UNIVERSITEIT VAN AMSTERDAM

Graduation project Bachelor Informatics Manual

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Summary

The graduation project is generally the last compulsory component that a student must complete to complete the programme. It differs from regular courses in terms of organization and assessment. This document is a manual for students and supervisors of the Graduation Project for the Bachelor of Computer Science. It describes the organization of the graduation project and the expectations towards students and supervisors as well as tips to both to bring the graduation project to a successful conclusion.

Appendix A: Ethical Compliance Procedure for Low Risk Student Projects in Informatics involving Human Participants

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Timetable

Contact moment	Explanation	When
Self-defined project proposal	Students who want to carry out a self-defined project must: 1. start looking asap for a supervising teacher or researcher from the IvI or ILLC. 2. submit a project proposal to the coordinator for approval.	**Deadline:** **2 weeks before the thesis project starts**
Project choice	Students who do not do a self-defined project will have access to the Canvas page of the graduation project with further information, including this manual and a list of projects to choose from.	**1 weeks before the thesis project starts**
Project choice	Each student selects a Top Five from the list of projects and submits it via an online form.	**1 week before the thesis project starts**
Student project assignment	The coordinator(s) assign the projects. In the event of an incomplete allocation, a second round may be necessary in which the unassigned students must indicate a new Top Five from the remaining projects. Projects from an external source often require an introductory meeting before the allocation can be made final. The coordinators will contact you about this. After assignment, you immediately contact your supervisor to discuss the project.	**0.5 week (about 3 days) before the thesis project starts**
Orientation	The student discusses the project with the supervisor. The student collects background information (including literature) and reads. The student produces a project plan in consultation with the supervisor.	**Project Week 1**
Submit	The project plan is submitted via Canvas. Further explanation about the structure and content of the project plan follows later in this manual.	**Deadline:** **Friday of Project Week 2**
Implementation, weekly meetings	During this period, the student works out the project in concrete terms. There is regular contact with the supervisor to discuss progress. In addition, some plenary meetings are held in which a number of students can give a short presentation about the progress of their research. This is for them to practice their thesis presentarion. **Participation of <u>all</u> students in their group meetings is desired.**	Throughout the project.

Special moments during this period:
For each project, See exact dates on Canvas.

Opening	Project beginning - Week 1
Submit: project plan (on Canvas) by Friday of week 2 (23:59).	Week 2
Submitting the first draft of the thesis before Friday of week 6 (23:59)	Week 6
Finalize the “Go/No-go” version of the thesis.	Week 9/10
Submission of the “Go/No-go” version, after permission of the supervisor.	3 weeks before the end of the project.
Completion, dotting the 'i' of the thesis, preparing presentation.	1 week before the end of the project.
Last week is reserved for Presentations.	

Second reader	The “Go/No-go” thesis is read by an independent second reader. They will have 5-7 working days to do so. Theses by students in an honors track are also assessed by a *third* reader. The third reader is a researcher outside the Computer Science Bachelor team.	Project Week 10/11
Handing in final version	Handing in the final version of the thesis, including a “delta document” with changes compared to the “Go/No-go” version is done	One week before the period end date.
Go/No-go At Go: hand in the thesis on Datanose	The student receives a message from their supervisor whether the second reader agrees (“Go”) with the content of the thesis, or that the thesis is of an insufficient level (“No-go”) and that more time should be put into the work.	

Preparing for the final presentation	With a “Go” the student submits the final version of the thesis to Datanose and prepares for the final presentation.	
Graduation	Presentations With a “Go” the student may present the work during the graduation presentations. **Submit the final version of your thesis to Datanose.** The final presentations will take place during the last week of the project.	
Re-sit submission of the thesis	In the event of a “No-go”, an improved version of the thesis may be submitted one more time for a reassessment until 4 weeks later at the latest. **Please note: for every week that the thesis is handed in later, half a point will be deducted from the final grade!**	**4 weeks after the project submission deadline**

Introduction

The Graduation Project Bachelor Informatics

The Bachelor Informatics programme is concluded with a graduation project. This project will run during periods two+three and periods five+six of the third academic year and will yield 18 credits if successfully completed. During the graduation project, the student revisits previously acquired knowledge, insights and skills in an integrated project to be carried out independently. The final result should be in the form of a research report (“thesis”) plus any appendices, such as code, and a public presentation. The whole is assessed on the quality of the insights acquired in the study and the ability to interconnect these and to give shape to a project to be carried out independently.
The Graduation Project for the bachelor’s degree in computer science is a compulsory part of the Bachelor Informatics programme. The organisation, supervision and assessment of this component differs from normal courses. Instead of lectures, labs or exams, students study a subject within computer science independently, but under expert supervision, and write a thesis for a period of approximately twelve weeks. The aim of the graduation project is for the student to demonstrate that they are able to independently carry out a research project and thus gain (basic) research experience. The student is expected to spend an average of 40 hours per week on graduation (480-500 hours in total).

Double Bachelor of Mathematics and Computer Science

For students of the Double Bachelor of Mathematics and Computer Science, different rules apply:

- Double bachelors participate in the graduation project in period five+six. The definition of the project already starts in January and is guided by the Bachelor of Mathematics.
- Double bachelors preferably do a graduation project at the interface of mathematics and computer science.

