MATH 5000M – Dissertation in Mathematics

2016–17

Introduction

Pages 22–23 of the *School of Mathematics Taught Postgraduate Student Handbook* give some guidance on MSc Dissertations. The purpose of this document (which should be read in conjunction with the above reference) is to give some further details and advice.

Recall that the dissertation is a compulsory module which must be passed for the award of the MSc degree; it is worth 60 credits out of the total of 180 credits required to be studied for the degree. Thus it is a significant part of the year's programme.

The dissertation is a piece of work executed by the student; it will be assessed on its academic content and on the quality of its presentation. The dissertation is examined by the School of Mathematics, and is then sent to the External Examiner for his/her assessment. Part of the assessment of the dissertation is by an oral examination/presentation.

Timetable

We shall have a meeting at **3 p.m. on Tuesday 21st March in the Leonard Rogers Room** to discuss the possible choices of dissertations, and the timetable.

In order that the supervision can be spread across the members of staff, students are asked to choose **three** projects that they would be interested in doing.

Please e-mail me (`J.R.Partington@leeds.ac.uk`) your preferences for first, second and third choices by **Friday 24th March**. Students will be informed shortly afterwards about which project they will be doing.

You will see from the accompanying list of project descriptions that projects are available in the following areas:

Pure Mathematics : algebra, differential geometry, functional analysis, logic;

Applied Mathematics : non-linear dynamics, astrophysical and geophysical fluids, polymers and industrial mathematics, integrable systems, mathematical biology and medicine.

The supervision of each project may be shared between two members of staff.

The deadline for the submission of completed dissertations is **12 noon on Thursday, 24th August 2017**. Importantly, note that two bound copies of the dissertation and an electronic version must be submitted by **12 noon on Thursday 24th August 2017**. Both copies of the dissertation should be handed to the Taught Student Office on or before the above deadline date, and the electronic version should be submitted through the VLE. An academic integrity form must be attached.

These deadlines will be firmly adhered to unless a student has written permission in advance to submit his/her dissertation at a later date. In accordance with University rules, late submission

results in a deduction of 5 marks (out of 100) for each day between 24th August 2017 and the date of submission; submissions more than 14 days late, without prior permission, will not be accepted, and you will fail the module, and hence the degree.

Note that problems with printers, binders, etc., are not regarded as valid reasons for late submission.

Students must keep a copy of the dissertation for their own records.

Students can make a case that 'special circumstances' apply to them. Information on these special circumstances can be found on the School of Mathematics website, under 'Student resources'; any such cases related to the submission of the dissertation must be made by 24th August 2017.

The oral examinations/presentations will be held **over a two-week period**, in the week commencing **Monday 4th September 2017** and the week commencing **Monday 11th September 2017**. Students will be advised of the exact date and time subsequently. **All students must be available in the School throughout both of these weeks.**

The External Examiners will be invited to be present during the oral presentation.

Assessment

Marks for the module will be allocated in the following categories: understanding (30%), achievement (30%), initiative (20%), quality of report (20%), presentation skills (10%).

The written dissertation will be assessed by an internal assessor appointed by the appropriate Head of Department; this internal assessor will be a different person from any supervisor. The dissertation will also be assessed by the External Examiner, who must confirm the final grade to be awarded for the dissertation.

The oral presentation will be attended by at least the supervisor(s), the internal assessor, and the relevant Head of Department (or his nominee). Further, certain members of staff will attend many of the presentations so as to provide comparison between the various presentations.

Each student will be allocated 45 minutes for the presentation. The student's presentation should take 30 minutes, and there will be questions for approximately 10 minutes.

Provisional grades for the written dissertation and the presentation will be assigned by the assessor in consultation with other colleagues present. These grades will be moderated by a committee consisting of the MSc Coordinator, the Heads of Department and project supervisors to ensure comparability between different candidates and between different subject areas.

All provisional marks are sent to the relevant External Examiner for his/her comments.

