

Guidance for MATH554 students, markers and supervisors

1 Choosing a supervisor and a topic

There is no list of topics for dissertation work; it is up to you to find a supervisor and negotiate a topic. Students on the Mathematical Sciences MSc will often continue with the same supervisor they had for MATH552. Otherwise, you are strongly encouraged to do some advance groundwork toward finding a suitable topic. During the semester before you start your dissertation, you should talk to a number of lecturers (not only those teaching MSc modules) in the department, to find out who works in areas similar to your interests. Many staff maintain personal homepages that contain information about their research. Links to these can be reached from the Mathematical Sciences staff list,¹ by clicking on a staff member's name.

Supervisor's note: For the scope and difficulty level expected in an MSc dissertation, please refer to to the comments under 'Quality of Content' in the marking scheme (§6). There is an expectation that dissertation students should begin to engage with research level material. Determining precisely what constitutes 'research level' in a particular area is a matter of academic judgement for the supervisor. Please also note that a MATH554 dissertation is worth 100% of a 60 credit module. The amount of work required to complete a project should reflect this weighting.

2 General guidelines

There are almost four months available for full-time students to prepare their main summer dissertation (part-time students have the second semester of year 2 and the summer). During this period you will work exclusively on the dissertation. Please note that the summer is often the time when lecturers attend conferences, so it is advisable to find out exactly when your supervisor will be away from Liverpool when you start your project. It is also a good idea to get to know other lecturers and PhD students in the same research area, so that there are other people you can talk to during any weeks your supervisor is away.

Note for MSc Mathematical Sciences students

Students on the Mathematical Sciences MSc often write a main dissertation that continues the same line of work as the preliminary (MATH552) dissertation. In this case, you may wish to include summaries of parts of the preliminary dissertation in the main dissertation, if this helps it to be more coherent. Material from the preliminary dissertation must be clearly labelled as such, and the mark for the main dissertation will be based only on new material.

¹www.liv.ac.uk/mathematical-sciences/staff

3 Dissertation presentation

The final submitted version of a dissertation must be an electronically typeset document in portable document format (pdf), with the text width and height set for printing on A4 paper. The type size must be either 11 or 12 point, and the margins should be set to sensible sizes (2–3.5cm). The recommended system for the production of dissertations in the Department of Mathematical Sciences is $\[mathbb{L}^T\[mathbb{E}^X\]$ (see §8). Students may choose to use other software, but should be aware that marks will be deducted for typesetting faults such as poorly formatted equations, inconsistent notation, inconsistent bibliography formatting, and low quality figures. Most mathematicians find that $\[mathbb{L}^T\[mathbb{E}^X\]$ helps to avoid all of these issues. Students whose dissertations include a large number of complex equations are strongly encouraged to use $\[mathbb{L}^T\[mathbb{E}^X\]$.

4 Length

There are no explicit minimum or maximum lengths for a MATH554 dissertation. However, a rough guide is that it should be approximately 50–60 pages in length (excluding any program listings), and experience has shown that it is difficult to score highly with a dissertation that is too short. Reports that exceed 60 pages in length will not be automatically penalised, though marks will be deducted for unnecessary padding, repetition, etc.

5 Penalty for late submission

Students who fail to submit their dissertation on time will have their mark reduced in accordance with the standard University system of penalties set out in section 6 of the Code of Practice on Assessment.² In particular:

- 5 marks per day will be deducted for each working day after the submission date, up to a maximum of five working days (the number of days will be rounded up, so 10 marks will be deducted from work that is 25 hours late, etc.).
- Work received more than five working days after the submission deadline will receive a mark of zero.

If you think that you may not be able to submit your dissertation by the deadline, it is essential that you discuss the situation with the Programme Director, at the first available opportunity.

Note: IT problems such as lost/stolen equipment, corrupted files, etc. **will not** be accepted as a valid reason for failure to submit on time. It is your responsibility to keep adequate backups of your work, and to ensure that you can make your submission before the deadline. In particular, you are strongly advised to store a copy of your work on the university M: drive, which is automatically backed up. Extensions will only be granted in exceptional circumstances, such as a large scale failure of university systems, confirmed by Computing Services.