- The thesis is assessed separately by the two programmes: once according to the rules of the Bachelor of Mathematics and again according to the rules of the Bachelor of Computer Science. The final grade for the graduation project is the average of the final grades of both programmes.
- Since the timetable for double bachelor students is different, the deadlines are still coordinated with Mathematics. It is expected that double bachelor students will participate in the weekly plenary meetings for the Graduation project of the bachelor's program in Computer Science.

Project

Each year the coordinator(s) collect suitable topics from various categories for the graduation projects. This list is made available to students via the Canvas page of the graduation project. For each project it is indicated who is responsible for the supervision.

Choice of project

In general, each project can only be done by one student, unless stated otherwise. The student makes several choices from the offered projects and makes these known to the coordinator(s) via an online form. The coordinator(s) then decide the allocation.

External projects

Often there are also external projects, originating from a company or institute that is not affiliated with the IvI, FNWI or UvA. These subjects have been substantively screened and approved by the coordinator(s).

For an external project, *two* supervisors are needed: an "external daily supervisor" within the company that offers the project (this is generally indicated in the description), in addition, an "internal supervisor" in the form of a teacher is needed or researcher within the IvI. If this is not stated in the description, the student must find it himself. A student who wants to do an external project must also have demonstrated during the study that they are able to work independently.

Before the start of an external project, an appointment is made for an introductory meeting with the student, the supervisor within the company and the IvI supervisor. During this meeting, the content of the assignment is discussed and agreements are made about mutual expectations. If, after this conversation, there are doubts about the "match", it can be decided not to let this project go ahead. In case of doubt, the decision of the coordinator is decisive.

Please also check the below link to find more details about the internship agreement for external projects.

https://www.uva.nl/en/about-the-uva/policy-and-regulations/education/model-internship-agreement-for-academic-education.html

Number of projects per supervisor

For each project it is indicated who the supervisor is (often the party that defined the project, except for external projects). However; a supervisor cannot supervise arbitrarily many projects. A supervisor does not have to accept all supervision requests either. The coordinator keeps an eye on which supervisors are still available.

Self-defined project

In very exceptional cases, a project proposed by the student can also be approved. A student who wants to propose a project himself must have a proposal fully approved by the coordinator, including supervisor(s), well in advance of the start date of the graduation project. In addition, a student with a self-defined project must have demonstrated during the study that they are able to work independently. The graduation project must have the character of a (small) research project: there must be a research question or problem statement for which an answer or problem can be found within the graduation project. solution is being developed. The mere development of a piece of software, website or app is not in itself a suitable subject,

unless it contributes to finding an answer to a research question or to solving a problem. This must be demonstrated in the script.

Implementation

Work method

The student works independently and individually on a project under the supervision of a supervisor. The supervisor is a lecturer or researcher in the field of computer science or a closely related field of research. Postdocs and PhD students can also supervise projects. PhD students do need the permission of their supervisor for this. The project can also come from an external party. In that case, a teacher or researcher from the Institute for Informatics (IvI) or the Institute for Logic, Language and Computation (ILLC) is always involved in the implementation of the project as secondary supervisor.

Meetings

Weekly plenary meetings are held throughout the project, led by the coordinator(s) of the graduation project. **Participation in all meetings is required[1].** The progress of the projects is monitored during these meetings: a number of students present the progress of their project and discuss the challenges they have encountered. During the entire graduation project, each student will therefore be asked a number of times to prepare a presentation. Sometimes a lecturer or researcher will also be invited to a meeting to monitor the substantive quality of the projects and presentations. Since the presentations are also a good preparation for the final presentation, the student receives a formative assessment for each presentation.

Adjustment during the trajectory

The supervisor of a project generally has an overall plan in mind, usually in the form of an end goal. In practice, however, a project rarely goes as expected. For example, it may turn out that the student has already completed all the goals within a month, so that the plan has to be expanded. It may also turn out that the plan of the supervisor works out differently than expected. Or that much more prior knowledge is needed than initially thought, so that the set goal is not achieved.

It is not a disaster that a project does not go as planned. This is actually quite normal, because it is also very common in research. A project that does not meet the original goals can still be a good project and is not necessarily a failure.

One of the supervisor's tasks is to monitor the project goals and adjust and/or adjust them if necessary. Adjusting a project is not unusual for a teacher or researcher, but less common for a student. If you are in doubt about this (and this happens regularly), discuss this with your supervisor.

Expectations

What is expected of the student?

- *An active attitude, a lot of independence*: the student is the process manager of the project; it is not the supervisor's job to chase the student, let alone to help the student get a pass. If you show no or too little initiative, you will fail.
- *Initiative*: the student makes regular appointments with the supervisor (preferably weekly, at least once every two weeks); the student contributes ideas about the progress.
- *An active planning*: the student works regularly and in a structured way on the project; the student adjusts the schedule if necessary; the student ensures that he/she arrives prepared for the appointments with the supervisor.

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1 1 If you can not attend, please report this to the coordinator in time, stating the reason for your absence.

Absence without valid reason can lead to a maximum of one point deduction from the final grade!

- *Talk to others*: it helps to talk to others about your project, for example to explain where and why you are stuck. The other person may not understand much, but talking will help you further. Fellow students are excellent for this, but family and friends are also good.
- *Facilitator-management*: each facilitator has its strengths, but they often have multiple teaching tasks, research projects and other obligations. Keep that in mind.
- *Start writing in time*: a thesis is rarely written in one go; it is a process of trial and error. It is advisable to start writing early, for example by keeping a log. It's tempting to think you'll remember all your hunches, but you'll thank yourself if it turns out to be different at the end of your project and you've kept good notes.

