

Guidelines for preparation, writing, and defence of the master's theses

2nd cycle study programmes of the Faculty of Computer and Information Science of the University of Ljubljana

University of Ljubljana

Faculty of Computer and Information Science

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A master's thesis is a public demonstration of one's professional maturity and it signifies the conclusion of second cycle education. It allows individuals to prove themselves as trained and educated professionals in the field of computer and information science, so great care and much thought should be invested into the preparation of the thesis. The master thesis includes in-depth discussions of a particular field of expertise and demonstrates your advanced level of knowledge acquired during the course of studies. You should thus bear in mind that your work will be reviewed by experts, as well as the general public, so you must demonstrate your ability to express your professional opinions in an elaborate, linguistically sound, and coherent manner.

The master's thesis is an integral part of the entire second year of the programme and it is worth 24 credits. This means that the preparation and writing thereof should correspond to approximately 720 hours of work. This is equivalent to four expert courses, which is four times more than what was required for your undergraduate thesis in the first cycle programme. Therefore, the thesis must be properly substantiated, perfected and of adequate quality. Your study requirements and writing should be organised in such a manner as to allow you to complete your study requirements on a regular basis, while preparing your master's thesis at the same time.

The procedure for the conclusion of the second cycle programme at the Faculty is described in the *Rules on the Master's Theses in the Second Cycle Study*

Programmes at the Faculty of Computer and Information Science of the University of Ljubljana which is accessible via the Faculty website and in the online classroom of the Master's Thesis course. Furthermore, the online classroom also contains all the relevant forms which you might require.

A short summary of the procedure which will lead you to your master's thesis may be found in Section 1. It should be read prior to composing your master's thesis, and please refer to the Rules themselves for detailed clarifications. Some additional guidelines concerning the form and the manner of writing of the master's thesis are included herein. The answers to any additional questions may be obtained at the Student Office (regarding procedural matters), your personal mentor (regarding content), the study programme administrator, at the master's seminar, or in the forum of the course General Topics in the online classroom. Section 2 includes technical guidelines for the preparation of the master's thesis and Section 3 includes language-related guidelines which must be observed. Section 4 describes the individual content-related sections of the text, and the conclusions are listed in Section 5.

1 The application and preparation procedure

The application and preparation of the master's thesis shall be carried out chronologically in the following order:

1. The selection of a mentor and thesis topic,
2. the preparation of the master's thesis topic,
3. topic approval on part of Committee for Student Affairs,
4. the writing of the thesis supervised by the mentor,
5. the delivery of the thesis,
6. the defence of the thesis at the master's examination.

A successfully completed master's examination marks the formal conclusion of your study programme and allows you to acquire all of the rights that belong to a second-cycle graduate.

1.1 The selection of the mentor and the topic

The preparation of the master's thesis starts at the beginning of the academic year when a *master's seminar* takes place, offering more details concerning the process of preparing the master's thesis as well as concerning the possible topics which are offered by mentors from various laboratories at the Faculty.

To assist you with the selection of your mentor and topic, there is a list of possible topics which is available in the online classroom as a part of the course Master's Thesis. A mentor may also be selected among the Faculty teaching staff based on the field of study that you are particularly interested in. A topic for the master's thesis that is not on the list of available topics may then be agreed upon with the mentor. In order for your thesis to be of suitable quality, it is imperative that you select a topic that you like and are interested in. Working with the mentor, set specific goals for your master's thesis and make a list of tasks that will guide you toward concluding your master's thesis. If agreed by the mentor, a co-mentor may also work with you on your thesis, in particular when the topic is interdisciplinary. Once your topic is approved, the Committee for Student Affairs may also appoint your co-mentor.

Once you have discussed your topic with your mentor, you shall fill in the form by which you shall select your mentor and state the working title of your thesis. The form must be submitted via student information system no later than 5th November.

