



Department of Mathematics

Third and Fourth Year

Project Handbook

2011 - 2012

May 2011

1 Levels 3 and M Projects in Mathematics

Introduction

A project is your chance to carry out some independent study on a topic that interests you, probably building on the mathematical skills you have learned elsewhere in your degree programme. Most students who attempt a project find it an enjoyable and rewarding experience.

All single honours students in Mathematics must do either a project-based unit or a unit involving essays etc. – the programme requirements regarding written work are spelled out in the Third Year Undergraduate Handbook.

M.Sci. students must take a Level M project worth at least 20 c.p., and a further 10 c.p. of written work. For the M.Sci. in Mathematics with Statistics, the 20 c.p. Level M project must be a statistical project (i.e. supervised by a member of staff from the Statistics group).

Students from joint programmes should first consult the relevant joint handbook and/or their Programme Director.

Blackboard course

There is a self-enroll Blackboard course with ID MATHS_PROJECTS. This course contains the list of suggested project topics, information on training, the online submission system, and other useful features. You **must** self-enroll for this course if you wish to take a project.

General advice

There is much to be gained from working on such projects. It is a piece of mathematics of your own choice, done at your own speed, as opposed to the conventional lecture format. It gives you practice in seeking out information, and charting your own course of study. A project supervisor will look for how well *examples* have been constructed or cited, that illustrate your topic, and how well you have been able to use the suggested literature and/or seek out new sources for yourself.

You will be assessed on the following criteria:

- How much work you have done, relative to the number of credit points and the level.
- Whether your report is correct, how deep your understanding of the material is, and how independent your thinking has been.
- How well have you written your report, in terms of logical structure and style of writing.
- How well the report has been presented, in terms of the word-processing and figures.
- Whether you have referenced sufficient number of original sources correctly.
- How well you present your work at project talk day.

The forms used for assessment are available on the MATHS_PROJECTS unit on Blackboard.

Timetable

- **June - October:** The student chooses a project title after discussion with a potential staff supervisor. You are advised to talk to potential supervisors before the end of the summer term, especially since each supervisor can only supervise a small number of projects and may be full up by the time you approach them if you leave it too late.
- **Before Monday 17 October 2010:** Return your project choice form (at the back of this handbook) to the box on the porters' desk.
- **October - mid-November:** The student defines the scope of the project more closely, by reading and by discussion with the supervisor. Skills training will be available during this time (for details, see the Blackboard course MATHS_PROJECTS).

For 10 c.p. projects:

- **November - January:** The student works independently on the project. It is expected that the supervisor and the student meet approximately once a month for an hour during term time to discuss the progress of the project, however this schedule should only be used as guidance, since individual circumstances might require somewhat more or less frequent meetings.

• **Monday 30 January 2012:** Reports on 10 credit point projects are submitted for assessment. They should be handed in to the School Office by midday.

- **Within two weeks of submission:** The student will give their talk, and will receive feedback from the supervisor. The exact timings will be confirmed nearer the time.

For ≥ 20 c.p. projects:

- **November - April:** The student works independently on the project. It is expected that the supervisor and the student meet approximately once a month for an hour during term time to discuss the progress of the project, however this schedule should only be used as guidance, since individual circumstances might require somewhat more or less frequent meetings.
- **Before the end of the first teaching block:** the student will give a short presentation (~5 minutes) to their supervisor. The topic will be "My project" and the talk should explain what the student is working on, progress to date, and the planned work schedule till the end of the project. Visual aids should be produced for this talk, and the supervisor will provide feedback on all aspects of the presentation, including progress of the project, using the form which are available in the MATHS_PROJECTS unit on Blackboard. **A copy of this feedback should be signed by both student and supervisor, and returned to the Project Coordinator who will keep it as a record of the progress of the project.**

• **Monday 30 April 2012:** reports on ≥ 20 credit point projects are submitted for assessment. They should be handed in to the School Office by midday.

- **Within two weeks of submission:** The student will give their talk, and will receive feedback from the supervisor. The exact timings will be confirmed nearer the time.

Please note that late submission of your project may result in penalties

Nature and length of projects

These projects are designed so that the student may study independently, from books, mathematical papers or other sources, and write a written report of that work. A good project will show that you have read some papers, understood some concepts, and can communicate what you have learnt clearly and enthusiastically.