What is expected of the facilitator?

- *Guidance with regard* to the subject of the project, the supervisor has the overview. Therefore, the supervisor is expected to guide the student through the subject. For example, if a student lingers too long in studying prior knowledge, the supervisor intervenes to help the student go through the material more quickly.
- *Guidance*: initially the supervisor explains and tells the student what to do. At a later stage, more emphasis will be placed on answering the student's questions and thinking along about the planning.
- *Control*: a project often does not go as planned: adjusting a project is one of the tasks of the supervisor.
- *Reading and giving feedback*: the supervisor is expected to read drafts of the thesis and provide feedback on them. Make proper agreements about this, because as a supervisor you simply cannot read and comment on all versions. A student may only hand in the thesis after approval from the supervisor.

The project plan

A project plan must be submitted in the first week of the graduation project. A project plan is a clear elaboration of the entire graduation project and describes the plan of approach. The project plan is submitted via Canvas after it has been approved by the project supervisor(s) (both in the case of an external project). It takes an average of four pages of A4 and consists of the following parts:

1. Of course, your **name, title of the project and the name of your supervisor(s)** not be missing.
2. the **context**; Describe here the part of the field in which this research takes place. It should be clear from this section how the research question, which will be described later, is positioned within computer science.
3. The relevant **literature**: what is the relevant literature associated with the research question? This often takes the form of a description of the “state-of-the-art”: a summary of results previously achieved by others and on which the research question builds.
4. The **research question**; describe the problem that will be worked on. This often takes the form of a reflection with regard to the “state-of-the-art” just described. As part of the research question, it is also described what the project will deliver: the product that will be delivered at the end, eg the results of a research, the source code of developed software, documentation.
5. **Methods**: how is the research conducted? Which subtasks can be distinguished? For example: extensive literature research, design and implementation of a program, design of an experiment.
6. the **schedule**; Describe how the available time is expected to be spent. It is often difficult to identify all activities in advance, let alone to indicate accurately on the day what will be completed on which date. In general, it is possible to identify a number of phases (eg literature research, design, implementation, experiments, writing a thesis, etc.) and to make a weekly schedule. Also consider the interim results, the dependencies that may exist and whether there are *critical* dependencies

that prevent the project from proceeding and what the alternative plan is in that case. A Gantt or Pert chart is often used for this.

Tips for a successful graduation project

The graduation project is more challenging for students than “normal” subjects in several respects: ● The graduation project is often the student's first contact with a research project.

- A lot is asked of the student's independence: the initiative and direction to successfully complete the project rests with the student.
- The project will last twelve weeks; that seems long, but it isn't; good planning is therefore important and that unfortunately often turns out to be a challenge.
- Students have never written a bulky document the size of a thesis before.
- The interaction between student and supervising researcher or teacher is often new to the student. The following tips are therefore good to keep in mind. They are not in a specific order and we add tips if we encounter common “problems”:

1. Meet regularly with your supervisor and/or update him/her digitally in between. Not only does it keep your work pace, it also keeps the project fresh in the mind of your supervisor, who probably has a lot more things to worry about.
2. Start your graduation project with a literature study. The aim of your literature study is to identify the missing knowledge (or sometimes even incorrect knowledge) to which your thesis will contribute (or correct). Make sure you present your literature study in that way in your thesis as well; don't make a messy list of what other people did.
3. Always keep the end goal in mind: the thesis. Think in particular of your research question(s). What does your script show? While it is possible to start an investigation purely on the basis of “curiosity”, chances are you will get lost and wander in circles. It is much better to focus on an answer to a specific question, such as "does algorithm X perform better when implemented in CUDA or in OpenCL?".
4. In most cases, a thesis is not written in one go. Your facilitator will want to see intermediate versions of you to see if you are on the right track. Make sure you send those intermediate versions to your supervisor in time with a request for feedback.
5. Use Gitlab/hub, Dropbox, Bitbucket, Google Drive, or any other version control system that also backs up your files somewhere online. Nothing is more frustrating than losing all your files (laptop crash) or accidentally introducing a bug in your code somewhere in the last 24 hours and then taking a week to figure out where.
6. Keep a log using a search tool, e.g. something like Evernote or OneNote. Whenever you have new angles, research questions, results, possible problems, possible conclusions, new hypotheses, free parameter values to vary and test, have a conversation with your supervisor, etc.: make a note of it. Keep a separate TODO list that you constantly update and should be empty by the end of your graduation project.

The thesis

At the end of the graduation project, a thesis must be handed in that summarizes the work done. The thesis must be approved by your supervisor and an independent second reader to pass for the final presentation, so it is an important part of your graduation project. Don't underestimate this! Realize that this is probably the most comprehensive document you've written yet. So start on time and consult with your supervisor whether you are on the right track. In the Appendix of this manual you will find a number of tips that can help you with the content of a good thesis. Also keep in mind the following:

- The use of LaTeX is mandatory. A LaTeX template is available on Canvas in which a standard title page and layout is defined.