1.2 Preparing the proposal for master's thesis topic

Within a month (by December 5th) you shall write the full proposal for the master's thesis topic by using the standard form provided. The proposal contains: mentor, a working title, problem formulation, overview of the related work, expected contributions and expected methodology. Your contributions are expected to present a step beyond the current state-of-the-art research-wise or technical-wise. Overview of a topic is not considered a sufficient contribution. You are expected to properly cite relevant works from the narrower field of your topic.

Make sure to prepare a high-quality proposal by consulting your mentor and include at least one monograph or a scientific paper in the references. The proposal should be submitted in time to the Student office in printed and electronic form.

1.3 Topic approval by the Committee for Student Affairs

The Committee for Student Affairs will review all submitted proposals. By the end of December, the Committee will consider all proposals and decide on acceptance or rejection. In the event that the Committee for Student Affairs approves the topic, it also appoints a thesis defence committee. In the event that the Committee for Student Affairs rejects the topic, you need to wait until the next academic year when you will have an opportunity of re-sitting the master's seminar. In case of minor problems, the Committee may decide to approve the topic conditionally, in which case the student is expected to take into consideration the requested changes and prepare a corrected version approximately within a week – the exact date will be specified by the student office.

1.4 The writing of the master's thesis

Once the topic is approved, you will have until the end of the current academic year (i.e. until 30 September) to complete and submit their Master's thesis. Exceptionally, this deadline may be extended by 4 months based on a well-founded request.

The master's thesis should be written independently, under the mentorship and in cooperation with the mentor and possible co-mentor. It is recommended that you meet with your defence committee at least once (outside the master's seminar) to get additional directions that will lead to a better thesis.

You are expected to report at least once publically about the progress of your work at the master's seminar (organized in the end of the second semester). The mentor is required to be present at the public presentation, the defence committee is also invited.

1.5 Master's thesis delivery

The delivery and the defence of the master's thesis are the final two steps in your second-cycle program. Prior to delivering the thesis, you need to fulfil all of your other obligations in the programme.

Once you meet all of the requirements and prepare a final draft of the thesis under the supervision of your mentor, you will submit the thesis via the submission system upon the approval on part of your mentor. The thesis is required to follow the proposal accepted by the committee for student affairs.

Together with the master's thesis it is mandatory to deliver also the filled out statement concerning authorship and the consent allowing the publication of the soft copy of the thesis in the collection Faculty Theses (Authorship Statement form).

The submitted master's thesis is automatically checked for plagiarism and the automatically generated report is submitted to the mentor via electronic mail. In case the mentor approves the submission, student submits a single printed version to the student affairs office. If mentor wishes so, you can prepare an additional printed version for the mentor as well.

1.6 Defence

The defence of the master's thesis takes place before *the Committee for the Evaluation and Defence of the Master's Thesis* appointed by the Committee for Student Affairs. The mentor and the possible co-mentor are also present at the defence but are not members of the defence committee. The defence of the master's thesis is public, so you may invite your parents, relatives, colleagues, and friends.

The defence is chaired by the committee chairperson. It begins with a 20-minute oral presentation which reflects the thesis content, while it needs to be coherent, technically correct, and interesting. The presentation must give the committee and the audience a clear picture of what the problem that you attempted to solve in your master's thesis was and how it fits into the broader expert field. The main part of the presentation should describe the solution of the problem and your original contributions.

The presentation should begin with an introductory page which includes the title of your master's thesis, your name, title, and the name of your mentor. The second page should describe the problem that you dealt with in your master's thesis. The third page should state the proposed solution of the problem and the goals which you set prior to writing the thesis. The pages that follow should explain what you did in your thesis. Twenty minutes is not enough time to include all of the details, so you should

describe how your solution is structured and then focus on one or two more interesting or more original contributions of your thesis. Conclude your defence with a page that briefly summarises what you have done, states any of your original findings, and lists unsolved problems and guidelines for the future development in the field.

