TARTU ÜLIKOOL
arvutiteaduse instituut

Guidelines for preparing and grading of graduation theses at the Institute of Computer Science of the University of Tartu

Introduction

These guidelines have been drawn up to assist the students of the Institute of Computer Science of the University of Tartu. The guidelines aim to improve the quality of defended theses and give general advice for writing and defending them. These guidelines also define the principles of grading theses.

1. The volume, goals and outputs of a thesis

The University of Tartu, as an academic institution, offers its students the opportunity to be involved in the research and development process by working on their theses. During the process, students learn what has been previously achieved and published in their area, what constitutes a research result or applied research result, how to achieve it, how new research ideas and applications are formed and developed, how hypotheses are being checked, which methodologies are used and how the research results are published.

When writing a thesis, the potential reader who has completed the same specialised training should be kept in mind. The thesis must be written and formatted in a manner that allows any person at the same level of study to understand it. It is essential to pay due attention to the problem statement and the task set-up, describe the related background with enough detail and

elaborate on basic definitions and ways of reasoning. A thesis is usually a work with some scientific value. If any constructs that need prior knowledge are used, one should include references to corresponding textbooks and reference manuals in the introduction. Specific knowledge of journal or conference paper results cannot be a prerequisite to understanding a thesis (such material should always be summarised in the thesis).

If the topic of a thesis is not directly qualified as computer science but is related to it (such as mathematics, materials science, psychology, biology, etc.), and the thesis will be defended at the Institute of Computer Science, the author must, during the preparation and writing of the thesis, also focus on the aspects of computer science. It should be clear why the thesis should be defended at the Institute of Computer Science and not elsewhere.

The work must include a description of information technology and computer science methods used to be eligible for classification as a thesis in computer science or information technology. In order to achieve that, it is essential to:

- document the technological choices; see Section 1.3.2;
- clearly emphasise the links with computer science, i.e. the thesis should describe a computer science solution to the set research questions.

For example, suppose the thesis presents new theoretical results in another field but uses computer science to apply them. In that case, the thesis can be considered to be in the field of computer science. The application has to be documented, but the number of computer science results does not need to be significantly larger than those of other fields.

1.1 Bachelor's thesis

A bachelor's thesis is a research paper written individually, and its credit volume of 9 ECTS is defined in the computer science curriculum. The student demonstrates his/her skills in achieving theoretical and applied research results in the thesis. The thesis presents a comprehensive approach to the problem, complementing the findings of the primary sources and trying to make the content of the thesis as understandable as possible for the reader. Generally, the volume of a properly formulated bachelor's thesis is approximately 20 pages (excluding appendices).

1.2 Master's thesis

A master's thesis is a research paper written individually, and its credit volume is defined in the curriculum (15 ECTS or 21 ECTS or 30 ECTS). A master's thesis is a part of the research and development process or creation of teaching methodology materials, and its results must be usable in later research by the author or anybody else within the area of research. The work must include new (ideally publishable) results, i.e. solutions or statements that are not generally known, or broaden understanding of known phenomena, methodologies, results, etc. The approximate volume of a master's thesis is from 40 to 50 pages (excluding appendices).

1.3 Types of graduation thesis

Typical types of graduation theses are listed below. A graduation thesis might only partially fit into one or another category, and it may be a blend of different types. A graduation thesis can be **either theoretical, applied, or a combination of the two.**

1.3.1 Theoretical study

A theoretical study presents a formal description of a problem or a particular task in a specific field with a strict, formally reasoned solution. If a prototype has been produced during the main theoretical part of the study, it should be provided with a description that meets the requirements set in Section 1.3.2. The theoretical study can be either an independent study or a review-type study.

The general assessment criteria for an **independent study** are broadly the same as for theoretical studies but may be subject to moderate concessions regarding novelty and/or relevance. The study may result in a new idea, theorem, a proof given in a new way, a formal description of a language/protocol/system or any other formal description of theoretical results.

In a review-type study, the combination of materials and formalisations results in a systematic approach that can be used as teaching or reference material. In any case, the work must include some novel elements that have not been addressed in well-known works. The proportion of novel elements must be sufficient to allow the author to demonstrate his/her understanding and proficiency in the subject.

The main assessment criteria for a fully review-based thesis are the following:

- the relevancy of the sources reviewed;
- the completeness of the review;
- the fluency of the synthesized approach;
- the integrity of the approach.

The main contribution of the review-type study is either a synthesis of ideas by different authors, resolving some errors in cited materials, or adding missing parts of the analysis. This does not mean that the author has to cite all published works or errors. The author of the paper must make subjective choices and be critical of the various sources while remaining within the bounds of academic conventions. In any case, the review-type work should cite the main sources on the subject in a manner that gives an average reader a quick overview of the problem and its solutions. The difference between a review-type bachelor's thesis and a review-type master's thesis lies in the volume of cited references, the scope of the area covered, and the comprehensiveness of the coverage.