There will be a formal *Examiners' Meeting* in October or early November 2017 (exact date to be confirmed). It is necessary that the external examiners confirm the provisional marks at this meeting. After this meeting, marks will be given to students by letter; to ensure that you receive this letter promptly, please ensure that your 'permanent home address' and 'examination address' on the portal are accurate.

Supervision

Your supervisor will provide guidance on your dissertation. This will include:

- giving some initial discussions on the general methodology;
- suggesting references to books and journal articles as sources;
- discussing in general terms the plan of the dissertation when you have made some progress, advising what it is realistic to include;
- helping you to notice deficiencies in your work;
- commenting on presentation, and organisation of the dissertation when shown draft versions;
- occasional advice on problems with LaTeX.

However, your supervisor is not expected to read every word in your drafts, nor to provide detailed comments on each chapter, nor to give detailed instructions on how to write in LaTeX.

Although the frequency and length of meetings with your supervisor are somewhat flexible, students will have about six meetings with their supervisor(s) during the summer. In general, each student should agree a timetable of contact meetings with their supervisor(s). Note that, in the period from June to September, supervisors have their own research, conferences, family and other commitments besides their role as a supervisor, and so are not normally available for the whole of this period.

Should you have difficulties with your dissertation, please discuss these with your supervisor in the first instance. Where a problem is unresolved, please then contact the Programme Co-ordinator or the Head of Department.

Getting started

It is not really expected that students will start their project until after the May/June exams. However, you may wish to arrange a preliminary meeting with your supervisor before that time, though this is not crucial. However, it is important that you begin your project as soon as possible after your examinations. If you have not already had a meeting with your supervisor, try to arrange an initial meeting with your supervisor as soon as you have recovered from the examinations — in early June. It is not necessary to await the results of the examinations.

It is probable that, in the first two weeks, you will sample quickly various papers, etc., suggested by your supervisor, and will seek to determine which aspects of a potentially larger project appeal to you. Seek to formulate a rather definite plan within two or three weeks of the start, and discuss this plan with your supervisor; take heed of any warnings that he/she offers, especially if he/she indicates that your plan is ‘rather ambitious’.

Advice on timing

To meet the deadline for the submission of your dissertation, you should schedule your work through a series of self-imposed targets. This means that you must plan ahead and keep closely to your plan. Let us recall that problems with printers, binders, etc., are not regarded as a valid excuse, so you should ensure that you have allowed adequate time to circumvent such difficulties.

As part of the project, especially in Applied Mathematics, you may be required to write and run your own computer program, and analyse your own data; please be aware that this can be time-consuming and so should not be left until late in the project.

Students are strongly advised to submit drafts of and plans for their dissertation to their supervisor; please ensure that he/she has sufficient time to make comments.

Written presentation and content

The objectives as specified in the Module catalogue are as follows:

'On completion of this module, students should be able to:

- *demonstrate the ability to plan and execute a mathematics project;*
- *conduct a systematic literature review on some aspect of mathematics;*
- *critically appraise the literature in the chosen topic;*
- *communicate their project in a written dissertation and oral presentation.'*

It is not a requirement that a dissertation for the MSc includes original results in mathematics. However a good dissertation will often improve and clarify a presentation of a topic from specified sources. A dissertation that does contain some correct, original work, such as extensions of known theorems, resolution of specified questions from the sources, or new examples, may be regarded as 'outstanding'.

It is stressed that the the aim of the dissertation is to assess your ability to undertake independent work. Most dissertations are necessarily a compromise between lofty goals, and what can be achieved in reality, and this is recognized by the examiners. Try to make your dissertation interesting to read and reflect your own motivation.

The standard of English, style and overall presentation is your responsibility. Your supervisor is not responsible for proof-reading, or checking your grammar and spelling; however, he/she should comment in some detail on the clarity and the English and grammar of a sample of your draft work.

A lot of advice on writing mathematics can be found in Chapters 3 and 4 of Dr. Kevin Houston's book, *How to Think Like a Mathematician*. Another good source, mainly on grammar, is J. Trzeciak, *Writing Mathematical Papers in English*, European Mathematics Society, ISBN 978-3-03719-014-2.