Take advantage of the time you are given for your presentation but also strictly adhere to the 20 minute time limitation! A presentation that is too short gives the impression that you do not have much to say. If your presentation is too long, it may seem that you are insufficiently prepared and it will be cut short by the committee chairperson. Twenty minutes is enough time for you to also focus on interesting technical details. Devote at least two or three slides to the description of what exactly you did and how you did it.

The presentation is followed by the questions of the committee members which may also refer to the general field that your thesis belongs to. Then, questions may also be asked by the audience. Try to answer the questions clearly, concisely, and convincingly. After the questions, the committee withdraws for a brief meeting in order to evaluate your thesis and its defence. During this evaluation, wait in the room where you held your presentation. When the committee returns, the committee chairperson informs you of the grade for your thesis, the grade for its defence, and the final grade of the masters exam. If the thesis is written in English, and the mentor agrees, the defence can be held in English as well.

A faculty computer and a projector will be available for use during your presentation, and if necessary you may also talk to your mentor and agree to use additional laboratory equipment or your own equipment. You may plug the projector to your personal laptop. Make arrangements to use and prepare the room where you will hold your presentation in a timely manner (at least a day beforehand) at the Student Office, and clean up your equipment that you used for the presentation immediately, so that the room may continue to be used as usual.

2. The preparation of the master's thesis

The master's thesis must be printed out on an A4 sheet of white paper. It needs to be bound in cloth or a different suitable material.

Any word processor may be used to compose your master's thesis. We highly recommend the use of LaTeX which is an informal standard for writing academic papers in the field of computer science. Getting used to writing in LaTeX might take some effort but this effort will be worth it because the result is a suitably stylised and nicely designed master's thesis.

2.1 Laying out the master's thesis in LaTeX

You may use a layout template which is available online. The attached sample shows how simply introductory pages may be laid out, sections and sub-sections named, tables written, graphic material inserted, tables and figures referred to in the text, and literature cited and listed.

2.2 Other word processors

In the event that you choose to use other word processors, make sure that the page layout is correct and in accordance with the requirements contained in this document. Text should be laid out as shown in Table 1:

Upper margin	20 mm (above the running head if it is used)
Lower margin	30 mm
Inner margin	30 mm
Outer margin	20 mm

Table 1: Page layout

The text should be in Times New Roman or a similar font, and the titles should be in Arial or Helvetica. Font size should be 12, and line spacing should be 1.3. The thesis should be printed on both sides of the paper. Sections should begin on odd-numbered pages. Sections should be numbered using multi-level indexation, which has also been used in these guidelines.

2.3 Mandatory parts

The cover of the master's thesis is written in Slovene and needs to contain

- 30 mm from the upper margin: the name of the university and the faculty in capital letters,
- in the middle of the page:
 - the name and surname of the author,
 - the title of the topic of the master's thesis in Slovene (same as in the original of the chosen topic),
 - title "MAGISTRSKO DELO" also written in capital letters,
 - the name of one of the following programmes:
 - ŠTUDIJSKI PROGRAM DRUGE STOPNJE RAČUNALNIŠTVO IN INFORMATIKA
 - ŠTUDIJSKI PROGRAM DRUGE STOPNJE PEDAGOŠKO RAČUNALNIŠTVO IN INFORMATIKA
- at the bottom, centre justification, "Ljubljana, leto," whereas year is the current academic year (e.g. "2012"). The heading should be 30 mm from the bottom edge of the sheet.

Immediately after the cover, the thesis should include introductory pages which are not numbered, in the following order:

- the title page (first page) is identical to the cover; however, it also states the mentor, whose name appears under the name of the programme and above the year,
- statement concerning the intellectual property of the master's thesis, which is evident from the published sample, or, if the student and the mentor agree to publish the thesis with licenses granting a certain part of the rights to everyone involved (e.g. Creative Commons or GNU GPL), the description of the used licenses (see file cc-licenca.pdf),

- acknowledgements showing gratitude to everyone who contributed to the successful completion of the master's thesis,
- possible dedication,
- table of contents which includes the numbered titles of sections and sub-sections, including page numbers,
- a possible list of used acronyms and symbols, which must be consistent throughout the thesis, regardless of how they are marked in the literature that was used.