- Students of the Double Bachelor of Mathematics and Computer Science use a title page that mentions both the Korteweg-de Vries Institute and the Computer Science Institute.
- Honors students are required to write the thesis in English, other students may choose whether they write the thesis in Dutch or English, but always in consultation with their supervisor.
- A new requirement for the thesis is that there must be a short section in which you reflect on the ethical aspects of your project. This requirement is related to one of the final attainment levels that a graduate student of the Bachelor of Computer Science must meet: "*The graduate of the program has insight into the social significance of Computer Science and the responsibilities of experts in this field within science and in the society*"[2]. You don't have to devote an entire chapter to this; a short section or paragraph is sufficient.

Submitting the thesis

Only if your daily supervisor gives permission for this, do you hand in the "Go/No-go" version of your thesis on Canvas (see the flowchart in Figure 1). An independent second reader will then have two weeks to determine whether it is of sufficient level to be allowed to proceed for the final presentation. During that time, we recommend that you do not sit still but dot the 'i', for example by doing extra experiments and processing the results plus any other improvements in your thesis: these extras can affect the judgment of the second reader. possibly switch from a "No-go" to a "Go". Two weeks after submitting the "Go/No-go" version, you submit the final version, including a "delta document" that describes the changes compared to the "Go/No-go" version (don't forget your name in that document too and the title of your thesis!!!). In the event of a "No-go" from the second reader, you will have one more opportunity to submit an improved version of your thesis. But be aware: for every week that the thesis is handed in later, half a point will be deducted from the final grade! See the "Deadlines" section for details. If this version is also not considered sufficient by the second reader, the project is considered "failed". You then have to redo the graduation project based on a new topic.

2 For an overview of all final attainment levels, see the "Onderwijs- en Examenregeling Deel B: opleiding specifiek deel Bachelor Informatica".

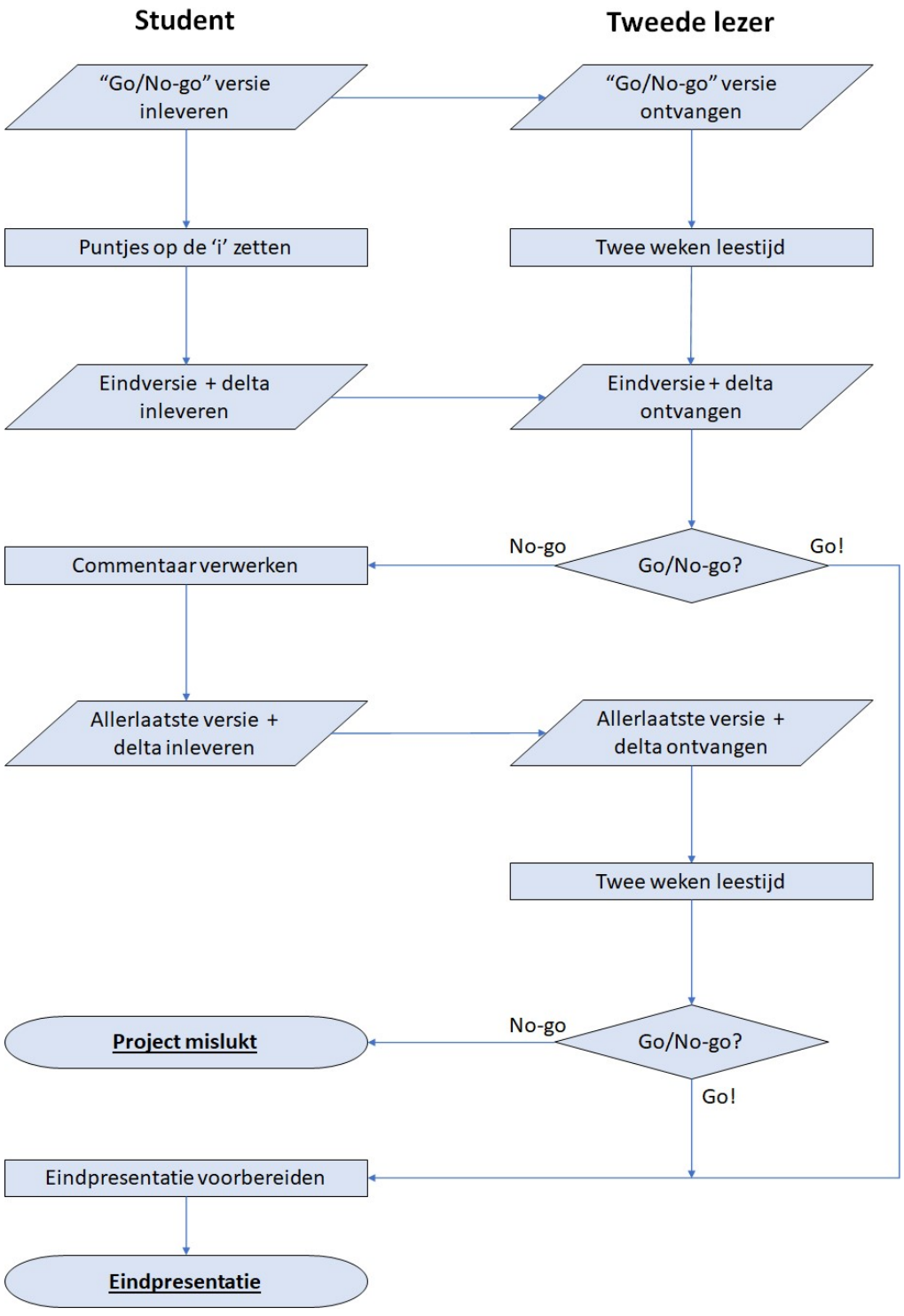

Figure 1: Flowchart showing the process of grading the thesis by a second reader.

