

MSc Project Guidance

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The following section gives information about the conduct of MSc projects and the preparation and submission of MSc dissertations. Further information and advice is provided in the F21RP Research Methods and Project Planning course.

MSc Project Conduct and Milestones

An MSc project is a substantial and extensive investigation of a challenging topic in the subject area of an MSc. It is intended to give an MSc student a major opportunity to exercise their new understanding and advanced skills acquired on their programme by applying them to a significant and advanced practical problem. It is primarily assessed by means of a major piece of writing that describes the full scope of their MSc project from its aims and objectives through its requirements analysis, design of software or experiments to implementation, summative evaluation and conclusions. Students are supervised by a qualified academic with expert knowledge in the subject area while they are doing the MSc project.

Preparations for the MSc project begin in the second semester on the mandatory course F21RP Research Methods and Project Planning. That course develops student skills in critical thinking, research planning, academic writing and experimental design appropriate to their MSc project. It also explains appropriate approaches to planning the project. Students are made aware of legal, social, ethical and professional issues at stake and how to address them. Students are expected to meet with their supervisors throughout semester 2 for guidance and assistance in researching the background to their project. This research phase issues in the student writing a research background report which is part of the assessed coursework for the F21RP course.

The research background report has 3 main elements:

1. Literature review
2. Requirements analysis of software or experiments to be attempted
3. Project plan

The first two elements can also be used as part of the MSc dissertation after suitable revision to reflect any changes in the project's direction and details.

Immediately after the MSc exams at the end of semester 2, students begin work on their MSc project and continue full time on the project for 15 weeks until around mid-August. At that point they submit an MSc dissertation, as described below.

The milestones of an MSc project are as follows:

1. project selection period at start of semester 2
2. project allocation in following week
3. research background to MSc topic completed by end of semester 2
4. begin full-time project immediately after end of semester 2 exams
5. project dissertation submission towards mid-August

MSc Project Selection

At the start of the second semester MSc students will be invited to select their MSc project. Students can either select projects from a list of projects that will be made available on the web or they can propose their own project. Lectures on the course F21RP Research Methods & Project Planning will give guidance on this process.

Projects listed on the web will include the proposed project title, the proposer, a description of its content, some references, an optional hyperlink to further details and the kinds of knowledge and skills that are

required to attempt it. The project proposer will be an academic in the department and that person will normally supervise the project. However, in a few cases another supervisor may be arranged instead. Project selection is done online by filling a form specifying 1st, 2nd and 3rd choices. In cases where the project title is very generic, the actual project attempted and its final title will be determined by negotiation between the student and their supervisor. Students are advised to contact the project proposer and discuss what the project involves and whether they are suitable before making a project selection. After the selection deadline has passed, students will be informed as to who has been allocated which project. This allocation is done so as to try to ensure that every student has as close to their 1st choice as possible.

Students may also propose their own project. If they do so, they should write on an A4 page, the project's title, a description of its content, their name and programme being studied, and detail any special software or equipment requirements. The level of detail required should be similar to the level of detail given in published project proposals by academics. The student should then submit the MSc project on the MSc project system and can approach a prospective supervisor.

MSc Project Supervision

Once an MSc student has been given a supervisor, the student should seek an early meeting with that supervisor. Students are expected to meet with their supervisor several times until the end of their MSc project. It is the student's responsibility to make that first meeting, and it is the student's responsibility to ensure that they attend set meetings throughout the entire project period. Failing to meet your supervisor regularly is a fairly good way of setting yourself up to fail your MSc project.

Even the cleverest MSc student is unlikely to be able to anticipate all the guidance that can be obtained from their supervisor. Only by attending supervisions is a student going to be well placed to get a good mark on their MSc project. MSc projects require research, practical work and writing. Students can expect guidance on these aspects from their supervisor.

MSc Dissertation - Format and Length

As a general rule, the body of the dissertation should be between 15,000-20,000 words - this will normally correspond to about 45-60 pages (from introduction to conclusion) if you include some diagrams. Dissertations which are significantly outside this range may be penalised for being too short or too long. We don't have a prescriptive style/format, but you should choose a font that is easy to read (normally 11 or 12 point) and are encouraged to use one-and-a-half line spacing. You should include appendices for additional material not central to the report (e.g., questionnaires, screenshots) and these will be in addition to the 45-60 pages for the main body.