In the event that the thesis is composed in a foreign language, the order of the pages is as follows:

- the first page of the master's thesis in Slovene,
- the first page of the master's thesis in English with the following translation:
 - »MAGISTRSKO DELO« translates to »MASTER'S THESIS«
 - "ŠTUDIJSKI PROGRAM DRUGE STOPNJE RAČUNALNIŠTVO IN INFORMATIKA" translates to "SECOND-CYCLE STUDY PROGRAMME COMPUTER AND INFORMATION SCIENCE".
 - "ŠTUDIJSKI PROGRAM DRUGE STOPNJE PEDAGOŠKO RAČUNALNIŠTVO IN INFORMATIKA" translates to "SECOND-CYCLE STUDY PROGRAMME COMPUTER SCIENCE EDUCATION".
- abstract written in Slovene
- abstract written in English
- statement concerning the intellectual property or the description of the used licenses in a foreign language,
- acknowledgements, possible dedication, and table of contents, in the same order as in the master's thesis that is written in Slovene,

- the extended abstract of the master's thesis in Slovene, which must be at least 10 percent of the length of the English core of the Master's thesis

As of here, the pages are enumerated on the upper outer margin of the page.

2.4 Equations, figures, tables, and other elements in the master's thesis

When writing your thesis, take into consideration the rules for the layout of expert technical texts. Mathematical symbols should be in italics, physical constants and units as well as mathematical functions should be in regular font. Number the equations with an order number in parentheses on the right side of formulas, and use these numbers to refer to them. In the event that a generally adopted term in Slovene does not exist for a particular technical term, state the Slovene term as well as the term as it appears in original literature, in parentheses, on its first occurrence in the text. The foreign term should be in italics.

Include graphic representations (diagrams, schemes, illustrations, screen shots etc.) that contribute to the clarity and legibility of the thesis. Figures should be numbered, stated in the text, and should also include a caption directly under the figure. Figures are inserted approximately where we first cite them. The figures and their titles should have centre justification.

Any numerical findings of your experiments should be presented in tables. These should also be numbered and should include the title of the table, which is directly under the table, similar to figures. One must cite all tables and figures in the text and they should be mentioned in the text. Tables are inserted approximately where we first cite them.

2.5 Citing references

In order to cite references, use the Slovene version of the IEEE citation style. When using this style, references (an article in conference proceedings, a book, a journal article, and a website) are cited as follows:

References

- [1] P. A. Bernstein, U. Dayal, “An overview of repository technology”, in *20th Intl. Conference on Very Large Databases*, Santiago, Chile, Sept. 1994, pp. 705-713.
- [2] R. Ramakrishnan, *Database Management Systems*, New York: McGraw-Hill, 1998, ch. 3.
- [3] R. D. Semmel, D. P. Silberg, “Extended entity-relationship model for automatic query formulation”, *Telematics and Informatics*, no. 10, vol. 3, pp. 301–317, 1993.
- [4] (2005) IEEE Information for authors. Available: http://www.ieee.org/portal/cms_docs/pubs/transactions/auinfo03.pdf (acquired: 21st Sept 2012)

When citing a reference in the text, the reference is marked with the number of the reference in square parentheses, e.g. [2] or [2, 3] when multiple sources are cited simultaneously. Examples of other types of citations are available in IEEE magazines, which may be lent in the library, or on their website [4]. It is very important that the references are cited correctly (author, title, when and where it was published).

If you arrange the layout in LaTeX, we recommend that you cite your references using BibTeX.

3. Language-related guidelines

The master's thesis is usually written in Slovene. Based on a well-founded request, the Committee for Student Affairs may allow the candidate to write his thesis in English.

The master's thesis may not include any linguistic errors. We recommend that the written paper be proofread prior to delivery. A technical text is not a literary text and therefore different rules apply.