Format of the report

The final report must be written in LaTeX (or TeX) and then the pdf file should be submitted via the VLE.

The final version of the dissertation should be printed 'back-to-back', and it should be bound. However, a simple 'spiral binding', or similar, is sufficient.

As a guide, the final dissertation should contain 60–80 pages of text (together with the title pages, etc., and the bibliography). However, please note that this is only a guide: an excellent dissertation could have fewer than 60 pages; certain subjects might require additional tables, computer programs, appendices, etc., taking the total beyond 80 pages.

Referencing and Plagiarism

The submission must be accompanied by an academic integrity form (this form can be found on the module area on the Blackboard VLE), and will be checked for plagiarism using the standard University software. If any plagiarism is suspected, the standard University procedures on this matter will be followed. Information on what constitutes plagiarism can be found in the University Taught Student Guide; in addition, please consult the page Skills@library page and

http://skills.library.leeds.ac.uk/avoiding_ plagiarism.php

For further details on plagarism and for advice on referencing

http://library.leeds.ac.uk/referencing

The preferred referencing styles in mathematics is either 'Harvard' or 'Numeric'.

The final project should include a summary page on one sheet of paper describing the scope of the work and the main results, indicating the main sources used.

Pages and sections should be numbered for easy reference, and the title page should contain your name, student number, the module code and title, the title of the project, the name of supervisor(s), and the date of submission.

The report should include a contents page and a full bibliography, indicating all the books, articles, and websites that are referred to.

Recall that, in the text, if a lemma or theorem is taken from some source, there must be a reference to the source; if it has been significantly expanded or adapted, then you should say this. Apart from short statements, you should not copy directly from sources, and everything must be expressed in your own words, except where explicitly stated. Students whose work is too closely based on their sources will have marks deducted.

Summary

We repeat that the submitted dissertation should contain the following:

1. Title page: Name, number, module, title, supervisor, date;
2. One-page summary of the dissertation and the sources used;
3. Academic integrity form;
4. Contents page;
5. Numbered pages (and sections);
6. Bibliography of sources used.

Advice to students on tackling the project

You are expected to draw up detailed notes on the topic, appropriately illustrated with examples and counter-examples. The final format of the report will depend somewhat on the subject area and topic chosen. One common format is that the completed set of notes should be, as near as possible, the sort of notes and examples a student would be expected to collect during a lecture course at the level of the MSc. This can involve paraphrasing material from a book, and solving problems in textbooks and other sources to which the answers are not provided; as stated, some projects may require the student to run a computer program, whose source should be referenced.

How to write a good project

1. The definitions and statements that you make should be correct and precise; it may well be that you and the assessor and the External Examiner know 'what you mean to say', but the assessors read what you write on the page, not what they guess might be in your head.
2. Mathematical discourse is not the same as casual conversation: you are expected to write with greater formality and care, in precise English, than when speaking to other people. Recall also that English is a flexible language, but that there are 'rules of grammar', and you are expected to follow them.
3. The project should be well-organised, and follow a pleasing logical structure, often moving from the general to the more specific. Statements should be given at exactly the correct level of generality. For example, do not say 'Let A be a Banach algebra. Then ...' if, in fact, the conclusion applies to all algebras.
4. Give answers to challenging questions. Assessors are more likely to be impressed by your solution to harder exercises.
5. Give your own examples after definitions.
6. Generalize results.

7. Deviate from the standard text. Do not just follow the definition, theorem, proof sequence given in a particular textbook. Work out what is important about what you want to say, and decide for yourself what should be a lemma, a theorem, or a definition.

8. Collect material from a variety of sources.

9. Use consistent notation. Different books use different notation; if you replace the notation in the correct places, then you demonstrate understanding.

10. Tell us what you have added: E.g., 'In [6], Smith sketches a proof that every grundle is rationally elliptic; here I shall give the details.' Another example is 'Jones's proof in [12] is incomplete as she asks the reader at two points why a statement is true. I have provided the answers.'

11. If you have to take something verbatim from a source, then quote the source and demonstrate that you understand it by giving a pertinent discussion or a good example.