1.3.2 Applied research

An applied research thesis can be based on a software solution created by the author, on testing software or hardware, or it can be built upon the learning material compiled by the author or upon the existing learning material.

An important component of the **work written on the basis of the completed software solution** is the analysis of the results, which must answer the following questions:

- How is the solution created by the author better than the previous solutions?
- Did the software work? What quality assurance methods were used?
- How well did it work? What are the measurable performance results?

Technological choices must be reasoned, i.e. the thesis must show why the technology was chosen, what the alternatives were, and how resource-intensive the choices turned out to be. The architecture of the solution must also be described.

In the case of programming-based theses, it is important to follow software and software source code documentation requirements. The requirements for the computer hardware and software, along with installation instructions and a user manual, must also be included.

The testing of hardware or software in a thesis may involve both the study of software or hardware (comparing different types) and the experimental implementation of that software or hardware. The thesis should include a problem description, an explanation of why the specific software or hardware is needed, an overview of existing analogues and the objectives and results of the testing. This type of thesis may involve testing an e-learning software or hardware during its creation or carrying out teaching activities with it at a university or other educational institution. The methodology used in the thesis must be reasoned and justified. An original user manual created by the student may be a part of the thesis, or the thesis may be based on the manual.

A thesis written on the basis of a teaching resource or learning material, which may be based on learning materials created by or with the assistance of the author: instruction materials, textbooks, course websites, other online materials, etc. During the preparation of the learning material, the focus can be on the presentation of the content or on the use of innovative techniques and methodology for the presentation. In the first case, the author contributes mainly to the writing and preparing the learning material. In the second case, the technical aspects of presenting the material are being assessed. However, the learning material has to be usable without major changes. However, the learning material alone cannot form a graduation thesis. In addition to the material, a student must include a study describing the process for completing the material and the theories, methodologies, and sources used. The learning material itself must be annexed to the thesis.

The main difference between a bachelor's and a master's thesis that presents learning material lies in the task set-up. While in the bachelor's thesis, the author is expected to provide a concrete solution, for instance, a course website, then the master's thesis needs to include novel results and/or a non-trivial application of existing methods or principles that demonstrates mastery in the chosen field of study. For example, a survey to assess the suitability of the learning material and an in-depth analysis of corresponding feedback and improvement of the materials is very suitable for that purpose. If the thesis is based on compiling learning materials for the course, the author's main contribution can be in the systematic presentation of prior knowledge. In this case, the requirements are the same as for review-type theses.

Bachelor's theses often focus on:

- the development of teaching-methodological assistant software (prototyping and experimentation);
- the compilation of sets of exercises together with solutions that can be used for teaching subjects related to computer science.

The master's theses that are based on the creation of learning materials focus mainly on the following:

- creation of teaching-methodological assistant software (a comprehensive solution with the relevant documentation);
- preparation of a collection of exercises and teaching-methodological guidance material covering the full course of a specific subject related to computer science;
- preparation of lecture course materials for a specific subject related to computer science;
- compilation of a computer science textbook or a closely related subject.

As to the learning materials, it is important to follow the relevant didactic principles that ensure the adequate pedagogical structure of the material. Particular emphasis should be placed on the linguistic quality of the learning materials, making sure that they comply with the commonly accepted terminology. When using a great number of new terms, it is advisable to add a glossary of terms to the thesis.

2. The rights and obligations of supervised persons and supervisors

The quality of a thesis depends on an author and on a supervisor, as well as on the cooperation between them. Both sides have their own rights and obligations in cooperation. Here are some tips to ensure that cooperation is regular and runs smoothly:

- A student chooses the topic of the thesis, in agreement with the supervisor, by the deadline set in the autumn term preceding the defence, which is notified to the students by e-mail and posted on the website of the Institute of Computer Science.
- A supervisor has to have at least a master's degree or an equivalent level of education. If the student's supervisor is not an employee of the University of Tartu, a co-supervisor is appointed from amongst the academic staff of the Institute of Computer Science. If the supervisor is not a member of the staff of the Institute of Computer Science, the Programme Manager may propose that a co-supervisor be appointed from amongst the academic staff of the Institute of Computer Science.
- A student may contact the Programme Manager with a request to find a suitable supervisor.

2.1 The rights and obligations of students

A student is responsible for the content and form of his/her thesis.

A student has the right to receive feedback from his/her supervisor on his/her thesis at agreed times.

A student is obliged to:

- Be active and contact the supervisor in order to agree on the terms of cooperation and the schedule of supervision;
- Attend the meetings that have been agreed with the supervisor;
- Keep to agreed deadlines;
- Take the recommendations of the supervisor into account when writing the thesis;
- Prepare the thesis independently; when working in a large group, clearly indicate his/her personal contribution;
- Know and follow the rules of correct referencing and the consequences of plagiarism, and it is advisable to use plagiarism detection software.

Students are responsible for their theses' correct spelling and style and submit linguistically correct text to supervisors for feedback.