- Technical texts need to be unambiguous, so keep the sentences brief, simple, and clear.
- The thesis should be written in an impersonal manner, we recommend the use of the 1st person plural ("we developed," "we made"). The use of the passive is also allowed but it is more awkward ("was developed," "was made"). Do not use the first person singular ("I developed," "I made") or use it exceptionally, only where you wish to emphasise your personal choice among multiple possibilities.
- Use the same name and symbol (if necessary) for a particular term or object throughout the entire thesis.
- If you are introducing new terms, make sure that there are clearly and precisely defined.
- Use established technical terminology.
- By writing technical texts, Slovene technical terminology is also developing. If you come across technical terms without a Slovene translation, work with the mentor to find a suitable Slovene translation, if necessary.
- Pay special attention to translations from English. Follow Slovene grammatical rules. In Slovene, nominal modifiers are to the right of the subject or the object ("SQL query" → "poizvedba SQL", "API interface" → "vmesnik API", "x-axis" → "os x"), making the reverse order, such as "SQL poizvedba", "Windows strežnik", "ACME sistem", is incorrect.

4 Structure of the master's thesis

The contents of the master's thesis should include:

- an abstract,
- an introduction,
- a main body, which should be sensibly divided into multiple sections,
- concluding observations,
- a list of references (bibliography),
- possible addenda.

Number the sections beginning with the section Introduction and ending with the section Concluding Observations. The list of references which is titled "References" should not be numbered as a section. If you are writing in LaTeX, the numbering is automatic and correct. In other word processors, however, you will need to manage the numbering yourselves.

The **summary** should be in one paragraph **and written in an impersonal manner**. It should contain approximately 100 to 200 words. Summarise what the goal of your master's thesis was and how you achieved it (what you planned, developed, made).

The **introduction**. Describe the problem that is being dealt with in the thesis and state the motivation for the thesis (why the solution to this problem is even necessary). Place the thesis into a broader technical context. Briefly describe how the problem was solved and list your main contributions. Finally, state the common thread of your thesis and introduce the contents by section.

The **main body** should be divided into sensible subsections. It should usually begin with a section concerning the theoretical background of your problem. You may also introduce the methods and tools that were used (description of methods, explanation of function, description of tools, examples of typical use, etc.). The following section then explains your work and contributions. For example, describe the method or the developed system in detail and then list the particulars concerning the implementation of your ideas in the developed hardware or software. If, for example, your thesis discusses the development of an information or software system or their parts or components, a separate section may list examples of the use of this system or programme. If a graphical user interface is a significant part of your system, screen captures of typical use may also be

included in your thesis. Otherwise, include the guidelines for use and the graphical user interface in an addendum. If your thesis focuses on the development of a new method, a section needs to be devoted to its experimental evaluation and the discussion of the experiment results. Also include the discussion regarding the significance of your results and call attention to any new findings that your thesis produces. Make sure your results are suitably commented in tables and diagrams because readers will not find some things self-explanatory.

The **concluding observations** should begin with one paragraph describing what was done in the thesis and what its main contributions are. The following few paragraphs should describe why these contributions could be important, how they could be applied, and what other things could be done or improved concerning the set goals. If the developed feature is already in use, you need to mention this in this section and possibly describe user responses or experience.

Bibliography. The references should be listed alphabetically according to the surnames of the authors. Only the references that you cite in the thesis should be listed. A long list of references is no proof that you have a good overview of literature. Pay special attention to citing online references – for example, if an article was published in a serial publication, it is not sufficient to merely list the website where it was found.

5 Conclusion

The master's thesis is your main paper in the second-cycle programme and is evidence to the level of professional maturity that you have achieved. You may refer to it when seeking employment and in additional professional training programmes. It is also a report that will be seen online by various people judging your professional work. Make sure that the contents are correct, that it is technically and grammatically correct, and that it is nicely laid out. You will be proud of a good master's thesis your whole life, and mentors and other Faculty teachers will be honoured by it and proud of their student.