School of Mathematics

Undergraduate Project Guide

Content

1. Introduction page 2
2. Aims and objectives page 2
3. The project supervisor page 2
4. Project calendar page 3
5. The Project Report page 3
   5.1. Different types of projects page 3
   5.2. What is expected page 3
      5.2.1. Plagiarism page 4
      5.2.2. Originality page 4
   5.3. The Software page 5
      5.3.1 Word processing page 5
      5.3.2 LaTeX page 5
   5.4. The structure of the project report page 5
6. Oral presentation and examination page 6
7. Awards of Marks page 6
8. Regulations page 7
9. Registration page 7
10. Submission page 7
11. References page 8

Updated March 2019 v.2.0
1. Introduction

The School of Mathematics offers projects to students in their third and fourth years. The projects can be a two-semester double project, or single semester projects. The double project has a 20 credit weighting for third year students (MATH30000) and a 30 credit weighting for fourth year MMath students (MATH40000). The single project has a 10 credit weighting for third year students (MATH30011 and/or MATH30022), and a 15 credit weighting for fourth year MMath students (MATH40011 and MATH40022). Students in the final year of the MMath programme are required to take 30 credits of project work: either as MATH40000; or as two 15 credit semester projects (MATH40011 and MATH40022). For students on the MMath Mathematics with Financial Mathematics degree programme the project has to be in Financial Mathematics. The requirements are different for some joint honours students: MMath&Phys students must take a 15 credit Mathematics project and a 20 credit Physics project; Students in the final year of the BSc Mathematics with a Modern Language degree programme can opt to do a one single-semester 10 credit project, which can be in either semester. Mathematics and Philosophy students must prepare a 20 credit Philosophy dissertation that is administered by the School of Social Sciences; and the Maths with Finance students have the option to take a project in Financial Mathematics.

2. Aims and objectives

The aim of a project module is to give third and fourth year students an opportunity to research a chosen mathematical topic in depth; and to improve their communication skills through producing a written account and giving a short verbal presentation on the topic. It provides opportunities to develop transferable communication and time- and task-management skills, through researching the topic and organising and producing the written and oral reports.

3. The project supervisor

The role of the supervisor is to give guidance, initially and as the project develops, to make you aware of the standard and quantity of work required; to comment on the general shape of your report and to give a certain amount of detailed feedback, for instance on a sample or draft chapter. For double projects (full year) the student is expected to prepare a piece of work, referred to as an interim report, that must be submitted to Blackboard via the MATH40000 year module, by the single semester project deadline in January. This will typically be an early chapter of the project, a description of what the project will eventually contain and a workplan for the second semester. This interim submission will not be a formal part of the examination, but will ensure you are making adequate progress and are comfortable using LaTeX. It will also enable you to obtain feedback on your work and to discuss with your supervisor possible improvements to your writing style and presentation. Each project is different, and the frequency of meetings should be determined between you and your supervisor as the project progresses. It is usual to meet with your supervisor every two weeks initially to discuss progress, ideas and methods. However, you are encouraged to work independently and show initiative and creativity. The main responsibility for progress lies with you. If you are stuck or unclear about where you should be heading then you should contact your supervisor as soon as possible: do not postpone this because the deadline seems far away.
4. Project calendar

<table>
<thead>
<tr>
<th>Project Information registration sessions for MMath students</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project information session</strong></td>
</tr>
<tr>
<td><strong>Registration opens online</strong></td>
</tr>
<tr>
<td><strong>Registration deadline</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project registration information for BSc students</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Registration opens online</strong></td>
</tr>
</tbody>
</table>
| **Registration deadline** | Semester 1 projects - week 1 of semester 1*  
Semester 2 projects – week 12 of semester 1* |

<table>
<thead>
<tr>
<th>Submission deadlines</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interim Report for double projects submission deadline (to Blackboard MATH40000)</strong></td>
</tr>
<tr>
<td><strong>Semester one project submission deadline</strong></td>
</tr>
<tr>
<td><strong>Semester one oral presentations</strong></td>
</tr>
<tr>
<td><strong>Double project submission deadline</strong></td>
</tr>
<tr>
<td><strong>Semester two project submission deadline</strong></td>
</tr>
<tr>
<td><strong>Oral presentations</strong></td>
</tr>
</tbody>
</table>

*exact dates will be available from the project pages on the school website

5. The project report

5.1. Different types of project:

Broadly, projects can be divided into several types:

Reading several sources and presenting the mathematical ideas from these sources as a coherent whole. The mathematics is expected to be correct and substantial, and the presentation uniform and understandable to other students in your year.

Investigating a mathematical or statistical model using numerical/statistical methods. This may include developing new methods or applying existing methods to new problems.