2.2 The rights and obligations of supervisors

A supervisor has the following tasks:

- Assist the student in selecting the thesis topic and consulting the student at all stages of the thesis writing process;
- Agree on the schedule of work and explain to the student the requirements established for the theses;
- Provide feedback to the student about the goal, structure and main problems related to the thesis;
- Assist the student in selecting the material needed for preparing the thesis;
- Advise the student on the use of a plagiarism checker or other tools to rule out possible plagiarism;
- Provide feedback on the thesis at an agreed time;

- Guide the student on issues related to the presentation of the thesis at the defence and explaining the defence procedure;
- Know the Institute's requirements for graduation theses and proceed from them during the process of supervision.

Rights of a supervisor:

- A supervisor does not have to correct orthographic mistakes, grammar or style of a thesis but should draw the student's attention to the mistakes in it and, if necessary, give the students recommendations for improving the legibility of the text;
- A supervisor may not allow the defence of a graduation thesis if the supervisor has not been familiarised with it or if he/she is not convinced that the thesis complies with the requirements established for graduation theses.

2.3 The submission of a thesis and being allowed to the defence

The general requirements and guidelines for defending a thesis are set out in the Study Regulations of the University of Tartu (Part IV, 72.–82.).

The author of the thesis uploads the thesis containing the simple licence described in the study regulations as a PDF file to the Institute of Computer Science's thesis register.

The supervisor in charge of the thesis submits to the defence committee the agreement to allow the thesis to be defended and proposes the appointment of a reviewer by sending an e-mail to ati.study@ut.ee.

Only a person who has at least a master's degree or equivalent level of education can act as a reviewer. A supervisor shall present a thesis to a reviewer at the earliest opportunity but no later than five days before the defence. A reviewer shall send the written review to the study coordinator (ati.study@ut.ee), a supervisor and an author of the thesis no later than two working days before the defence.

Completing all courses in the curriculum is a prerequisite for the admission of a thesis to the defence, and admission to the defence has to be approved by the Head of the Institute.

If the electronic publication of the thesis is not possible due to the state or business secret or any other secret information, it includes, the author of the thesis must submit, before submitting the work, a reasoned application to the Vice Dean for Academic Affairs for establishing restrictions on the defence procedure and publishing of the thesis at least one month before the submission date. The application form is available on the University of Tartu website. The restrictions shall be established by the Vice Dean for Academic Affairs by his/her directive. In this case, only the summary of the thesis, as well as the body of the work that does not contain any classified information, will be published. However, the entire thesis must be submitted to an academic affairs specialist and a supervisor, and the whole defence committee shall get acquainted with it.

3. The structure and format of graduation theses

This Section of the guidelines includes the requirements and recommendations for preparing graduation theses.

3.1 Language and style of theses

Graduation theses shall be written either in Estonian or English. The style of the text must be academic, i.e. it should be written in a specialised scientific language that is characterised by

the use of a variety of non-textual ways of expression (tables, figures, numbers, formulas, etc.), as well as the appropriate use of terms and expressions specific to the subject.

A thesis must be written in the correct language and be neutral in style. Neutrality means avoiding evaluative and attitudinal language.

Some rules for a good style are the following:
- The wording and phrasing should be precise and logical, avoiding obscurity and long-windedness;
- The author should abstain from the undue influence of foreign languages (e.g. using the sentence construction inherent to English in the text written in Estonian) and mistranslations;
- Use precise and clear specialised language supported by commonly accepted and established terminology;
- Avoid slang, journalistic and populist language, as well as the use of poetic and figurative expressions inherent to spoken language;
- Avoid self-reference such as "… as I explained in the previous Chapter, …";
- Write as shortly as possible but still as much as necessary.

Foreign terms used in a thesis written in Estonian must be written in italics; however, it is advisable to use the term in Estonian and to enclose the original term in brackets when the term is used for the first time in Estonian in the text. Names of companies, products and programmes are not terms.

3.2 Use of artificial intelligence in graduation theses

The University of Tartu website provides general Guidelines for using AI applications, including the guidelines for the use of artificial intelligence (AI) in thesis writing. The following guidelines are specifications which have been drawn up with students of the Institute of Computer Science and their theses in mind.

AI applications can be used, for example, as a source of inspiration, as a tool for developing your own thoughts and ideas, for translation, and to support learning in the early stages of your work. AI applications can also be used to help with the editing of a student's text during the thesis finalisation phase.

3.2.1 Use of AI for substantive (text creation) purposes

If AI applications are used to produce substantive parts of a thesis, the method of using AI should be explained in the methodology section of the thesis. The description of the use of the AI application should unambiguously indicate to what extent and in what way it has been applied in the work.

The same rules apply to the use of content generated by AI applications in the thesis as for any other source, i.e. it must be referenced. The content created by an AI application may not be presented under the name of the author of the thesis. If the content created by an AI application is not referenced and there is no clear description of its use, it is plagiarism.

