your proposal reflects on both you and your advisor and that the GSC will not hesitate to reject a poorly prepared or incomplete proposal and certainly will not accept a proposal until they feel that it is complete, clear and free of presentation problems.

4. What should be in your proposal?

According to the rules of the Faculty of Graduate Studies (FGS), your thesis must show "mastery" of your selected area of study. (Note that, at the MSc level, it is not necessary to do any original research, though doing some is normal practice within the Department of Computer Science.) Above all else, the topic you describe in your proposal, as well as your presentation of that topic, should also reflect such mastery. The most immediate effect of this is that your proposal must be a complete, self-contained description of your proposed work. Any important details omitted will argue to the GSC against your having mastery of the area. Having said this, the committee realizes that, at the stage of a thesis proposal, it is not possible to have reviewed all background material (and thus have perfect mastery) nor is it possible to be able to present all the details of your proposed work. The GSC will, however, look to see that you have covered reasonable breadth in your review of the area, that your solution methodology is clear and well thought out and that you therefore give the committee confidence that you will have mastery by the time you complete your thesis.

Key components of your thesis proposal include:

- An abstract of the proposed work
- A clearly specified problem statement (where "problem" is taken in the broadest sense)
- An introduction to the problem and your proposed solution
- A review of related work describing how it relates to your proposed work (this review is not intended to be exhaustive but rather representative of existing work in the area)
- A statement of how you propose to solve your problem including sufficient methodology to convince the committee that your proposed solution is likely to be successful
- A description of precisely how you will evaluate the success of your work

- A statement of the resources required to complete your work and how you will gain access to them
- A description of the results you expect to obtain and why they are of interest to the field
- A timeline for the completion of your thesis providing realistic dates for finishing "milestone" events
- If appropriate, a statement of how you will manage any sensitive data (i.e. information of a personal nature) that you might have access to or create during the course of your research
- A brief summary of what you have just proposed.
- A detailed, quality bibliography of work related to your proposed thesis research.

These components can be used to structure your proposal as described in the following section.

5. Typical length and structure of a proposal

The length of a proposal often varies somewhat depending on the area of the proposed work and the topic itself. In general, a proposal is normally between 10 and 20 pages, single column, 1.5 spacing using 12pt font including figures and references. This is a guideline and the actual length of your proposal is best discussed with your advisor. Be aware, however, that excessively lengthy documents may be sent back unread to be revised to provide better focus. An upper bound of close to 20 pages is a good limit in practice. Also, please do not use a font size of under 12pt since your proposal should be easy for the committee members to read!

While the exact structure and organization of your thesis proposal may vary from the following suggested structure, all the material discussed in each item described below should be included somewhere in your proposal and should be presented in a logical order.

- A **title page** that includes your proposed thesis title, your name and student number, your advisor(s)' name(s), and the date of submission.
- An **abstract** that, in one or two paragraphs, provides a concise summary of the work you are proposing including a statement of the problem that you are trying to solve and how you expect to solve it. This is one of the most challenging parts of the proposal to write since you must provide some detail without the reader having yet been given the background knowledge. It is probably best to write the abstract last!
- A concise **problem statement** that, in one to three sentences, describes specifically what the problem is that you intend to solve. This problem statement can be technical in nature. For example, "I intend to explore the benefits and liabilities of fuzzy logic in the scheduling of work across heterogeneous distributed computing environments." The problem statement can, if you like, be provided at the beginning of the 'Introduction' section but should certainly be somewhere very near the beginning of the proposal to help provide context (for the reader) to the material you later provide. Please note again, that the word 'problem' is intended to be interpreted broadly. It is entirely possible that your 'problem' might be less specific in nature. For example, "I intent to develop and empirically test a tool for integrating database schemas."