The final presentation

If the second reader agrees with the content of your thesis, you may proceed for the final presentation. This is the last part of the graduation project. This presentation contributes to the final grade (see the assessment

form on Canvas for the criteria) so it is a good idea to prepare it well. The student presents the graduation project to an audience consisting of at least graduation teacher, supervisor(s) and second reader and possibly interested teachers, fellow students, family and friends. The presentation consists of a presentation part followed by questions from the audience. Because this is also the very last part of the study for many, the lecture also has a festive character in addition to a formal role. We therefore recommend that you also invite family, friends and other interested parties to this occasion.

Assessment

Assessment criteria

The student is assessed on: performance, thesis, presentation and participation in the meetings. See the assessment form on Canvas. The first three parts are graded separately. There are guidelines for the mutual weighing of the components, but this can be deviated from if the nature of the work gives reason to do so. You will receive a maximum of 1 point for participating in the weekly plenary meetings.

Deadlines There are strict deadlines for the graduation project. If the submission deadline for the “Go/No-go” version of the thesis is exceeded, points that are submitted later each week will be deducted from the final grade in accordance with the table below:

Submission period (in: week after the first deadline)	Points deduction
1	0,5
2	1,0
3	1,5
4	2,0

If the thesis is handed in later after the first deadline, the option to submit a modified final version at a later date will lapse (as was the case after submitting the “Go/ No-go” version is the case: “dotting the 'i'”). So a version of the thesis that is submitted after the first deadline is also the final version.

Plagiarism

All theses are checked for plagiarism. Cases of suspected plagiarism are submitted to the Examination Board, which will impose any sanctions. The rules regarding plagiarism are discussed in the first year during the tutoring or the Practicum Academische Vaardigheden (PAV) or Academische Vaardigheden Informatica (AVI). For more information, see the “UvA Student Fraud and Plagiarism Regulations” and the plagiarism statement signed by all students at the tutorship/PAV/AVI.

After the graduation

Transfer

Consult with your supervisor about how your work should be transferred: thesis, software and data.

Diploma

Once your graduation project has been completed and you have completed all subjects, you can apply for your diploma. This goes as follows:

- You have already ensured that your course package has been approved, otherwise you could not start with the graduation project (see above).
- Check whether the final grades of all your courses are registered in SIS. If not, go after the teacher.
- Check if your personal information is registered correctly: full name (particularly note any accents!), date of birth, place of birth. If not, have it changed! This information is stated on your diploma and a diploma is only awarded once.
- Go to the service desk of the ESC to request your diploma. You can also send an e-mail to servicedesk-esc-science@uva.nl; you will then receive an "bachelor diploma application package".
  - You must, among other things, hand in a copy of your passport.
- Once everything has been submitted, you will receive a confirmation of receipt. If everything is in order, you will receive an invitation to the graduation ceremony at the end of October or early November.

Inquiries at the ESC show that if you want to start a master's in September, you must submit all your grades, approval of courses and diploma application to the ESC in the first week of August at the latest. See also: Graduating and applying for a diploma on the AZ list.

Awards

If the thesis is of an exceptional standard, it could possibly win a "thesis award". Unfortunately, prizes are awarded more often for master's theses than for bachelor's theses, but here's a list that we know bachelor's theses can qualify for:

- Amsterdam Data Science Thesis Awards (for theses on data science and AI topics)

Beware of the offer of free publication thesis

After graduation (or PhD), many students receive mail from publishers with the offer to publish the thesis (or dissertation) for free. Usually these are subsidiaries of VDM Publishing, such as Lambert Academic Publishing. The Library advises not to enter into agreements with this because you will lose the copyright. You can then no longer publish (parts of) the work elsewhere.

Appendix

Tips for writing a thesis[3]

The following tips are good starting points for writing a thesis. Of course, it is possible to deviate from these rules, especially for advanced writers, but take the following as a solid starting point.

Most important tips

1. The structure of a thesis is almost always as follows:
    a. The **title page** with a title, your name, the name of your supervisor(s) and the submission date.
    b. The **summary** (English: “abstract”); the summary is a short (a quarter to half A4) overview of what is described in the thesis. Often this is the first thing that is written down, but in general it is not completed until the thesis is finished. It is often forgotten that this should also summarize the conclusions. The summary must be readable on its own, so it must not contain any references or other references.
    c. The **introduction;** this part begins with a description of the context of the research within the field as a whole. No research is completely new, so an overview of the most important publications describing the research field should not be missing. This literature review often takes the form of a reflection on the most important results from these publications, so that it becomes clear what the contribution is of this graduation project compared to “the state of the art”. The introduction is concluded by a concrete formulation of the research question.
    d. The **middle part**; this part is generally the most extensive. It describes the approach followed to answer the research question. Often it takes the form of a description of a “**design**” which is then built (“**implementation**”) and with which “**experiments**” have been carried out. At the end, the “**results**” of those experiments are shown.
    e. The **discussion**; in this last part the results of the research and the research question come together. It must answer the questions formulated in the introduction.
2. It is not possible to give an unequivocal answer about the length of the thesis: the thesis must be complete but short and concise, in other words: use as much text as necessary. In practice, the length varies between 20 and 40 pages (in the standard LaTeX format, excluding white space and figures). In the past there have been brilliant theses written as little as 15 pages, mediocre theses over 50 pages and everything in between. The use of figures to clarify the text is strongly recommended. Artificially scaling up the number of pages by generating more white space, using larger fonts, scaling up figures unnecessarily, printing single-sided or by superfluous “messing” is not appreciated.
3. Make sure your thesis looks neat: it is also your business card and with a sloppy-looking thesis you immediately give the wrong impression to a reviewer.
4. To get an impression, it is good to look at a few theses that have been submitted in previous years. You can find it at “UvA Theses online ”.
5. Think of the main message of your thesis. Some theses have two main messages, but usually it is only one. Try to incorporate this message into your title. This determines how you set up the rest of the thesis: the whole point - and the *only* point - of the rest of the thesis is that you explain, defend, and demonstrate/answer this main message. Nothing else. For example, a thesis might be titled “*Dissemination of information as an early warning sign of the Lehman Brothers collapse in financial time series*”, which already indicates that a new analysis is being presented that can warn