Example: Usability testing questions were created by using the prompt "Create ten questions for me to ask my usability testers" (AI application name and version number).

If AI is used for creating content, the text of the thesis or its appendix has to include the prompt, the result of the prompt and the use of the result of the prompt. If the description of the use of the AI is extensive, the use of the AI must be presented in the appendices of the thesis as a diary

or overview with reasonable precision. It is not reasonable to include the prompt or the description of the prompt in a footnote.

3.2.2 Use of AI for formatting

Applications based on AI that do not create new content but process existing text and improve formatting may be used as supporting tools and should be briefly described at the end of the introduction.

3.3 The structure and main components of a thesis

The typical structure of a thesis consists of the following components:

1) Title page
2) Information sheet
3) Table of contents
4) Introduction
5) List of terms and definitions (optional)
6) Chapters
7) Summary
8) References
9) Appendices (if relevant)
10) License

3.3.1 Title page

A title page presents the names of the educational institution, the institute, the curriculum and the author, the title of a thesis, the type of the thesis and the name(s) of supervisor(s), the location and the year (see templates).

3.3.2 The information sheet of a thesis

The information sheet consists of the following information in Estonian as well as in English:

1. Title of the paper
2. Short abstract
3. Keywords
4. CERCS (Common European Research Classification Scheme) code of the scientific area of the paper, for example:
    ○ P170 Computer science, numerical analysis, systems, control
    ○ P175 Informatics, systems theory
    ○ B110 Bioinformatics, medical informatics, biomathematics, biometrics
    ○ T180 Telecommunication engineering
    ○ S281 Computer-assisted education
    ○ P110 Mathematical logic, set theory, combinatorics

CERCS codes can be found on the Estonian Research Information System website.

The title of a thesis should not be too long, preferably not more than one and a half lines. When formulating the title, it is better to avoid the need for internal punctuation.

If the title is in English, all words shall start with capital letters (except articles and conjunctions).

If the work has a visual abstract (graphical abstract)[1], it is presented immediately after the information sheet. If a visual abstract can be fit in the information sheet in one language, it may be placed in the information sheet.

The visual summary must include the following components:

● The title of the thesis
● Author's name
● Name(s) of supervisor(s);
● Curriculum and year
● University of Tartu, Institute of Computer Science ([may be presented as a logo](#));
● #UniTartuCS;
● Visualised work process, outcome and conclusions in an infographic style.

A visual summary is compulsory for the thesis of the Data Science curriculum, not for the others.

3.3.3 Table of contents

If possible, the table of contents should be built automatically using the relevant functionality of the word processor in use. It is appropriate to use up to 2 to 3 levels of headings. It is important to note that the table of contents itself is not included in the contents.

3.3.4 Introduction

The introduction of a thesis must consist of the following components:

● Justification for the choice of topic (its actuality and novelty);
● The purpose of the thesis;
● The overview (of the theoretical background) that includes references to previously published research (a longer theoretical overview can form a separate chapter following the introduction);
● Problem statement (if necessary, it should include the posed hypothesis/hypotheses, research question(s), and subject of research);
● The description of the structure of the thesis by chapter;
● a short overview of appendices (including the content of attached materials).

Any of the above-listed components may form a separate chapter or a part of a chapter.

3.3.5 List of terms and definitions

The list of terms includes the definitions of specific terms with their foreign equivalents used in the thesis. It is not necessary to list any well-known terms. It is not obligatory to present the terms used in the thesis in a separate chapter. However, it is desirable if it facilitates the understanding of the content of the thesis during reading.

3.3.5 Chapters

The main body of a thesis is presented in chapters. In general, it is reasonable to divide the text into 3 to 5 numbered chapters. Each chapter starts on a new page.

---

[1] For more information (choose domenis.ut.ee to enter):
  ● [Dmytro Fishman - graphical abstract video (*in English*)](#)
  ● [Maarja Pajusalu - graphical abstract video (in Estonian)](#)
  ● [Maarja Pajusalu - example video (in Estonian)](#)

A chapter can be divided into (sub)sections. However, in this case, a chapter has to include at least two sections. Longer sections can be further divided into sub-sections. It is not recommended to go beyond three levels for sections.

A new section shall be started on a new page only if the previous page does not have room for the title and at least two rows of text.

The titles of chapters and sections should not contain hyphenation, interrogative words, interrogative sentences, subordinate clauses, punctuation, phrases and abbreviations in a foreign language (unless it is essential). There is no full stop at the end of a title.

It is advisable to start each chapter with a short introduction, which certainly cannot be longer than half a page, and place it before the subheadings that will follow. If such an introductory paragraph is written in one chapter, it should be added to every chapter. It is advisable to end each chapter with a smooth passage into the next chapter.