²www.liverpool.ac.uk/tqsd/code-of-practice-on-assessment/

6 Dissertation Marking Scheme

Academic Content

Introduction & Conclusion

The introduction should clearly set out what the dissertation contains. It should put the work into context, explaining why it is interesting and/or important. A summary of relevant literature should be included, and references to background material should be given where appropriate. The conclusion should summarise what has been achieved, and clearly explain the salient points established by the dissertation. It may also be appropriate to suggest possible avenues for further work on the topic.

• Quality of Content (scope of material, level of difficulty)

A dissertation must reach a level of difficulty beyond what is easily accessible in a textbook or from the notes provided in a taught MSc course. A dissertation must also consider a topic that is sufficiently broad in scope, given the length of the project and the level at which the work is being assessed. It should be evident that the student is beginning to engage with research level material. Students are *not* required to produce publishable results, though this does sometimes happen.

Evidence of Understanding

A dissertation should clearly establish that the author understands the material, which must be at the appropriate level and of sufficient scope (see Quality of Content, above). High marks cannot be awarded under this heading for elementary work, or work that is too narrow. A mathematically correct, well-structured and organised report that covers all the salient points, and (where appropriate) includes examples that add to the exposition, should be viewed as evidence of understanding. Depending on the subject area, further evidence of understanding might include filling in details of calculations, assessment of different methodologies and coherent presentation and discussion of original results. On the other hand, egregious mathematical errors, incoherent explanations and serious omissions should be viewed as evidence of a lack of understanding.

Marker's note: Minor mathematical errors which are likely to be typographical in nature should be addressed under Clarity of Presentation, below.

• Originality of Treatment

An MSc dissertation should contain a coherent account of the topic at hand, in the student's own words. High marks cannot be awarded under this heading for elementary work, or work that is too narrow in scope (see Quality of Content, above). The dissertation should also show that the student has contributed something to the topic. Evidence of this may include (but is not limited to) the following.

- Assembly of material from disparate sources.
- Calculation of new examples.
- Creation of a sophisticated program code.
- ► Extension of a theorem to a new context.
- A substantial improvement on an exposition.

[20 marks]

[20 marks]

[10 marks]

[20 marks]

A dissertation should contain references to books and papers directly related to the topic at hand, and also to background material where appropriate. In particular, references must be given in situations where the dissertation depends on little known or very advanced literature.

Marker's note: Formatting errors in the bibliography should be addressed under Clarity of Presentation, below.

• Initiative & Diligence

Bibliography

An MSc student is expected to work independently, consult relevant literature, and to make progress throughout the duration of the project. Important tasks should not be left until the last minute, and supervision meetings should not be cancelled without good reason.

Marker's note: The mark given under this heading should accurately reflect the amount of assistance the student has required. Only students who have worked through most material independently should be awarded high marks. However, marks need not be deducted for assistance with difficult or technical points.

Written Presentation

• Clarity of Presentation

A dissertation should read well, be properly structured, and free from repetition. Sectioning should be used appropriately, and equations should be worked into the text. The notation used for mathematical content must be well chosen, properly defined and consistent. Equations, figures and text must fit within the margins, and there should be no spurious line, paragraph or page breaks. The bibliography must be formatted consistently and correctly. Where figures are included, these must be sharp and clear. If program code is included in the report, this must accompanied by explanatory comments or documentation.

• Grammar, Spelling and Punctuation

A dissertation should be written in correct English, and free from spelling and punctuation errors, particularly spelling errors that can be eliminated by a spell checker.

(Total 100)

[10 marks]

[5 marks]

[10 marks]