Developing new mathematical ideas or adding details, where statements and/or proofs are not in the literature. Compared to the previous types, the amount of mathematics may be less, but should be no less accurate.

Essay style projects - for example a historical project. The amount of actual mathematics would probably be lower, but there should be a correspondingly greater amount of analysis and criticism.
Other types of project are also possible, and many projects will be a combination of more than one of these aspects. A mark of 100% would be obtainable for a perfectly written project which a student has done mostly independently and is sufficiently novel that the content could be published in a respectable journal.

5.2. What is expected

This varies according to the type of project.

**Length:** There is no set length, and it depends on the 'density of the content'. Your supervisor will advise you on this for your specific project. As a rough guide, projects tend to be about 25 pages per 10 credits. If there are many diagrams, or much computer code then this should be increased by a corresponding amount, and essay style projects should also be a little longer.

**Structure:** Title page, Introduction, Table of Contents, Main body, Conclusion, Appendix, References (see below for more details)

**Correct English:** Grammar, punctuation and spelling are important. Notice that in all books and research papers you read, the mathematics is punctuated properly, and displayed equations end in a full stop where appropriate. The book by Higham [1] (listed in the bibliography below) is an excellent manual for writing mathematics.

**Typesetting:** All projects must be typeset on a computer although diagrams may be added by hand. You will also be expected to submit a pdf version, which may exclude the diagrams if they are hand-drawn. See below for more details.

5.2.1. Plagiarism

Plagiarism is simply passing someone else's work off as your own, and is considered a serious offence. In mathematics, copying a definition or the statement of a theorem is not considered plagiarism. But for a long proof, it is much better to read it, absorb it and then write it in your own words, perhaps adding extra details. If there is something you want to copy more or less verbatim (perhaps a proof), then make sure you quote the source so you are not passing it off as your own. The electronic online submission Turnitin will be used to check for plagiarism. See University guidelines on plagiarism. Please note that self-plagiarism, restating your own work from previous projects without reference, is also counted as plagiarism.

5.2.2. Originality

Writing a project is like telling a story, and there are various ways you can put a bit of originality into a mathematics project.

There might be details in a proof you don't understand at first reading, so when you write it add some details which would have helped you. Also where the original author has written "clearly, ..." you could add a justification of this point - why is it clear? Explaining the proof in a different way or drawing analogies to other proofs is another possibility.

A simple way to add something of your own is to add examples illustrating a definition or a theorem, or showing that a particular hypothesis is needed.
If you are reading from a text book that has exercises, then solve some of these exercises at the appropriate place in your project.

In numerical work, you can investigate a system or aspects of a system that have not been studied before. Also presenting your own computations of an existing result is your own original work.

Like telling a story, it’s how the facts fit together in a narrative that makes it your own.

Finally there is the indisputable originality of proving a new result that cannot be found in the literature, or giving a significantly different proof of an existing result. Such a possibility is most likely to arise from suggestions by the supervisor.

5.3 The Software

5.3.1. Word processing

There are two types of software suitable for writing the project. Firstly the wysiwyg type such as MS Word or OpenOffice.org, both of which have equation editors though both have their limitations. The other type is LaTeX, which is the ideal for writing a large amount of mathematics - it has a steeper learning curve than the wysiwyg variety, but is usually worth the effort. If you are thinking of working in a research environment, then it is even more worthwhile investing the time to learn LaTeX. The School also has a limited number of licences for Scientific Word, a package providing a user-friendly front end to LaTeX. Whatever software is used to write the project it must be capable of producing machine readable pdf, needed for the online submission.

5.3.2. LaTeX

The school provides an online short course on LaTeX which is accessible from the Year modules MATHS3000 and MATHS4000, or from the link below. Demonstrations of the material are given during reading week in the first semester of term.

http://www.maths.manchester.ac.uk/~pjohnson/pages/latexShort.html

5.4 The structure of the project report

Title page: The project must begin with a title page showing the title, author (you!), your student ID number, your supervisor’s name, and the course code.

Contents: A table of contents while not essential is very helpful for the reader.

Summary (Abstract): An introduction, giving an overview of the project and its context, and perhaps mentioning prerequisites (such as saying, "the reader should be familiar with a first course in linear Algebra"). Often an introduction will contain a paragraph or so describing briefly what is done in each chapter. It is also worth stressing the original contributions that you have made in the abstract.

Main content: The main body should be divided into sections or chapters, rather than being a continuous stream of ideas.

Conclusion: Possibly a conclusion, summing up the most important aspects. This is often a good place to show an overall understanding.
Appendix: 'Appendices' if relevant, giving for example computer code or mathematical details that would be distracting in the main body of the text.