12. Make sure the account is clear (e.g., words in theorems are defined) and logical (e.g., the definitions come *before* the theorem).

13. Use a number of sources from journals.

A key point is that you should *demonstrate* that you understand what you have written.

Advice to students on the presentation

Given the time constraints, it will not be possible for you to explain every detail from your report. Thus you should choose some aspect, e.g., a theorem or set of examples, and use that to demonstrate that you understand the material in the report.

There are two main aims to the presentation:

1. students should demonstrate that they understand and have mastered the material;

2. students should demonstrate their presentation skills.

Students can make their presentation in any format they like, e.g., OHP slides, PowerPoint, black/white board, video, flip-chart, etc.

Students should inform the Programme Co-ordinator at least one week ahead of time of their requirements for the presentation. It cannot be assumed that the room for the presentation will contain a computer with every possible computer program.

Students are responsible for ensuring **in advance, and not at the time of the presentation**, that they can use the equipment that they require.

Further advice to students

- The presentation will pass by quicker than you think, so plan carefully.

- Cover some part of the material in depth rather than all parts superficially.

- A good example is worth a thousand words.
- Latex reports can be quickly turned into a 'Powerpoint' type presentation by using the Latex package Beamer. (Google 'Latex beamer' to find this.) However, be warned that presentations taken directly from Latex reports usually contain much too much material, and are difficult to comprehend.
- **Practise your presentation** in front of friends and/or other students. This will give you confidence and you will be less nervous. It also allows you to judge the timing. **Many students misjudge the timing — and have to be stopped before they have finished what they have prepared: make sure that this does not happen to you!** It is possible to book a room in which you can practise the presentation in front of some friends; to arrange this, please contact the Taught Student Office.
- Does it look professional?

Assessment Guidelines

The following is meant as a guidance to what constitutes a particular mark. However the assessors and, especially, the External Examiner will take their own decision independent of these guidelines.

Distinction, 70 - 100

- Extremely well organized and presented.
- Project could serve as a basis for a course at the Master's level.
- Excellent choice of examples and logical flow.
- Required little help from supervisor (relative to the difficulty of topic).
- Good evidence of originality and independent thinking.
- Mastery of material.

To achieve a Distinction, students do not need to have achieved mastery or excellence in all the above. Marks will be given for originality and evidence of independent thinking.

As we have stated, in some cases a dissertation will contain original results in mathematics. (However this is not a requirement.) The presence of some original work will indicate that the dissertation may be awarded a distinction, but other factors will also be considered.

The full range of marks from 70 to 100 should be utilized by the examiners, with the following criteria in mind.

Distinction, 95 - 100 Excellent in all criteria, with original work of publishable quality.

Distinction, 85 - 94 Excellent in most criteria and highly competent in others, shows mastery of the material. The dissertation could be used as a basis for a course in the material without many changes.

Distinction, 75 - 84 Excellent in many criteria and competent in others, demonstrating a high degree of mastery of material.

Distinction, 70 - 74 Excellent in many criteria and competent in others, demonstrating a high degree of mastery with some minor gaps.

Merit, 61 - 69

- Well organized and presented.
- Good choice of examples and logical flow.
- Required a reasonable amount of help from supervisor (relative to the difficulty of the topic).
- Some evidence of independent thinking; follows standard texts sometimes.
- Sound understanding of the material.
- Project could with some significant corrections and/or extensions be used as a basis for a course on the material.

Pass, 50 - 59

- Adequately organized and presented.
- Reasonable choice of examples and logical flow.
- Required a substantial amount of help from supervisor (relative to the difficulty of the topic).
- Little evidence of independent thinking; tends to follow the sources closely.
- Includes some good understanding of material.

Fail, 0 - 49

- Poorly organized and presented.
- Poor choice of examples and logical flow.
- Required a significant amount of help from supervisor (relative to the difficulty of the topic).
- No evidence of independent thinking; very closely follows sources.

- Little understanding of the material.
- No new examples.
- Contains confused or illogical arguments and definite errors.
- Many errors in English making the dissertation hard to read.

JRP, February 2017