MSc Dissertation - Content and Structure

Your project will be assessed primarily from the dissertation and it is therefore essential that it is a full account of your work and clearly presented. The detailed structure will depend on the type of project, and you should obtain advice from your supervisor. Your supervisor can also be expected to comment on outlines or drafts. When writing your dissertation, make sure to pitch it at the right level. You should not assume that your reader is an expert in the specialist topic that you are reporting, but should assume they have a good knowledge of the general discipline (CS/IT). If you think a good fellow student would understand it, then that is about right.

All dissertations will normally have the following elements:

- Title Page
- Abstract: A summary of the dissertation highlighting major points and describing the dissertation's scope and conclusions.
- Acknowledgements: Anyone you wish to thank.
- Table of Contents: Detailed breakdown with chapter headings, section headings, and maybe subsection headings, each with page numbers.
- Table of Figures: Location, number and legend of all figures in document (optional)
- Chapters of Content (see later)
- References (see later)
- Bibliography (optional - recommended reading such as sources that you have used but not cited)
- Appendices (optional)

Chapter 1 will normally start with a short introduction to the problem you are addressing and your aims and objectives, give a short review of the context, and describe what follows in the main body of the report.

Chapter 2 will normally include a critical review of relevant literature, so the reader understands what you are building on. You may also describe techniques, guidelines and even existing products if relevant to what you will be presenting later. It is important that this review is written in your own words throughout, reads as a coherent and connected piece of writing, shows the *relevance* of the material presented to the problem being addressed, and provides some critique/analysis of the material and its applicability to the problem. In essence it is your analysis and understanding that we are interested in, how you build on existing work, understand its limitations, select from available methods/tools, and present that coherently.

It is important to select your *references* carefully in your review. It is not sufficient to find 15 web sites which seem to have something relevant to say. Sources should be authoritative, accurate, and preferably should still be around in 5 years time. Academic papers and books usually meet these criteria, but also some web site sources are acceptable - sometimes a web site is indeed the most appropriate and authoritative source on a subject.

The structure of the middle section of your dissertation will vary according to the type of project. Many possible structures are possible but two typical structures are discussed below:

A. Software Engineering Project.

The goal is to develop some software to solve some problem. The chapters should cover requirements, design, prototyping and redesign, implementation, evaluation, conclusion.

This structure is appropriate where you have a customer (external or supervisor) who wants some software for a real (or imagined!) problem. A successful project is one where you elicit the customer's needs, develop a reliable and functional solution, and test/evaluate the software to demonstrate that it does indeed meet the customer's needs. It should also of course be technically non-trivial. A simple set of web pages might satisfy some customers but would not result in you getting an MSc.

B. Research Project:

The goal is to advance understanding by carrying out an investigation which may include prototyping a system. The chapters will present the problem (sometimes as a hypothesis), review existing work (as above), describe the research undertaken (including design of any experiments), present the results of any experiments, present any conclusions, relating these to past work and suggesting further work.

This structure is appropriate for open-ended investigations inspired by either a novel idea (like "The use of multimedia can negatively affect the experience of learning") or a plausible principle or hypothesis (such as "Distribution of a database provides information access speedup"). The aim is to investigate something about which not enough is already known or understood, and hence make a modest contribution to knowledge. Where a program is developed, it is not an end in itself. Rather it is an instrument for experimentation and discovery. The interest, significance and quality of the results are the primary criteria of success (bearing in mind that negative results of a well-conducted investigation are often as valuable as positive.)

Many variants of these structures are possible. For example, some projects will centre on the evaluation of an existing software system, and the structure will reflect that. Some projects may involve surveys of user or organisation opinion, and it may be the design of these surveys that forms a central element. Don't feel constrained to structure your document in a particular way, but ensure that the structure is discussed with your supervisor.

Note that in both styles of dissertation the final chapter will normally present conclusions and discuss further work. It should be clear just what has been achieved against the original objectives/problem description set out in chapter 1. It is important to make clear what has been learned and achieved and what further work could be undertaken by you or others to further the objectives of the project.