References: This should include in all the texts you have made use of during your project, including websites. Reference to websites should include the date of access, just as reference to a book should include the edition number if there's more than one. It is a good idea to collect this information as you progress, rather than trying to remember at the end which sources you used (usually an impossible task). There are several different acceptable styles for lists of references, and looking in books or research papers will help. It is important to cite specific references in your project. Simply providing a long list at the end is not helpful because it does not tell the reader what each reference was used for.

6. Oral presentation and examination

There will be an oral examination for every project that will take place after the submission deadline and will be scheduled by your supervisor at a mutually convenient time. The two semester project submission deadline is in place so that students can arrange their oral examination prior to the examination period. This exam should begin by the student giving a short (5-10 minute) presentation on the project, followed by questions from the examiners. The main purpose is to test the student’s understanding of the material in the written project. The presentation can be delivered with chalk and blackboard, with overhead transparencies, on a computer or with no visual aids at all. Please ensure you give the supervisor adequate notice of which method of delivery you prefer. In such a short presentation, you will not be able to cover all the details of the project, so do not try. It is better to give a short overview describing what you find are the most interesting points, and perhaps selected details.

Students, who fail to attend the oral examination without good reason, will see a reduction of marks for Understanding.

7. Awards of marks

Marks for all projects are awarded under principal categories (but not every criterion here is relevant to every project):

- A well written introduction and possibly conclusion; bibliography; overall organization of material.
- Precise and effective communication; Clarity of writing and exposition; explanation and coherent use of notation; clearly written equations.
- Precise mathematical arguments; consideration of accuracy in use of numerical methods.
- Originality; Independent work; Individual expression and critical writing; Independent use of library.
- Appreciation of the meaning, context and significance of the work.

While 'quantity' is not explicit in this list, lack of content would be reflected in low marks across all 5 categories.
8. Regulations

8.1. Who can take a project:

Level 3: Students may opt to do a project, which may be either a one semester (10-credit) or a two semester (20-credit) project. Normally, a student would not undertake a one semester project in each semester, however permission to do so can be granted by the Year Tutor. A first semester project may be converted to a two-semester project up to the ninth week of the first semester, and only with the agreement of the supervisor. On some joint degree programmes where the mathematics modules of the third year would amount to less than 40 credits, you may not be permitted to take a double mathematics project. Therefore you will need to check the programme structure of the course you are studying.

Level 4: All MMath students must take 30-credits worth of projects, which can be a two semester 30-credit project or a one semester project (15-credit) in each semester. Students who wish to take the latter option are required to arrange supervisors for both projects at the start of the academic year.

MMath&Phys: Note that MMath&Phys. students on a Mathematics and Physics joint degree are governed by regulations in the School of Physics. It is usual to do two projects, one in mathematics MATH40011 in the first semester or MATH40022 in the second semester (15 credits) and one in physics PHYS40181 in the first semester and PHYS40182 in the second semester (20 credits). There is a possibility of one combined project in an appropriate topic in mathematical physics with permission from both the Mathematics and Physics project coordinators.

8.2. Overlap

A student may do a project and also take a course that covers related material but the overlap must not be too large because, in terms of content, the project will be judged on the non-overlapping material. Check with the supervisor and plan ahead to avoid any such conflicts.

9. Registration

You must register by filling in the online registration form from the Schools project website to confirm you have the agreement of the supervisor. The registration form is available for MMath final year students in either week 9 or 10* and must be completed by the deadline. For BSc students the registration form is available during course unit selection in mid-July. If, having agreed to do a project, you later decide not to proceed, please inform the supervisor (since the supervisor might then be able to take on another student) and also the Teaching and Learning Office.

*specific dates will depend on the timing of the Easter break and term dates. These will be shown on the school website.

10. Submission

For Full Year Projects the student is required to submit an electronic copy of an Interim Report to Blackboard (the MATH40000 year module) by the semester one project deadline in January. This will typically be an early chapter of the project and a description of what the project will eventually contain. This interim submission will not form part of the examination, but will ensure you are
making adequate progress and are comfortable using LaTeX. It will also enable you to discuss with your supervisor, possible improvements to your writing style and presentation.

An electronic version in machine readable pdf format should be submitted online (via Blackboard) by the following deadlines:

2019/20 Project Submission Dates:

Semester 1 Projects and Full Year Interim Report – 13th January 2020
Full Year Projects – 5th May 2020
Semester 2 Projects – 14th May 2020

Late submissions will be subject to a penalty of a 10% reduction of the final mark for each weekday late.

The front page of your project should contain at least the following information: your name and student number; the name of your project supervisor; the relevant course code and the title of the project.

A Project Supervision Questionnaire will be sent to you after the oral examination has taken place. You should also keep a copy of the project for your own use at the oral examination.

11. References