3 Original title “Writing your thesis” by Rick Quax. Translation and additions by Rob Belleman.

against coming financial crises and is being tested for a series of real-time data Don't be general like: "*A study of social opinion formation in online networks"* accompanied by a listing of unrelated results in the chapter "Results". Instead, the results you show should follow each other logically, build up to finally prove or demonstrate your main point beyond any doubt.

6. Then start writing a summary. That guides the development of the rest of the thesis, so do it carefully. It forces you to think about what your most important finding is, what open questions it answers, and why it matters. For inspiration, for example, take a look at "How to construct a *Nature* summary paragraph " and stay as close to it as you can.
7. The Introduction usually follows a similar sequence of topics as in the summary, so start with the motivation of your work, the context, and the open questions. Then go on to say what you have done, followed by a literature search (large literature searches can also be done in a separate chapter). In reverse order (literature research first) is also fine, depending on what fits your storyline best. Then close the introduction with your main finding and its broader implications (usually this is repeated / reformulated / extended at the end of the conclusion). Do not wait to give your main findings and conclusions, but already give them in the summary (very concise) and introduction (a bit concise): your thesis is not a detective thriller with cliffhangers, it is a scientific work.
8. Let each paragraph convey a single message. To begin with, formulate each message to yourself in one sentence. The ordered list of all these messages, arranged by section heading, is the 'skeleton' of your thesis that will determine the logical structure (storyline). Make sure that the next message logically follows the previous one: for example, use a literature review to emphasize how other people have looked at the problem before and then how you view it differently (if applicable) or where the missing pieces are.

   When writing the entire paragraph, always make this message come across in the first (or sometimes the second) sentence. Often you can reuse the sentence you wrote earlier in the skeleton. The rest of the paragraph should explain the message more deeply or defend the statement. A person who reads the first sentence and decides to skip the paragraph should not miss anything important. The order of all first sentences of the paragraphs should result in a reasonable summary of the entire thesis.

   Example:

   A system consisting of coupled units can self-organize into a critical transition if a majority of the units suddenly and synchronously change state [1-3]. For example, in sociology, the actions of a few can induce a collective tipping point of behavior of the larger society [4-11]. Epileptic seizures are characterized by the onset of synchronous activity of a large neuronal network [12, 14-16, 18]. In financial markets the participants slowly build up an ever densifying web of mutual dependencies through investments and transactions to hedge risks, which can create unstable 'bubbles' [19, 21, 23].

9. Within each paragraph, do your best to make the sentences follow each other logically, and connect them as such. Begin a subsequent sentence such as "The rationale is that…", "For that reason…", "This implies that…", "Namely / However / Notwithstanding / That is,…", "… may then ... ". Sometimes only a direct sentence without such a "connector" is also fine if the connection to the previous one is clear or if it improves the "flow".

   Example:

   The IDL measures to what extent the state of one unit influences the states of other units. As the state of one unit depends on another unit, a fraction of the bits of information that determine its state becomes a reflection of the other unit's state. This creates a certain amount of mutual information among them. A unit can then

influence other units in turn, propagating these 'transmitted' bits further into the network. This generates a decaying amount of mutual information between distant units that eventually settles at a constant. The higher the IDL of a system, the larger the distance over which a unit can influence other units, and the better the units are capable of a collective transition to a different state. Because of this we can measure the IDL of systems of coupled units and detect their propensity to a catastrophic change, even in the absence of a predictive model. See Sections S1 and S2 in the SI for a more detailed explanation and how it differs from existing indicators.

(Note, for example, that the second sentence is a "Name" sentence, but it has been omitted to improve the "flow" of the text)

10. Tell what you did, not what you did not do. For example, do not start a paragraph with “Since migration is a broad concept, this thesis will not cover everything”. That applies to literally every scientific study that has ever been conducted, so making such a claim is meaningless, uninteresting, and disturbing.
11. Say what must, not what can. This tip is often overlooked, but it is very important.

    Example: a statement such as:

    In general, the Post-Napoleonic 19th century in the Netherlands can be divided into a period of recovery and a period of industrialization.

    only makes sense if you actually have results related to this gap, for example because the migration patterns differ in these two periods (and why). If there are no results related to this and you thought, "It would just be nice to tell the reader such general interesting facts and considerations", please think again.
12. Any claim you make must be substantiated.

    Example:

    Migration is strongly correlated with geographical differences in income levels.