3.3.6 Summary

The summary must state clearly the main results of the thesis. The summary should not introduce new ideas, arguments or reasoning that were not present in the main body of the thesis. A sensible approach would be to refer to the goal of the thesis and construct the text of the summary in a manner that clearly shows how the goal was achieved and what the author's contribution was.

The summary may contain a short overview of the possibilities and perspectives for the further development of the work done. This section may, as an alternative, form a separate chapter before the summary.

It is advisable to use the simple past and passive voice in summary, for example, "In the thesis it was shown ..., described ..., solved ...", although the use of passive voice in the present tense is also acceptable.

3.4 Formatting of written papers

The text must be aligned on both sides. It is advisable to use serif fonts (e.g. Times New Roman). The font size must be 12 points, and the line spacing should be set from 1.0 to 1.5. Space between words must be minimised by using hyphenation. As to compound words, division should occur between the two constituent words. In titles, hyphenation should be avoided.

Pages must be numbered, with the numbers at the bottom of the page, either in the middle or on the right. There is no page number on the title page.

3.4.1 Figures and tables

Figures are numbered and captioned. The caption, together with the number, is placed below the figure, for example, "Figure 3. An explanation of this figure."

If a figure has been taken from an outside source, there has to be a reference to the source at the end of the caption, for example, "Figure 17. An explanation of this figure [1]."

Numbering can be sequential throughout the thesis (the preferred style) or sequential within each chapter, using the following pattern:

<chapter-number.sequence-number-within-chapter>.

The same rules apply also to tables. The only difference is that the number and caption are written above the table.

NB: Tables have titles, and figures have captions. There must be a reference to every figure and table in the text. Figures and tables should be located as close as possible to the first reference to them in the text, for example, "Table 2 presents data …", „Figure 3 presents/shows/gives …", "Figure 2 presents the graph."

Figures and tables should be of high quality and comprehensible and should support the information in the text. Chapters and sections must not end with a table, figure or list.

3.4.2 Lists

Every list must be preceded by an explanation for using it, for example:

„The main arguments are the following:

- the first argument;
- the second argument;
- the third argument."

In the case of longer lists (more than five elements), it is better to use numbers or letters, not identical symbols such as dots.

A detailed description of how to prepare lists is available on the Estonian Language Institute website.

3.4.3 Abbreviations

File name extensions are expressed either as capitalised abbreviations if it is a format name (e.g. PDF, thus a PDF file, as well as a ZIP file or a compressed file) or as a lower-case abbreviation that is preceded by a dot that refers to the fact that it is a file extension (e.g. files with the extension .docx are uploaded).

Words behind abbreviations, except the very common ones, must be written out fully when they first occur in the text.

3.4.4 Symbols

Symbols of mathematical objects are printed in italics, except the names of operations and functions (e.g. log, max, sin).

$$(x - 1) \sum_{i=1}^{N} (1 - z_i)^a$$

All formulas that are referred to in the text must be numbered.

$$(x - 1) \log \sqrt{2m + n^3} \tag{1}$$

Numbers and brackets are written upright (e.g. see formula (1)). The names of programme objects (identifiers, keywords, operators) occurring in the thesis' text are also printed in italics or brought out by monospace font (e.g. Courier New).

3.4.5 Names of directories, files, programmes, etc.

Names, especially trademarks, have to be written exactly in the manner required by the owner of a trademark (or name). It is important in the case of names and trademarks where the initial letter is written in lower case or where capital letters or any other signs are used in the middle of the word (e.g. non-breaking hyphens).

Directories and files have names that are written between quotation marks or in italics. For example: "… "Idea" and "Sandbox" directories are stored" or "directories, such as *Idea* and *Sandbox* are stored or "the file titled "test_helper.py" is located in the directory".)

Hardware and software products, just like any other products, have names which do not require any quotation marks. For example: (laptop) Desknote B920 Pro, (printer) Laserjet 1000, (operation system) Windows 10, (Microsoft programmes) Word, PowerPoint, Outlook, Excel, etc. Web portals, such as Instagram, Twitter and Facebook are also names.

3.4.6 Appendices

Numerical data and other materials necessary for solving the research problem, but not necessarily presented in the text, or if the material is too extensive (background data for research, source codes of programmes, documentation, tables, etc.), should be presented as appendices. The text must include a reference to each appendix, i.e. all the appendices must be related to the text. Appendices should be numbered according to their reference in the main text. The number of an appendix should be displayed in bold letters in the left-hand margin of the page, followed by the title of the appendix. There is no full stop at the end of a title. Each appendix must start on a new page. If the text, picture, table, etc., presented in an appendix is not owned by an author, a precise reference must be made to its origin.

3.5 Referring and list of references

Referring is an academic tradition acknowledging authors of the ideas, statements, data, etc., used in a text. It also allows the reader to view the source if necessary. Unless otherwise justified, the sources referred to in a thesis must be authoritative and academic. For example, articles on Wikipedia are not considered academic.