7 Qualitative marking descriptors

Grade	Description	Key Features
Outstanding (A*) 80%+	Outstanding work. Factually almost faultless. Clearly directed and logical. Comprehensive coverage of topic. Strong evidence of reading/research outside the material presented in the programme. Substantial elements of originality and/or independent thought. Very well written.	Distinction: Originality. Well-directed. Independent thought.
Excellent (A) 70–79%	Excellent work. Logical, enlightening. Originality of thought or approach. Good coverage of topic. Clear, in-depth understanding of material. Good evidence of outside reading/research. Very well written and directed.	
Very good (B) 60–69%	Very good work. Logical, thorough. Factually sound (no serious errors). Good understanding of material. Evidence of outside reading/research, exercise of critical judgement. Some originality of thought or approach. Well written and directed.	Pass: Essentially correct and complete. Competence, critical judgement.
Good (C) 50–59%	Good work. Worthy effort, but undistinguished outcome. Essentially correct, but possibly missing important points. Largely derived from material delivered in the programme, but with some evidence of outside reading/research. Some evidence of critical judgement. Some weaknesses in expression.	
Marginal Fail (D) 40–49%	Inadequate work. Incomplete coverage of topic. Evidence of poor understanding of material. Poor presentation, lack of coherent argument.	Compensatable fail: Significant weaknesses,but serious effort.
Fail (F) <40%	Unsatisfactory work. Serious omissions, significant errors/misconceptions. Poorly directed at targets. Evidence of inadequate effort.	Fail: Little or no achievement of learning outcomes.

8 Guidance on LATEX

 $\[Mathebauerrow ETEX\]$ is widely used for the production of mathematical documents, and is the recommended system for students writing dissertations in the Department of Mathematical Sciences. As with many computer languages (especially those that have been in existence for a long time), there is a huge amount of information about $\[Mathebauerrow ETEX\]$ on the internet, but not all of it is good. The guidance below includes links to reliable resources.

8.1 Introductory worksheets

The course materials for MATH549 include some introductory worksheets on $\[AT_EX]$. Copies are available from the MATH554 Vital page. Students on the MSc in Mathematical Sciences will already have these, but the lecturer has kindly agreed to share with all MSc students in the department. Please do not contact the MATH549 lecturer for help typesetting your dissertation. Talk to your supervisor in the first instance, and see §8.5 if (s)he is unable to help.

8.2 Books and guides

The Not so Short Guide to $\[mathbb{E}T_EX 2_{\[mathbb{c}\]}$ is freely available,³ and is a good starting point for learning $\[mathbb{E}T_EX$. However, it is very basic, and lacking in certain areas, particularly bibliographies (see §8.4, below). Some books that are more thorough are available from the library, including:

- *Lateral Constant Preparation System* by Leslie Lamport (second edition)
- The LATEX Companion by Michel Goossens, Frank Mittelbach and Alexander Samarin

Although these are rather old (in computing terms), $\[mathbb{E}T_EX\]$ itself has not changed since they were written. However, many packages have been updated, and many new packages have been created. Manuals for most packages can be obtained from the Comprehensive T_EX Archive Network (ctan).⁴ These are usually written by the package author him/herself, and are therefore definitive.

8.3 Graphics

There are several software packages capable of creating high quality graphics for inclusion in mathematical documents. For plotting functions and data, Gnuplot (free), Maple, Mathematica and Matlab are good options. For diagrams, you can try geogebra or xfig (both free). A very common error is to use the wrong file format for storing graphics. Diagrams and plots should be stored as eps or pdf files.⁵ Using a bitmap format such as jpg or png may lead to blurring, especially if the diagram contains text (axis labels, etc.).

It is also possible to create diagrams and plots from within a LATEX document, using the tikz package⁶ and the pgfplots package,⁷ respectively. These take some time to learn, but they do produce very good results.

³www.ctan.org/pkg/lshort

⁴www.ctan.org

⁵Note that modern installations of pdflatex will automatically convert eps files to pdf during typesetting. You may find websites or other resources that say eps files cannot be used with pdflatex; these are outdated.

⁶www.ctan.org/pkg/pgf

⁷www.ctan.org/pkg/pgfplots

8.4 Bibliography

Manually formatting a bibliography is generally inadvisable. An automated system will produce consistent, error-free results in far less time. For a bibliography consisting of books and papers, the simple B_{IB}T_EX system is more than adequate. See pages 70–71 and 155–164 of the book by Leslie Lamport (§8.2, above) for more details. There is also the newer biber/biblatex system, but this is much more complicated.

8.5 If all else fails

There is a Q&A site for $\[Mathebaar]{EX}$ and related software at tex.stackexchange.com. Many $\[Mathebaar]{EX}$ experts (including package maintainers and some of the $\[Mathebaar]{EX}$ 3 programming team) are active on the site, and a lot of frequently asked questions already have answers there. Well-posed questions are usually answered within hours.