- An **introduction** that describes the problem area and motivates the need for your proposed work. In the introduction you need to say why you are doing the proposed work and what its significance is. (i.e. Does anyone else care about what you are doing?) It is in the introduction that you typically also define/explain most of the necessary terms and acronyms. You also need to provide a quick sketch of your proposed solution and briefly explain how it differs from other work. Be sure to build from more general concepts to more specific ones so that the reader will understand everything. You should be able to have someone else read just your introduction and be able to then tell you what you are proposing to do and why it is interesting. That is, the introduction should be understandable by itself without the rest of the proposal.
- A **related work** section that surveys previous work related to what you are proposing. This section should be carefully written and organized to make the relationships between the earlier research efforts clear and to also explain how that research relates to your proposed work. It is primarily this section that makes it apparent to the committee that you are, in fact, prepared to undertake your proposed work. The work you reference should be quite extensive, relevant and recent. Insufficient references suggests to the committee that you may not be aware of all the related work and this means that it is possible that your work may already have been done by someone else. The inclusion of irrelevant (or too many) references may lead committee members to question your understanding of the area. Finally, lack of recent references might suggest that your proposed work is no longer of interest or is, perhaps, too hard a problem that other researchers have chosen to overlook. Finally, be careful to base your related work on quality publications. All (or very close to all) of your referenced papers should be from well-respected, refereed sources (i.e. journals or top tier conferences in your selected area). Referring to dubious papers lessens the committee's confidence in your thesis proposal. Finally, your selected papers should reflect a reasonable amount of breadth in terms of authorship and source. Insufficient breadth might lead the committee to fear that you are following individual opinion instead of well-founded and widely accepted scientific results.
- A detailed **problem description**. Although you have already described the problem you are addressing in general terms, you need to ensure the committee that you have thought of all the details of that problem (and the environment(s) in which it occurs) that might affect your proposed solution. The detailed problem description further convinces the committee that you know everything that is necessary to undertake your proposed work.
- A description of your proposed **solution strategy** and expected results. Although you may not know the precise details of how you will solve the problem you have just described, you should be able to give the committee sufficient detail to convince them that what you are proposing is a good idea that can be done within the time constraints of an MSc degree and that you understand the issues associated with the techniques you intend to apply. In particular, you should be able to describe how your proposed solution will address the details of the problem and environment described in the previous section of your proposal. You should also realistically summarize what you see as the advantages and disadvantages of your proposed solution and, accordingly, what you expect the results of your work to be.

- A description of how you propose to undertake the **evaluation** of your work. You must ultimately be able to answer the question of whether or not the work you have proposed and (later) completed is important. This is often done by direct comparison with other, existing work in the field. Such comparisons may be done experimentally, analytically, through simulation or possibly a combination of these. For example, you might be proposing a thesis where, at the end, you will want to compare the performance of an algorithm you developed and implemented with the performance of a similar existing algorithm. When doing this, always try to make the comparison(s) as objective and meaningful as possible. Compare your type of apple to someone else's type of apple, not to an orange. Be sure to explain the methodology behind your comparison (e.g. how you will gather performance results accurately or how you will construct and run a simulation study). Always remember to keep statistical significance in mind whenever this is appropriate. Results based on samples of small size do not constitute evidence of improvement nor do results where the degree of improvement exceeds the margin for error in the experiment. When actually doing the assessment, try to be totally objective and always resist the temptation to tweak your work until you get the "expected" results. Instead, explain the results you get.
- A statement of the **resources required**, if any, to complete your work and a description of where you will gain access to these resources. For example, if you need to have dedicated access to a number of machines for an extended period of time, then you need to say that you have the agreement of the machines' owner(s).
- A tabular set of **timelines** that provide realistic estimates of when the major phases of your thesis will be completed (including the writing of your thesis). These are often difficult to predict without experience so be sure to involve your advisor in setting these dates. Remember that it almost always takes longer than you expect to get anything done and that you will likely also have other responsibilities (e.g. coursework, marking, etc.) while you are trying to complete your thesis.
- A brief (one to two paragraph) **summary** of the proposal (i.e. the previous sections) that highlights the key points in the proposal and provides a list of contributions to the field that you expect your work to provide. Be very specific when listing your contributions and explain why they are of interest to the computing community.
- A **bibliography** of the papers, etc. you have read and cited in your proposal. The bibliography should be ordered in a convenient way, normally by last name of first author and should use a consistent style for all entries. (Note that using LaTeX and BibTeX is an easy way to ensure such consistency and ordering.) Each entry should contain complete information (e.g. not be missing page numbers, etc.). The selected papers in your bibliography should be carefully chosen to be up to date, important references in the field.