MSc Project Evaluation

It is not enough to achieve something in doing your MSc project by way of software development or by conducting some experiment. You also need to demonstrate the worth of what you have achieved by some kind of independent standard other than your own satisfaction with what you have done. With a software development project you can do this by conducting an evaluation with the help of some third parties.

Evaluation is different from testing your software. The aim of testing is to verify that your software does what it is designed to do. The aim of evaluation is to validate that your software fulfils the project's requirements. A minimum evaluation might be a checklist comparison of what the original requirements were and what you succeeded in implementing. However, this is usually insufficiently convincing as it is too simple to subvert. You could easily rewrite the requirements to fit with whatever software you succeeded in producing and give yourself a perfect evaluation score.

More convincing is to conduct an evaluation where you exercise your software in accordance with the project aims and get independent persons to give judgements about the worth of what you have done. Since most software is interactive, a typical evaluation might consist of giving users a series of representative tasks to perform using the software and assessing how well they succeeded in doing them. You could record whether they succeeded or needed help to succeed or gave up or failed and score how well they succeeded in doing (efficacy, accuracy, time, effort etc.) The testers can contribute to that assessment by filling in a questionnaire addressing a range of usability and functionality aspects of the system. Their judgements would help establish the independence of the evaluation. The questionnaire could ask users to rate aspects of the system along various quality dimensions and you could provide average scores of these ratings. The questionnaire could also ask users to give free text comments about what worked and what needs improvement. The number and choice of testers needn't be so numerous and balanced that they would eliminate all biases to a scientific level of respectability. However, between 5 and 10 testers of varied character should be enough to be reasonably indicative of how well your software does what it is supposed to and what its shortcomings are.

Your evaluation should be written up and presented in your dissertation after you describe what you have achieved. Usually you would present this in a special chapter by itself. No software is perfect so the evaluation is likely to reveal shortcomings. You shouldn't try to hide or disguise them. You are unlikely to convince your dissertation markers that your software was one big success story if your evaluation just presents a bland picture of a successful outcome. You should turn around the shortcomings by being

honest and realistic about them and even take the opportunity to say how they might be ameliorated. That self-critique is often the most interesting part of a dissertation. It is also a hallmark of a good project write-up that the author is capable of recognising the project's limitations and can clearly see what needs improving.

MSc Dissertation References

Your dissertation may cite a wide range of sources (e.g., papers or web sites that you have used) as background and context for the work. Sources are cited at the relevant point in the text and full source information is given in the references section. There are a variety of acceptable citation and referencing styles, but the most commonly used styles in Computer Science are the Harvard style and the IEEE style. These are briefly discussed below.

Harvard (author-date) style

The author's name and the date of publication are used in the body of the text when citing sources - e.g., (Jones, 2003). Variations are possible, for example we can say that Jones (2003) has developed a new technique. The bibliography is given alphabetically by author. Journal and book names are italicised, e.g.

Annas, G.J. (1997), 'New drugs for acute respiratory distress syndrome', *New England Journal of Medicine*, vol. 337, no. 6, pp. 435-439.

Grinspoon, L. Bakalar, J.B. (1993), *Marijuana: the forbidden medicine*, Yale University Press, London.

Notice that there is a lot of information about the articles cited, not just the title and author. This ensures that the reader can find the article in question. Find out what is expected for different types of article (e.g., books, conference papers) and aim to give as complete information as possible.

IEEE style

Here references are listed alphabetically but given a number. The citation number is used when citing the document in the body of the text (e.g., [2]). Differences in how the references are listed are otherwise minor.

[2] W. Chen, R. Yeung, and P.P. Wainwright, "Linear networks - assessing their feasibility", *Phys. Rev.*, vol. 12, no. 1, pp. 105-119, April 1994.

You should select which style to use and use it consistently. Look up how to reference different kinds of sources, taking particular care with electronic sources. Give as much information about these as possible (title, author, date if possible) and consider just using footnotes for non-authoritative electronic sources. If you want to use another style apart from IEEE and Harvard then you should discuss it with your supervisor.