3.5.1 Referring

When reference is made, note that:

- a reference to the original source should be made **every time** another author's work is either reviewed, summarised, quoted or copied – it does not matter whether it is textual, graphic or audio-visual material;
- the reference usually appears in two places, with varying degrees of detail: within the text and at the end of the text, in the list of references used;
- whichever reference style has been chosen, it is important to follow the **same style** throughout the whole thesis;
- using an automatic reference management system included in many word processors is advisable.

Several bibliography styles (e.g. IEEE, APA, ACM, SIAM, etc.) have been invented. However, in computer science, mainly the following styles are used:

1) In the case of **numbered references, i.e. Vancouver style** (the style used in the examples of these guidelines), the sequence number of the source in the bibliography and the relevant pages are written in square brackets after the quotation. For example, if the source is reviewed: "Reviewed text [5]" or a set of numbers that are separated from each other by a comma and a space "reviewed text [1, 3, 6]" or an interval of numbers " reviewed text [2-6]". In the case of quotation, the reference to the number of a page of the source is made (e.g. "Quotation, quotation, quotation" [5:2]";

2) **AMS style** (**American Mathematical Society**) (more precisely, one of the many AMS styles) uses the abbreviations of name(s) of the author(s) (e.g. [ABC]), accompanied by a

year of publication if the difference between the same author's papers needs to be made ([ABC2017]). AMS styles are implemented within LaTEX via BibTex (the style mentioned here is called *alpha*);

3) **APA style**[2] (American Psychological Association) where in-text citations include the following: author's/authors' surname(s) without the given name and the publication year, for example: „... (Koit, 2010)" or "Koit (2010) notes that …". In the case of quoting, the page number is added, for example, "Koit (2010: 727) notes that …".

4) Numerical referencing is short – a reference number, which makes it easy to get from the bibliography to a description of the source but harder to read (you have to check the reference every time). In the case of using the author(s) name abbreviations style, it is easier to modify and add new references while writing the text, and it is also easier for a reader to understand the references. In the case of subsequent references to the same source, it is also easier to notice that the reference to the source has already been made.

The reference within the sentence usually applies to the referred sentence. For example:

Machine translation became a subject of research in Estonia at the end of the 1950s when some mathematicians at the University of Tartu, led by Ülo Kaasik, tried to translate mathematical texts from Russian into Estonian [1].

If a reference is made to an extensive text (e.g. for a whole paragraph), the review is to be formulated in a manner that clearly conveys the ideas of the author who is being cited, for example:

Mare Koit et al. [1] have written that machine translation became a subject of research in Estonia as early as the end of the 1950s when some mathematicians of the University of Tartu, led by Ülo Kaasik, tried to translate mathematical texts from Russian into Estonian. Some programmes were created for the Ural computer, which was ridiculously slow compared with the ones in use today: 100 operations in a second, which did not allow for an effective translation. According to her, this work gradually came to a standstill.

In order to review the whole paragraph, it is useful to use introductory clauses, for example:

- The following paragraph is based on the article by A. Isotamm [2]…
- The following material is a review of the textbook by R. Prank [3]…

A reference is always part of a sentence, i.e. the reference is always before the full stop ending the sentence.

Sometimes, it is necessary to summarise references and present them as footnotes. This method is especially convenient for referring to directories, files, applications, etc., making the text much more reader-friendly.

References should be made according to the principle that sentences should be eligible without reading the reference, and the reference should be made logically within a sentence. Thus, the constructions, such as "therefore, [2] argues that …" should be avoided.

It is useful to consult your supervisor, who can help you to choose the most suitable referencing style and use it correctly.

---

[2] More detailed instructions: https://apastyle.apa.org/.

3.5.2 Requirements for the list of references and some examples

The list of references includes the sources used and cited in the thesis – only the sources cited in the work are listed, and each source listed must be cited in the work. The list of references should include only the sources used and cited within the thesis and may not include any references that cannot be directly associated with the text of the thesis.

In organising the list of references, two options can be used:

1) **Alphabetical order** - based on the authors' names;
2) The order **of succession of the references cited** in the text.

The first option is convenient due to the simplicity of finding source information also outside the scope of reading the thesis by the name of an author. As to the second option, it is easier to keep track of references or the first use of reference while reading the text in sequential order.

General rules:

1. The bibliography section is titled the "List of References".
2. All details concerning the referenced source are taken from the work's title page and/or the reverse of the title page.
3. A reference record is compiled in the language of the referenced source, and it consists of several elements presented in a particular order (see below).
4. It includes a minimum but necessary amount of details that allow the work to be found in the library, database, or the Internet.
5. As the reference record is in the same language as the publication, the abbreviations are also in the respective foreign language, for example, page, edition and volume are in English p., Ed., Vol, and in German S., Aufl., Bd.
6. If the author of the source is an institution/organisation or the author is not included at all, the source is entered alphabetically in the references list by the first word of the title.
7. In the case of several authors, all the names are included in the list of references. However, references in the text should include only the name of the first author and the existence of other authors should be acknowledged with the abbreviation "et al.".
8. If the year of publication of the work is unknown, the abbreviation s.a. (*sine anno*) is used.