The best guide to the length of a project is that 10 c.p. project should correspond to approximately 100 hours of work altogether. For longer projects the amount of time spent on it should increase linearly in the number of credit points. This guideline corresponds to the University norm that 120 credit points correspond to a full academic year's work; and we shall bear it in mind when assessing projects.

Most Level 3 projects are worth 10 c.p. Some may be longer. Level M projects are 20 c.p. or more. But in all cases you should discuss the requirements in detail with your supervisor.

As well as a written report, the student is required to give a short talk on the project, after the report is handed in, at project talk day (see the section on 'The Talk' on page 7). It counts for 10% of the project mark. The length of the talk will be approximately 10-15 minutes.

Choosing a project

You may choose a project from the list on the Blackboard unit MATHS_PROJECTS, or you may undertake a project on a subject of your own choice provided that a member of staff approves the topic and is willing to supervise it. Many members of staff will be happy to discuss the possibility of supervising projects related to their research, even if they are not listed in the handbook; you should feel free to approach any member of staff to discuss whether they will be able to supervise a project that is of interest to both of you.

You should choose your project as soon as is reasonable and get agreement from a suitable staff member (not necessarily the one who suggested the title) to act as supervisor. Note that each member of staff can only supervise a small number of projects. Therefore:

You are strongly advised to talk to project supervisors before the end of the summer term.

As there is considerable variety amongst the topics here, it is as well to have some clear discussion with your project supervisor of what he/she will be looking for in your completed report. It is best to define the parameters of the report sooner rather than later.

The form on the last page of this Handbook should then be completed, detached and returned to a box on the Porter's Desk in Mathematics.

Please return your signed form by Monday October 17th, 2011.

Projects in Engineering Mathematics

The Engineering Mathematics department runs projects; details are on their web pages.

If you are interested, talk to the project supervisor. You may undertake one of these projects, under the rules of the Mathematics Department project scheme, with a supervisor in Engineering Mathematics and a second marker in Mathematics. It will be your responsibility to ensure that the procedures given in this handbook are followed.

Your project report

Your written exposition counts for the bulk of your marks and you should invest time in thinking about its presentation. It is helpful to decide exactly whom you are writing for: the default should be that you are writing for a fellow third-year student, but it may be appropriate to write for an alternative audience. If you are not clear about this, discuss it with your supervisor. The main thing is to decide on a particular audience for your report, and write so as to be intelligible and interesting to that audience.

Imagine a typical reader looking over your shoulder as you write, and reacting to your words. Try to keep this reader interested, intrigued, but not baffled.

Try and make a continuous chain of written thought; do not lurch from one topic to another without adequate introduction or rationale. ‘Discontinuity’ and jumps in exposition are off-putting to your readers. Hence *clear organisation* is very helpful, to the reader and to the writer. Unless it is very short, divide your work into sections, each dealing with a clearly identified subdivision of your topic. Begin by saying what the project is about; start each section by outlining what is to come. The reader should always know whereabouts in the whole structure he/she is, and how each section relates to the overall plan.

Consider carefully how diagrams may help the reader understand. They can be invaluable both in helping your written exposition along, and preparing the way for your oral report later.

You should also clearly indicate in your text the source of your ideas. This is an important point and is dealt with below under *References and Plagiarism*.

The ending should draw the whole piece of work to a satisfactory conclusion; do not give the impression of grinding to a halt because you can not think of anything more to say.

Project reports may take a variety of forms: essays, mathematical reports, computational work, practical work, etc. The lengths of the projects are therefore very varied; but essay-type reports are typically between 8,000 and 15,000 words long. But you do not *have* to produce a report of $\geq 8,000$ words: a short report representing the result of a good deal of thought is very likely to be worth more than a longer report of a more superficial character.

Training on how to write mathematics will be provided at the start of Teaching Block 1.

Books on how to write

Here are some books on how to write, and particularly how to write scientific and mathematical reports.