6. The review process and the GSC's response

A minimum of three members of the GSC, selected by the chair, will provide reviews of your proposal to the chair. The committee as a whole will consider the comments of the reviewing members and will place your thesis proposal in one of three categories:

- **Category 1 (acceptable as submitted) –** The first category is for thesis proposals that are approved without any changes. This category is rarely used.
- **Category 2 (only minor changes required)** – The second category is for thesis proposals that require relatively minor changes/clarifications. Proposals in this category are resubmitted directly to the chair of the GSC who verifies that the required changes/clarifications have been made and then approves the proposal without involving the rest of the committee.
- **Category 3 (major changes required)** – The third category is for thesis proposals that have omitted one or more significant portions or that are otherwise considered unacceptable by the committee. In this case, the proposal must be rewritten to address the concerns of the committee and resubmitted for review by the entire GSC. The GSC meets approximately every two weeks. This usually allows it to review MSc proposals in a timely fashion. After the meeting takes place, the chair of the GSC will synthesize the comments of the reviewing committee members to produce a letter to the student submitting the proposal. That letter will state the outcome of the review and will also provide the committee's feedback to the student. Feedback is typically provided in two parts: a list of concerns and/or questions the committee had with the proposal and a list of less serious issues related to, typically, presentation and citation practices. Suggestions on the research itself may also be made, if such comments by the reviewing committee members were provided. In most cases, you should receive feedback within about three weeks from the time of submitting your proposal though, unfortunately, depending on the number of proposals submitted at a given point in time and the workload of the committee and its chair, this may take up to four weeks.

7. Common problems with MSc Proposals

There have been a number of problems with previous thesis proposals that have occurred so frequently that it is worth identifying them explicitly. Some of these are major problems that will typically result in your proposal being placed in the third category while others are less serious but nevertheless common and annoying to your proposal's reviewers (remember that it is always good to make it easy for your readers to review your work).

The most common serious problems seen in previous MSc thesis proposals include:

- *Failure to identify and clearly state a **specific** problem that you are addressing* – You must make it clear to the committee what you are intending to do. Even if you are planning on doing work that is more generally focused (such as developing a taxonomy or a framework) rather than, for example, solving a specific implementation problem you must clearly identify what it is you intend to do. A good rule of thumb is that you should be able to specify what it is you are trying to do in a single sentence, perhaps with a couple of sentences of clarification afterward.
- *Failure to clearly describe the methodology you will use to complete your work* – While, at the time you are writing your proposal, you will be unable to provide complete details on how you will solve your problem, you must be able to describe the techniques you plan on using and explain why they are appropriate for what you are trying to do. You should also discuss how any necessary alterations to aspects of the proposed techniques that might need to be done for use in your work will be accomplished.

- *Failure to properly organize your proposal* – If you do not organize your proposal in a logical fashion, it is extremely difficult for the reviewing members of the GSC to tell that you have a good understanding of the area and are therefore prepared to begin your proposed work. Most importantly, your thesis proposal itself, and each section within it, must have good "flow". This means that each statement must logically follow the one preceding it. You must always present complete "trains of thought". There should be no "leaps of faith" required to understand what you are writing about. This reflects the process of scientific reasoning. Things should carefully follow from one step to the next as in a mathematical proof. It is also a good practice to look at each paragraph in each section individually and ask yourself the question: "Does this paragraph correspond to the title of this section?" If your answer is "No." then you need to consider moving or refocusing that paragraph. A common example of this occurs when related work is discussed in a different section. (This is often easily identified by the presence of a large number of citations in the paragraph in question.)
- *Failure to make comparisons between related work* – It is insufficient to simply enumerate work related to your proposed thesis. You must logically organize and discuss the related work in such a way that it is clear to the reader how the various previous research efforts relate to each other and, especially, how they relate to what you are proposing.
- *Failure to remember that the GSC is, by its constitution, a multidisciplinary committee* – You must write your proposal accordingly. You are not writing to an expert audience within your specific chosen area of study. As a consequence, you must always define all acronyms and explain terms before you use them. You may assume only a general, undergraduate level of knowledge and must, in your thesis proposal, explain everything beyond that. Always follow the old adage: "Know your audience!"