For example:

1) **For a book**

Author(s) (surname with initials). Title. Edition or reprint details. Place of publication: publishing house. Year of publication.

[5] Isotamm A. Programmeerimiskeeled. Tartu: Tartu Ülikooli Kirjastus. 2007.

For used graduation theses the author's name, the title of the thesis, university name and institute name, type and year of the thesis shall be presented.

[6] Margens E.-L. Informaatikaõpetajate täiendkoolituse küsitluse ettevalmistamine ja katsetamine. TÜ arvutiteaduse instituudi bakalaureusetöö. 2015.
https://comserv.cs.ut.ee/ati_thesis/datasheet.php?id=46781&year=2015 (date).

2) **For an article in a collection**

Surname and initial(s) of the author. Title. *Name of the collection in italics*. Place of publication: publishing house (publisher), year of publication, page numbers of the whole article used.

[7] Engelbrecht J. Mehaanika — lõputu hulk uusi probleeme. *Teadusmõte Eestis: tehnikateadused*. Tallinn: Eesti Teaduste Akadeemia, 2002, 21–24.

3) **For an article published in a journal**

Surname and initial(s) of the author. Title. *Name of the journal in italics,* year of publication, number of the journal, page numbers of the whole article used.

[8] Kaalep H.-J., Koit M. Kuidas masin tõlgib. *Keel ja Kirjandus*, 2010, No. 10, pp 726–738.

4) For articles from the Internet or electronic journal/collection

Surname and initial(s) of the author, title of the article, collection (if relevant), and year of publication. URL address (the full Internet address of referenced material). The date when the author last viewed the material on that Internet page.

[9] Virkus S. Infokirjaoskus ja infokäitumine infouuringute kontekstis: I. *Infofoorum*, 2003, 7. http://www.tlu.ee/i-foorum/ifoorum7/Artiklid/sirje.htm (20.06.2005).

If the author cannot be identified, the address of the source of the information with all the entries and the date of acquiring it has to be presented.

[10] IBM Watson. http://www.ibm.com/smarterplanet/us/en/ibmwatson (26.08.2016).

As an exception, the date of the last visit is not needed if the source is an electronic archive or a specialised dictionary.

[11] Elektrooniline krüptograafiliste publikatsioonide arhiiv Eprint. http://eprint.iacr.org.

[12] e-Teatmik: IT ja sidetehnika seletav sõnaraamat. http://ww.vallaste.ee.

If the year of publication and the volume (number of pages) of an electronic PDF file are known, they have to be referred to in the same manner as if they were published on paper.

References should include only the sources that are referred to in the thesis.

In the case of citing by authors' names, the references should be in alphabetic order.

5) References to Artificial Intelligence (AI)

OpenAI (2022). ChatGPT (version number): https://chat.openai.com.

Microsoft (2024). Microsoft Copilot (version number): https://copilot.microsoft.com.

4. Defence procedure

Graduation theses shall be defended at the times set by defence committees. The dates and places for defence with the relevant timetables shall be published on the Institute of Computer Science website. Graduation theses are defended in the form of an academic debate. Depending on the type of thesis, the following time limits are established for the presentation:

- **10 minutes for a bachelor's thesis**;
- **15 minutes for a master's thesis.**

The main stages of the defence procedure are the following:

- the author's presentation;
- questions related to the presentation;
- opinion of the reviewer;
- general discussion;

- opinion of the supervisor;
- the author's final remarks.

Public presentation is a part of the defence procedure for bachelor's and master's theses. The following section includes some recommendations and best practices related to the defence procedure.

4.1 The structure of the presentation of a thesis at a public defence

The presentation should be structured, and the topics should follow each other logically. The presentation consists of five main parts:
1) introduction, description of the goal and research task, overview of the structure of a thesis;
2) description of methods, approach and hypotheses;
3) description of the work process,
4) presentation of results,
5) conclusions, summary.

The introduction should not be just a statement of the problem but indicate the presenter's motivation to solve the problem. It is important to describe the process of solving the problem and the choices the author had to make to achieve the final results.

The results should be summed up shortly and clearly, pointing out only the most important details.

4.2 Preparing of a presentation

It is not advisable to present too much material. A good presentation includes one or two central points. The point of a presentation is to communicate (scientific) results. However, the presentation should not be too superficial. The most important aspects should be introduced in a more detailed manner than the rest of the work. It is better to start immediately with examples that illustrate the problem in the most expressive way. In the case where complex formulas are shown on slides, they should be explained to the audience.

4.3 Use of examples

The use of relevant and comprehensible examples is the best way to explain the content of the work to an audience. Otherwise, the presentation may become too abstract and elusive for listeners. Examples that explain what a definition, property, mathematical structure, new term, theorem, idea, technique or algorithm involves offer a better overview of their genuine essence. Practical examples that connect the subject of the research with real life are especially good.