    The easiest way to substantiate a statement is to add references to previous works that have proven/proved this claim. If it doesn't exist, you have to prove it yourself. If neither of these is possible, don't make the statement. Only alternative: make it an assumption.
13. Formulate claims as accurately and concretely as possible, but not too much; as long as it supports your story. So instead of:

    Migration is related to social developments.

    you might actually mean to say:

    Migration is strongly correlated with regional differences in income levels.

    but don't overdo it either as in:

    The number of people who changed their home address from X to Y in a given year has a Pearson correlation in which the difference in income level between income (Y) and income (X) is greater than 0.6 for the 1900s, ..., 1999 in region ABC.

Of course, your thesis should be reproducible as a whole: so make all these details clear, but not in one sentence.

14. Your thesis, including the appendices, must be reproducible.
15. Save your main text for the “red thread” of your storyline: it only contains the most relevant results and discussions. Use the Appendix (or “Supplementary Material”) to show other results. For example, a sentence in the main text could be:

    This result is insensitive to the choice of parameter value *w* (see Appendix A6).

    Then, in Appendix A6, you show ten plots for different parameter values, or a more concise form thereof, with the parameter value on the x-axis and the corresponding quantity on the y-axis. It is quite possible that the appendix is (much) larger than the main text. For example, this article has a body of about six pages and an appendix of about 40 pages.
16. Never refer to “ Data not shown ”: in the digital age there is no valid reason to omit any underpinning.
17. Make captions for figures and tables (“captions”) as complete and self-contained as possible. If your caption is a single sentence, it is likely that it is not yet complete. Think of a reader reading only your summary and your figures with captions, in that order. Would this reader understand your research, at least the main points? It is often advisable to include the main message in the caption to grab the reader's attention, especially if your figure is complex. So do not write something like:

    The activity level of a set of neurons under a microscope.

    For example, this could be a good caption:

    The level of activity of a set of neurons under a microscope as a function of time, after seeding one neuron with an electrical potential (black line). The activity was measured by changes in calcium ion concentrations. These concentrations were detected by imaging fluorescence levels relative to the average fluorescence of the neurons (activity 0) measured prior to activation. In the sparse cultures with few synapses per neuron, the stimulated neuron evokes a network burst of activity in all other neurons in the field after a short delay. By contrast, in the dense cultures with many synapses per neuron, only the stimulated neuron has an increased potential. The data for these plots were kindly provided by Ivenshitz & Segal [41]. (a) Low connectivity and (b) high connectivity.
18. Although the previous point might make you think otherwise; Every figure and table must be referenced somewhere from within the main text. The main text functions as a common thread to which all figures or tables are attached. You might as well not include the figure or table without a reference from the main text. This also applies to figures and tables in any Appendix!
19. Put the caption for a figure *below* the figure, the caption for a table *above* the table.

Other tips

1. Find and read a copy of a Dutch/English writing style guide to academic writing. For English, a well-known one is the (old) “Elements of Style” by William Strunk, for example https://faculty.washington.edu/heagerty/Courses/b572/public/StrunkWhite.pdf

    a. For example, do you know how to write a summary? Note the second comma in English: “I did this, that, and more”. You do not have that in Dutch: "I did this, that and more". If your enumerated sentences contain commas (which is rare), use a semicolon as a separator instead. Do the same when listing a bulleted/numbered list.
    b. At the UvA it is customary to follow the rules of British English.

2. Keep your English as simple and to-the-point as possible. Most readers are not native speakers of English, so do not show off your knowledge of rare and complicated words, and don't use expressions like "en masse" (originally French) that won't be understood by everyone.
3. Use the active form for sentences ("We are studying ...") rather than inactive ("What has been studied is ... ").
4. Use concise sentences. Do not combine too many facts or considerations in one long sentence with two or three commas.
5. Put equations on separate lines, possibly with an equation number if you want to refer to them in the text. Equations are still part of the text, so use the correct punctuation: usually a comma or a period at the end of the equation so that the line immediately after either continues with the same sentence (and lowercase) or a new sentence, respectively.

Read more / external links

1. 20 tips for a scientific writing style
2. So you're writing a paper
3. Scientific Papers

APPENDIX A : Ethical Compliance Procedure for Low Risk Student Projects in Informatics involving Human Participants

Introduction

Some informatics projects involve research with human participants. For example, researchers may conduct interviews or focus groups with potential users to gather requirements. They might also want to evaluate new technology designs, prototypes, or digital devices with users.

It is crucial to conduct such research in an ethical manner. Participants must be treated respectfully, fully informed about the study before they agree to take part, allowed to withdraw at any time, and protected from harm or coercion. Additionally, any identifiable information must be anonymized, and study data stored securely.

Research with human participants carries different levels of risk. The majority of Master's and Bachelor's projects that involve human participants will be low risk. This ethical compliance procedure has been developed for these types of projects. It comprises an ethical compliance form to be read and signed by you and your supervisor. If you, and your supervisor, can answer "yes" to all of the statements, then your project is indeed low risk.

However, certain studies—such as those involving children, sensitive topics, or potentially stressful situations—are considered to be high risk. In these cases, a full ethical review by the ECIS-SP (Ethics Committee Information Sciences – Student Projects)[1] must take place before the research can be conducted.

Who is this form for?

This form is for Bachelor's and Master's students whose projects involve research with human participants. If your project does not involve human participants, then you do not need to complete this form. If you are a PhD candidate or staff member, then you should also not use this form.

How to use this form?