1. S. Krantz, *A Primer of Mathematical Writing, Being a Disquisition on Having Your Ideas Recorded, Typeset, Published, Read and Appreciated* (American Mathematical Society, 1997), contains a lot of sensible advice, though some of it is aimed more at research workers than undergraduates.
2. N. J. Higham *Handbook of Writing for the Mathematical Sciences* (S.I.A.M. 1993/1998), particularly good on writing advanced mathematics, but also discusses basics.
3. Joan Van Emden, *Effective Communication for Science and Technology* Palgrave Macmillan, 2001
4. Phyllis Creme and Mary R. Lea, *Writing at University* 2nd ed., (Open University Press, 2003). Includes report writing, electronic writing, using the Internet.
5. R. Barrass, *Students must write* (Routledge Falmer, 1995): wide-ranging and useful.
6. C. Turk & J. Kirkman, *Effective Writing*, E. & F. N. Spon, 1989: aimed particularly at technical writing.

References and Plagiarism

See also Appendix C in the Third Year Undergraduate Handbook.

A common weakness of projects is a poorly referenced exposition. You are *not* expected to have invented a whole new subject field and written it up for your supervisor! You *are* expected to have read some, maybe several different, sources, and you *are* expected to acknowledge where you have found the various ideas, quotations, proofs and so forth that you make use of in your text. This is *not* a weakness in your project: it is a sign that you have made full and proper use of the literature available (in libraries or on the internet). It is a courtesy to your readers to tell them where to find out more about the various things you are telling them.

It is essential to make *proper acknowledgement of sources*; this is regarded as correct scientific behaviour. In each section of your report it should be clear where the ideas have come from. Not to do so is to lay oneself open to the charge of *plagiarism*, that is, using other people's work and passing it off as one's own.

Plagiarism, as defined above, is a breach of University Regulations, and a disciplinary offence. The Rules and Regulations for Students concerning plagiarism can be found at:

<http://www.bris.ac.uk/secretary/studentrulesregs/>

and advice can be found at:

<http://www.bristol.ac.uk/is/library/findinginformation/plagiarism/advice.html>

The guiding principle is that no work is entirely original; many of the ideas, quotations, proofs and so forth come from other sources both published and unpublished, including the author's previous work. This applies to all scholarly work, including that of the highest quality. Stating the sources is necessary not only to avoid plagiarism, but also to demonstrate the amount of wider study involved and provide information to readers who would like further information about particular aspects of the work.

- **References** to the original work from which the ideas etc. came should be given in a form similar to mathematics journal articles, ie author/year [Gauss, 1801] or reference number [3] in the text, followed by a full details in the reference/bibliography section at the end. All references in the bibliography should be cited in the text (perhaps as "for further reading on this topic, see refs...").

Peer reviewed publications including journal articles and books from reputable publishers hold greater weight than most other sources. Online directories such as Wikipedia can be a useful starting point, but without systematic peer review there is a much higher probability that the author of any given piece of text is biased or uninformed. Using any internet sources (Wikipedia, etc) as references for detailed proofs and definitions should be avoided, unless explicitly agreed otherwise with the project supervisor.

- **Direct quotation** of text must use quotation marks and a citation as in other fields. However for mathematical definitions and theorems it is sufficient to say something like "The definitions in this section are taken from ref [6]", or "Theorem 4 [theorem 2.3 of ref 6]" without the use of quotation marks. **If you quote large sections of text, e.g. from Wikipedia, then you must provide a reference to a specific URL to avoid a plagiarism accusation, and little (if any) credit will be obtained for the quoted text.**
- **Common theorems** such as the fundamental theorem of calculus, and common techniques such as differentiation are so well known that they can be used without a reference, although to provide one is a courtesy to the reader who may be interested in more details. However if the theorem is explicitly stated, its source must be cited, perhaps with an explanation of any changes in notation. Any theorem or technique that is not in an undergraduate textbook or lower level undergraduate lecture course is not a "common theorem" and so a reference must be given.

Preparing and handing in your project report

The written report will be double-marked, by the project supervisor and another member of staff. You must therefore hand in **two copies of the report**. Both copies should be submitted to the School Office by midday on the date of your submission.

You should also submit an electronic version of your project through the MATHS PROJECTS unit on Blackboard by the same deadline. Automatic plagiarism checks may be run against this electronic version.

The report is part of your final assessment material, so one copy will be kept by the University. You should keep a copy for yourself. We may like to make some projects available to future project students for learning purposes; we will assume we have your permission to do this unless you explicitly tell the Project Coordinator otherwise.

