

Bachelor and Master projects

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In this text I want to collect some ideas I have concerning the supervision of Bachelor and Master projects. My experience is that it is good, both for myself and the student, to formulate some rules at the start of the project.

Choice of topic. My own area of expertise is Algebraic Geometry; in my research a number of other topics play a role, such as Algebra, Homological Algebra, Category theory, Representation theory, Number theory, Topology, Analytic Geometry and Differential Geometry. In theory, I could supervise theses on a fairly broad range of topics in pure mathematics; but in practice, I only feel competent enough to supervise projects on topics that are related to my own interests, which usually means that there is some connection to Algebraic Geometry. Within IMAPP there are of course several other mathematicians with overlapping expertise, and I strongly encourage you to talk to several potential supervisors before making a choice.

Before I can propose a topic for your thesis, I need to know more about your mathematical background. Please send a list of courses you have already taken and your grades for them. Information about courses you are currently taking, or are planning to take, is helpful, too. For the choice of topic it is relevant to know more about your ambitions and interests. For this, please try to answer, to the best you can, the following questions:

- What are your ambitions? What are your goals for the next years?
- Do you already know what kind of job you'd like to have? Do you want to become a researcher? teacher? Do you want to work in the industry?
- Which topics in mathematics have your special interest? What do you like, which topics do you like less?
- What are you good at? For which things do you have less talent?

Please send your answers to these questions to me by email; this makes it easier for me to store them on my computer, so that I can find them at a later time, when needed.

Based on the information you have provided, I will usually try to find a couple of topics that seem suited. I will send you a brief description of these. On the basis of this, and of what you can find on the internet and in the library, you have to make a choice. If none of the proposed topics sparks any enthusiasm, let me know, so that I can try to find something else.

Planning. When you start working on your thesis, we decide when you want to start and when you should like to (or need to) finish. As far as possible, I will see to it that the project is finished on the intended final date. The final responsibility for this is in your own hands, however. In practice, writing the thesis often takes (much) more time than expected; take this into account when planning your schedule. If you're unable to work on your project for a longer period of time, please inform me.

During the project, you should write detailed notes on what you have been doing, including examples that you have worked out, etc. These notes do not form the final thesis (see below) but they do contain material that can be used in the thesis. Make sure to store these notes in a place where you can find them when you need them (which can be many months later).

Discussing your progress. As a rule, I assume we will meet to discuss the project once every second or third week. For these appointments I will reserve a full hour in my calendar. Meeting more frequently is usually not very productive, as you may not have much to report on. If we meet less often, the project may lose momentum.

Usually it is convenient to make a new appointment at the end of our meeting. Sometimes there are reasons not to do so; in such a case I expect that you will contact me in due course to make the next appointment. If you're unable to come, let me know as soon as possible, preferably by email. If I need to cancel the appointment, I will let you know at once. Make sure that I have your email address, and that you regularly check this account for incoming mail.

The principal goal of our meetings is to discuss what you have worked on, and to give you the opportunity to ask questions. Further, I will try to give suggestions for how to get further. To use the available time in an optimal way, please send me a summary of what you have done a day before the meeting at the latest; this will give me the opportunity to prepare the meeting.

It is of vital importance that you realise that you yourself are responsible for a steady progress of the project. I expect you will search for relevant literature on your own initiative, that you try new things, ask questions, etc. To find literature, use MathSciNet; see:

<https://mathscinet.ams.org/mathscinet/>

You have access to this site from computers of the RU, or from home via a VPN connection.

Writing your thesis. You will not start writing (parts of) your actual thesis until you have my approval. Depending on the topic, it may make sense to already write some first chapters, while you are still studying the material for later chapters. In other cases it may be better to start writing only towards the end of the project.

Per chapter I want to see a detailed outline of what you are going to write. This means that you should make a subdivision into sections and subsections (all with tentative titles), and that per subsection you write a detailed list of topics you want to include. Concretely, this means you should write one by one which definitions, lemmas, propositions, examples, etc., you are going to include. At this stage you do not yet write the actual text of these items. Only after I have approved the outline, you start expanding it into an actual text.

You should formulate very clearly what you expect the reader to know. What prerequisites do you assume? Who do you have in mind as reader? Keep a good balance with the existing literature on your topic. It's pointless (and illegal) to copy large parts from some existing source; instead you should refer to the literature for details, where relevant. Further, you need to make sure your text is attractive and interesting to the reader. Include good examples, start every new part of the text with a clear explanation of what you are going to do. Focus on the main line of the story.

Before you start writing, you should study a good text on the writing of mathematics. I recommend Chapter 12 of the *The Chicago Manual of Style*, entitled "Mathematics in Type". (The online version of the CMoS is available via the website of the University library.) In this chapter some basic rules of style are discussed that pertain to mathematics. Another brief text that may be useful is David Goss's "Some Hints on Mathematical Style".

In practice students (as well as more experienced mathematicians) grossly underestimate how hard it is to write a good mathematical text. About the writing of mathematics whole books have been written, and I don't think it is necessary to read those. Most important of all is that you take this seriously and that you *really* think hard about how to convey the message to the reader in an optimal way. Even then, some practice is required to become a good writer.

Typesetting. You should decide at the very start of the project in which language you're going to write the thesis. The thesis needs to be prepared using $\text{T}_{\text{E}}\text{X}$ or $\text{L}_{\text{A}}\text{T}_{\text{E}}\text{X}$ or some dialect of it. Experience teaches that the best results are achieved by keeping the typography as basic as possible, without too many bells and whistles. The precision and style of what you write are important; once you get this right, the font and layout you use is hardly relevant. $\text{T}_{\text{E}}\text{X}$ is only a tool to typeset your text. If your text is poorly composed, the most beautiful font is not going to improve this. Try to express what you want to convey in ordinary text as much as possible; the basic features of $\text{T}_{\text{E}}\text{X}$ will then suffice to typeset this.

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