With the increasing use of Web sources you should take particular care how you cite these. You should make sure to put more than simply the URL, as URLs often go out of date. The guiding principle is that you should maximise someone's chances of finding the document. You should also state when the web page was last accessed, as web resources often change their location. One format that you can use is the following:

Author's name, title of document, publisher, date of document, size of document, URL web address, (date last accessed)

For example, using the Harvard style we might have:

Taylor, H., (2009), *MSc Dissertation Preparation Guidance*, Heriot-Watt University, 29572 bytes, http://www.macs.hw.ac.uk/macshome/courses/pg/diss_prep.html, (last accessed 1/5/2009)

Whatever style you use the references section should come between the main text and the appendices. Normally references should start on a new page, and should not have a chapter or section number, just the heading "References". Some word processing tools may provide help with referencing - consider using these. However, the main thing is to give proper thought to how and what you cite.

MSc Dissertation Style

Style in technical writing is discussed in more detail elsewhere. See for example:

The Elements of Style: A Style Guide for Writers (2005), by William Strunk, ISBN 0-97522-980-X,
<http://academic.csuohio.edu/simond/courses/elos3.pdf>

The main point to make is to present material clearly and concisely, and in an objective fashion as possible. Your personal impressions and feelings should rarely come into it. You should normally avoid using expressions like "I did this" and instead report the work in a passive voice ("it was done"). However, where you are genuinely voicing an individual opinion, you may use the first person. Also, while the passive voice is normal for scientific writing it is not used universally, so don't feel forced into a style that you find awkward. The main thing is clarity and objectivity.

While considering style we should re-iterate what has been said elsewhere about plagiarism. If you copy more than half a line directly from a source without quoting and citing it then it can be considered as plagiarism. If something is so good you want to cite it literally then do it like this:

Taylor provides a concise discussion of how we can quote material:

"While considering style we should re-iterate what has been said elsewhere about plagiarism. If you copy more than half a line directly from a source without quoting and citing it then it is considered plagiarism. If something is so good you want to cite it literally then do it like this." [2]

Note that the copied material is in quotation marks AND the source is cited.

MSc Dissertation Preparation Tools

There are many tools to support document preparation, from LaTeX to tools built into Microsoft Word. Find out about them and use them. Spelling errors will not be acceptable if there are spelling checkers you could have used to detect them. Errors in referencing and poorly laid out graphics may be penalised where you could have used a simple tool to insert them for you.

MSc Dissertation Assessment

Your dissertation will be marked by your supervisor and by a second reader. If they disagree by more than a certain amount, a third marker will be brought in to ensure the appraisal is balanced. If it is borderline (close to an MSc with distinction mark or the lowest mark for an MSc or PG Diploma), it may also be looked at by the external examiner for the programme. So what are the assessors of your dissertation looking for? You will be given the marking rubric that we use. We are looking for some or all of:

- Clear and concise presentation of work
- Demonstration of depth of technical understanding
- Coverage of related work; knowledge of the field
- Quality of any product
- Demonstration of ability to critically analyse other work and come up with original analyses and ideas
- Any contribution to knowledge.
- Evidence of initiative and perseverance
- Demonstration of professional conduct, considering ethical, social and legal issues where appropriate, and of course no evidence of plagiarism.

MSc Dissertation Submission Procedures

You should submit your dissertation in PDF format on Canvas through the course F21MP. Your dissertation must have the standard front page with your name, HW ID and MSc Programme. This PDF will be checked for plagiarism using TurnItIn.

You must complete the Declaration of authorship module on F21MP Canvas page, before submitting your dissertation.

This is a serious declaration and examiners may refer any dissertations with suspected plagiarism to the University disciplinary committee. Properly acknowledging sources means quoting as well as citing the source of any copied material.

Computer Science MSc Dissertation Assessment Grading Guidelines

The below criteria are indicative of what is expected for different grades. Markers will use these criteria as a guide while also using their subject expertise and academic judgement regarding the overall quality of the work.