For any project involving human participants, the student and their supervisor should go through the form together, point by point. Assuming the project complies with all of the points, then the project is low risk, and the form should be signed by both the student and supervisor and included as an appendix to the final report/thesis.

The student must also prepare an information sheet and consent form for participants using the template provided at the end of this document. The supervisor should check and approve the information sheet and consent form before starting the study.

NB: If the student and supervisor determine that the research does not comply with all points (or if the research changes in such a way that it no longer complies with the points), then the student cannot use the ethical compliance procedure and must instead apply for ethical advice.

Ethical Compliance Form

In signing this form, I and my supervisor confirm that my project complies with all of the following points:

- Participants will not be exposed to risks greater than those encountered in daily life.

Researchers must protect participants from physical, mental and emotional harm. Ethical advice must be sought for any projects involving sensitive topics (e.g. sexual activity, drug use, political behaviour, ethnicity, or discrimination) or which might induce discomfort, stress or anxiety (e.g. violent video games, bright or flashing lights, loud noises).

- Any study materials used by the participant should be either paper-based or involve software running on commonly available, commercially produced hardware (e.g., personal computers, laptops, tablets, or smartphones).

Participants should not be exposed to risks associated with using specialised, experimental, or custom-built equipment. If biometric data (e.g., eye movement, skin temperature, or heart rate) is collected, ethical advice must be sought.

- No information about the evaluation or materials is intentionally withheld from the participants.

Withholding information from participants or misleading them is unacceptable without justifiable reasons for doing so. Any projects requiring deception (for example, only telling participants the true purpose of the study afterwards so as not to influence their behaviour) are deemed high risk and require ethical advice.

- No participant is under the age of 18.

Any studies involving children or young people under the age of 18 are deemed to be high risk and require ethical advice.

- No participant has a disability that limits their understanding of the project or capacity to consent.

  Any studies involving participants with disabilities that impact their capacity to consent are deemed to be high risk and require ethical advice.

- Neither I nor my supervisor are in a position of authority or influence over any of the participants, and participants were not pressured by anyone (e.g. employer) to take part in the study.

A position of authority or influence over any participant must not be used to pressure participants to take part in, or remain in, any study.

- Participants receive an information sheet which contains the following information:
  - *A detailed description of the study*
  - *A statement informing participants that they can withdraw from the study at any time*
  - *A statement informing participants that they can withdraw their data after the study (typically there is a cut-off date once data analysis begins: this should be specified)*

- *A confirmation that any data collected will be stored securely (i.e. locked filing cabinets for hard copy, password protected computer for electronic data), and in an anonymous form*
- *The contact details of both the student and the supervisor.*

- Participants sign a consent form, explicitly stating that they agree to take part, and that their data can be used in the project.

Participants must not take part in the study without their knowledge or consent (i.e. no covert observation: this is considered to be high risk).

Project title: _____

Student Name: _____

Student Registration Number: _____

Student Signature: _____

Date: _____

Supervisor Name: _____

I have read and approved the participant information sheet and consent form.
Supervisor Initials: _____

Supervisor Signature: _____

Date: _____

Information Sheet and Consent Form Template (for Low Risk Informatics Student Projects with Human Participants)

Invitation to take part

You are being invited to take part in a research study to further our understanding of <topic>. Thank you for carefully reading the following information. This study is being conducted by student researcher <student name> doing a degree in < degree name> at the University of Amsterdam.

What is the the purpose of this research?

<one sentence description, in plain English, of the aim of the research>

Who can take part?
<explain selection criteria, if any>

What is involved in taking part?
<explain clearly what the participant will be asked to do, how long it will take, what sort of data you will be collecting and the method of data collection>

Is participation voluntary?

Your participation is voluntary and you can choose to take part in only certain parts of the study, or not at all. You may withdraw from the research at any time and without providing a reason, in which case, we will not use your data and will destroy it immediately. After having taken part in the study, you can still withdraw consent and request the removal of your data up until the start of data analysis (<state time, e.g. one week after study completion>). To do so, please email <student email> and include your < full name and/or participant code>).

How will my data be treated?

Data will be anonymized such that it is not possible to identify you. Data will be stored securely (e.g. for paper-based data, in a locked filing cabinet or for digital data, on an encrypted or password-protected server). Furthermore, no data (anonymised or otherwise) will be used as input to Generative AI tools (e.g. ChatGPT). In line with GDPR and relevant regulations, the data will be kept for <state time period> after data collection, after which it will be destroyed. (optional) Anonymised data may also be submitted to the Open Science Foundation (OSF) in the interests of open science.

Will I receive compensation?

<describe any compensation being offered, or delete this heading if you are not offering compensation.

Questions or Concerns:

If you have any questions about the study, please feel free to contact the student researcher: <student name and email>. You can also contact the student's supervisor: <supervisor name and email>. *NB: please use your UvA address, not a personal email.*

Declaration of Consent

I confirm that I:

- am 18 years or over
- have read and understood the provided information
- agree to participate in this study
- consent to the use of the resulting data as described above
- consent to the research team carrying out further analysis of my **anonymised** data (tick here if you agree) ____

.....	.....
Name of participant	Signature of participant

.....
Date

[1] Use the following link to access the FNWI Research Management Portal, where you can apply for ethical review of your project https://rms.uva.nl/servicedesk/customer/portal/14. Please ensure you select "I am a student" so that the application is routed to the ECIS-SP.