Your work should be word-processed, easily readable, printed on both sides of the paper, and presented in some form of binder. Leave a margin of at least 2.5cm on both sides of the paper. Number every page (so that it is easy to refer to bits of your work by page number). Also number diagrams etc., and refer to them by number at the relevant point of the text.

The first page of your project should contain the following information:

Project title
Name of student
Level and number of c.p.
Name of supervisor
Date of handing in

Also, you must include a statement that the project complies with the guidelines in the section *References and Plagiarism* on p. 5, so:

The second page of your report must be a signed copy of the plagiarism statement that can be found in the Maths Projects unit on Blackboard

Your project talk

Explaining ideas to other people is a useful general skill, and it is valued by employers. The project talk gives you an opportunity to practice it.

Talks will be given in sessions shortly after project submission. Each session will have approximately six students giving their talks, and a similar number of academics who will mark the talks.

Your talk will be assessed on the following criteria:

- The choice of material for your talk
- The clarity of exposition, and logical structure of the talk
- Delivery of the talk (are the pace and volume appropriate)
- The quality and usefulness of the visual aids
- Your response to questions that are asked

The forms used for assessment are available on the MATHS_PROJECTS unit on Blackboard.

Discuss the talk with your project supervisor. Should it be a general description of all the work, or should it focus on one part of the work? What kinds of visual aids are most appropriate (many students will use projected slides)? Other questions will probably occur to you; you should discuss them with your project supervisor.

Having clarified these points, you should bear them in mind when preparing your talk. You should write out a detailed outline of what you are going to say. You may or may not want to write out a complete text for the talk, but if you do, you should regard it as part of the *preparation* process, not something to be used during the talk. Reading from a prepared text is likely to produce a very dull talk, unless you have professional-level skills in reading aloud.

It is very helpful to *practice* the talk: persuade a friend to listen to the talk, and discuss it afterwards. You may wish to arrange a group of project students to give their talks to each other and provide feedback. You could also ask your supervisor to hear your talk and provide feedback. **Timing is essential.** If you run over the agreed time, you should expect marks to be deducted. If you end a minute before the agreed time, that is not serious, but if your talk is significantly shorter than the agreed length, again marks may be deducted.

In a nutshell: careful preparation is the key to a good and relatively stress-free talk.

Training on presentation skills will be provided at the start of Teaching Block 1.

Training Provided in the Department

As well as the standard skills training provided by the Students' Union and the Career's Service, there will be relevant training provided within the maths department. This will occur at the start of Teaching Block 1, and will be announced by email. Sessions will be given on:

- Organisation and Planning
- Presentation Skills.
- How to write mathematics.
- How to use \LaTeX (a mathematical typesetting programme which allows easy production of mathematical documents).

Materials from these sessions will be posted in the MATHS_PROJECTS unit on Blackboard.

Assessment

The project reports will be marked by two people, normally the project supervisor and another member of staff. They will use a Project Assessment form which you can see in the MATHS_PROJECTS unit on Blackboard. You will receive copies of these forms, and your talk assessment form, as feedback. You should also, of course, feel very free to ask for feedback directly from your supervisor. However your final project mark will not be released until after the examination board meets at the end of the academic year.

Peregrine Prize

The Department awards a prize for the best project submitted at any level and is open to all students. The award is presented on graduation day. Please refer to the '*Guidelines for Examiners*' for further information.

Problems that may be encountered

If you have any concerns with the subject matter of your project or with meeting the project deadline you should consult your project supervisor in the first instance.

If you experience difficulties with your project supervisor please contact either the Undergraduate Coordinator or the Project Coordinator.

If medical or personal circumstances affect your work, please notify your supervisor and the Undergraduate Coordinator.

Please note that late submission of your project may result in penalties!

**TO BE FILLED IN BY STUDENTS TAKING A LEVEL 3 OR M
MATHEMATICS PROJECT**

STUDENT'S NAME _____

PROJECT TITLE _____

LEVEL: circle one: 3 M

NUMBER OF CREDIT POINTS: circle one: 10 20 30 40

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SECTION BELOW TO BE COMPLETED BY THE SUPERVISOR

SUPERVISOR'S NAME _____

SUPERVISOR'S SIGNATURE _____

SUPERVISOR'S TWO SUGGESTED SECOND MARKERS _____

*Please detach and place in box on the Porters' desk in the Mathematics Dept
by Monday October 17, 2011*

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