4.4 Use of technical equipment

When preparing for the presentation, a student should consider what sort of equipment is available. It is advisable to prepare slides for the presentation. The safest option is to use the formats which are created and shown with the same software. Therefore, it is best to use presentation software that includes a presenter view that shows the remarks on the slides, the time that is used for the presentation and an overview of the slides to come. In the case of more specific needs, it is wise to check which file formats are supported by the computer to be used for the presentation or to use a personal computer. It is also worth checking how to transfer the presentation to the computer used for the presentation. Check the Internet connection and make a copy on a memory stick, if necessary. Be ready for an alternative solution if one of the options fails.

5. Grading of theses

This part of the guidelines includes the principles of grading theses and explains the values of grades.

5.1 Components of the grade

Graduation theses are graded on the basis of the following four criteria:

1. Content

- Topicality, actuality, academic value, authoritativeness (work of acknowledged authors) and comprehensiveness (whether all the relevant topics are covered) of primary sources;
- The level of analysis and synthesis of literature;
- Validity and comprehensiveness of the method(s) used;
- Logicality of the approach to the topic;
- Reasoned and comprehensive comparison of the results achieved with previous results;
- Applicability of the results;
- Novelty of the results;
- Quality of the created software.

2. Level of complexity

- Compliance of the thesis to the requirements established for bachelor's and master's theses;
- Complexity of novel (scientific) results, viewpoints, created software and approach to the topic presented in the thesis;
- The volume of work done.

3. Appearance

- Academic, correct and clear use of language;
- Good technical realisation (clear and logical structure; the quality of tables, figures and other illustrative material);
- Accuracy of references (were the rules of the chosen reference style followed; whether all sources are referred to and whether the sources of all the references are provided, etc.):
- Cohesion of the text (whether the different parts of the thesis form an integral unity).

4. Presentation

- The structure and consistency of the presentation;
- The clearness of the presentation, the use of examples;
- The correct use of language;
- The capability of answering questions and participating in discussion.

A reviewer makes an evaluation suggestion regarding the first three criteria according to the grading scale presented in Section 5.2.

A defence committee evaluates, besides the first three criteria, the author's presentation and considers the evaluation of a reviewer.

5.2 Grading scale

Each criterion is graded individually, as follows:

5   Very good*;*

4   Good;

3   Barely acceptable;

2   Poor;

1   Very poor.

5.2.1 Explanation of the scale

As a general rule, only the first four grades should be used. Decimal points can be used in positive grades.
- Grade 5 (very good) requires that the work is almost flawless according to the given criterion and is outstanding in some aspects.
- Grade 4 (good) means that the thesis is a good work without major shortcomings.
- Grade 3 (barely acceptable) is the lowest positive grade, which should be used if the work meets the minimal requirements of the criterion but contains some substantial shortcomings.
- Grade 2 (poor) is a negative grade that should be used if the thesis does not meet the minimum requirements for the criterion. Grade 2 in two criteria automatically means F (fail) as a final grade.
- Grade 1 (very poor) should be used only in exceptional cases if the thesis clearly violates the basic principles of an academic work (for example, in the case of plagiarism). Grade 1 in any of the criteria automatically means F (fail) as a final grade.

5.2.2 Final grade

The suggested final grade is derived from the {sum of criterion points} x 5 according to the following scale:

A   91–100   Excellent

B   81–90   Very good

C   71–80   Good

D   61–70   Satisfactory

E   51–60   Pass

F   50 or less   Fail

Useful links

- Guidelines, principles and application forms of the Faculty of Science and Technology, University of Tartu. https://reaalteadused.ut.ee/et/sisu/loodus-ja-tappisteaduste-valdkonna-tapsustavad-juhendid-ja-pohimotted-ning-avalduste-vormid (22.03.2024)
- Rugaber S. Thoughts on the Structure of CS Dissertations. http://www.cc.gatech.edu/fac/Spencer.Rugaber/txt/thesis.html (22.03.2024)
- Schillo M. Help on how to conduct a computer science research project. http://www.virtosphere.de/schillo/research/tips.html (22.03.2024)
- Saari P. Kirjandusele viitamise juhend füüsika (3+2) bakalaureuse- ja magistritöödes. https://fi.ut.ee/sites/default/files/2022-03/viitamise_juhend_fyysikas.pdf (22.03.2024)
- Peyton Jones S.L., Hughes J., Launchbury J. How to give a good research talk. https://www.microsoft.com/en-us/research/academic-program/give-great-research-talk/ (22.03.2024)
- Schoeberl M., Toon B. Ten Secrets to Giving a Good Scientific Talk. http://www.cgd.ucar.edu/cms/agu/scientific_talk.html (22.03.2024)

- McMillan D. Life after death by PowerPoint 2010. http://www.youtube.com/watch?v=KbSPPFYxx3o (22.03.2024)