Grade	Guidance Notes
A+: ≥80%	<p>Aims and objectives of project are stated and motivated both clearly and convincingly relative to state-of-the-art. The project demonstrates clear ability to formulate/construct hypotheses.</p> <p>A very thorough understanding and excellent presentation of the subject, background material and context. Clear evidence of independent ability to find and use references and good citing and referencing.</p> <p>A high degree of critical appraisal and analysis.</p> <p>An excellent understanding and application of research methods.</p> <p>Quality and description of programming/implementation and/or use of data show mastery of the chosen subject (if applicable).</p> <p>Conclusions are clear, well supported by the content and well considered. Suggested future work is of research value. Clear evidence of originality of thought and reasoning and outstanding ability to comprehend the subject matter within the wider context.</p> <p>The highest level of structure and presentation. Skillful use of well-chosen examples.</p>
A: Normally ≥70% <80%	<p>Aims and objectives of project are stated and motivated both clearly and convincingly relative to state-of-the-art. The project demonstrates clear ability to formulate/construct hypotheses.</p> <p>A very thorough understanding and description of the subject, background material and context. Clear evidence of independent ability to find and use references and good citing and referencing.</p> <p>A high degree of critical appraisal and analysis.</p> <p>An excellent understanding and application of research methods.</p> <p>Quality and description of programming/implementation and/or use of data show mastery of the chosen subject (if applicable).</p> <p>Conclusions are clear and well supported by the content. Clear evidence of originality of thought and reasoning.</p> <p>Very well structured and presented. Good use of well-chosen examples.</p>
B: Normally ≥60%, <70%	<p>Aims and objectives of project are clearly stated and motivated. Project demonstrates the ability to ask the right questions and formulate/construct hypotheses to address the issues.</p> <p>An increasing understanding of the subject, background material and context. Some evidence of independent ability to find and use references and good level of citing and referencing.</p> <p>Critical appraisal and analysis is demonstrated.</p> <p>Good understanding and application of research methods.</p> <p>Quality and description of programming/implementation and/or use of data is above the basic standard (if applicable).</p> <p>Appropriate conclusions and recommendations based on the presented work.</p> <p>Good structure and presentation, and good choices and use of examples.</p>

C: Normally ≥50%, <60%	<p>Aims and objectives of project are reasonably stated and motivated. The student shows the ability to ask questions and find answers.</p> <p>A reasonable understanding of the subject, background material and context, suitable level of citing and referencing.</p> <p>A reasonable degree of analysis and critique of state-of-the-art in the context of the project's goals.</p> <p>Acceptable consideration of research methods.</p> <p>Quality and description of programming/implementation and/or use of data is adequate to good (if applicable).</p> <p>Conclusions are reasonably formed and recommendations are generally supported by the work undertaken.</p> <p>Reasonable structure and presentation, appropriate choice and use of examples.</p>
D: Normally ≥ 40%, <50%	<p>Does not meet MSc standard. A basic piece of work which demonstrates:</p> <p>Limited clarity and motivation behind the project's aims and objectives.</p> <p>Limited knowledge/understanding of the subject, background material and context, inadequate citing and referencing.</p> <p>Supported by only little analysis and critique.</p> <p>Poor or non-existent consideration of research methods.</p> <p>Only basic or incomplete implementation (if applicable).</p> <p>Identifies the basic issues, but conclusions are not supported.</p> <p>Meets the basic requirement for structure and presentation.</p>
E: Normally ≥ 30%, < 40%	<p>Poorly stated, explained, or motivated aims and objectives.</p> <p>Very limited knowledge of the background material and context, inadequate citing and referencing.</p> <p>Little critical analysis of state-of-the-art in the context of the project's goals.</p> <p>Very poor consideration of research methods.</p> <p>Implementation is incomplete or absent (if applicable).</p> <p>Inadequate discussion of the results with very poorly or unsupported conclusions</p> <p>Very poorly structured and presented.</p>
F: Normally <30%	<p>As above, but one or more of the above listed components is missing, i.e. the dissertation shows:</p> <p>No evidence of knowledge of the background material and context, no proper citing and referencing or</p> <p>No critical analysis of state-of-the-art in the context of the project's goals or</p> <p>No consideration of research methods or</p> <p>No implementation (if applicable) or</p> <p>No discussion of the results with supported conclusions.</p>
<p>All Dissertations must be conducted in an ethical manner and be ethically approved, and must cover Legal, Ethical, Professional and Social Issues arising in the project.</p>	