Some common, less serious, problems often seen in MSc thesis proposals include:

- *Grammatical and spelling errors* – the prevalence of such errors speaks negatively to your concern for detail and your industriousness. These are characteristics that are fundamental to success in scientific research and higher-level study such as the MSc and PhD degrees. You should remember that negative impressions of your written work will often be reflected later in such things as reference letters written for you. As a first step, you should always spell check your thesis proposal. Remember, however, that spell checkers are not perfect and will fail to detect certain errors. Further, grammatical checkers are notoriously bad in certain situations and technical writing, such as that in a thesis proposal, is one such situation. The bottom line is that automatic checking must be only a first step. Careful, human proofreading is also needed. If necessary, it might be useful to arrange to have proofreading of the final (submitted) version of your proposal done by a native English speaker. A proposal which has obviously been poorly proof-read may be returned for improvement prior to review.
- *Inadequate and/or dated citations* – whenever you refer to the work of others (including figures you may have reproduced), to specific systems and/or when you make specific claims that you do not justify explicitly yourself within your proposal you need to provide a citation to the related work. Further, such citations should always be made on the first reference to the corresponding system or piece of work. There are no exceptions to these two rules. Further, when selecting citations, you should always pick the best possible reference where "best" is judged in terms of direct relevance, quality of the

source, and recentness of the citation. Always try to avoid the use of old citations that might have been superseded by more recent work.

- *Incomplete and/or inappropriate references* – Each reference you provide should be as complete as possible. This means that it should include such things as page numbers, and date of publication, etc. Sometimes it requires a little extra work to get this information (especially if you found the paper online) but this information should be included so that it is easy for the reader to locate the reference if they need to. (Note also that this will be even more important for your thesis document itself since a larger audience will likely read it.) It is also increasingly common to see references to web-based documents. In many cases, such documents are completely un-refereed just like technical reports and are thus of dubious quality and value. Such references should be used extremely sparingly in your proposal and certainly should not be used alone to argue for any key point that your work depends on. Always try to find references in recognized journals and top-tier conferences whenever possible. A proposal that obviously makes little or no attempt to provide complete and consistent bibliographic entries may be returned for improvement prior to review.

8. Timing of MSc thesis proposals

Regulations state that your thesis proposal must be approved at least three months prior to your thesis defense. This delay will be determined using the date of **final** acceptance of your proposal. This will be the date on the letter sent by the GSC either indicating that your proposal has been placed in category 1 or on the letter sent by the GSC indicating that your **revised** (category 2) proposal has now been accepted. You should not leave your proposal to the last possible minute to submit. There are several reasons for this. First, and foremost, is the fact that when you submit a "proposal" after the bulk of the work has been done then it is not really a proposal but is, instead, a summary of what you have done. This is not the intent! If you submit at this late stage you are running the risk of having done your MSc work on a topic that is not acceptable to the GSC. In this case, you might have to select an entirely new topic and start all over again. While this is a worst-case scenario, it is not impossible and it is certainly within the rights of the GSC to reject a proposal entirely. In general, you should prepare the thesis proposal and have it accepted before undertaking the majority of your MSc thesis work. Preparing your proposal at this stage helps you to decide what specifically needs to be done to successfully complete your thesis and is therefore advantageous to you. Further, if there are issues with your proposal that the GSC will require to be resolved before approving the thesis, then, if you have waited till near the end of your program to submit the proposal, you will be delayed in graduating. In such situations, the delay in graduation is your fault not the GSC's! Finally, an early submission of your proposal allows you to receive potentially valuable feedback from the members of the GSC. In the review process, the GSC commonly makes suggestions and poses questions related to your proposed work as well as critically reviewing your proposal. By doing so, the committee is, again, acting in a fashion similar to the PhD advisory committee. Often their suggestions are valuable in helping you produce a better MSc thesis more expediently. In practice, submitting your proposal so that it can be approved at least six months prior to your defense is strongly recommended.