

Ministry of Education and Science of Ukraine  
Petro Mohyla Black Sea National University  
Computer Sciences Faculty  
Computer Engineering Department

*Obukhova K., Zhuravska I.*

**Guidelines for implementing  
the Master's Thesis for the applicants  
of the specialty 123 Computer Engineering**

*Methodological recommendations*

**Volume 448**



Mykolaiv – 2024

**UDC 004**

**O 10**

*Recommended for publication by the Academic Council of the  
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***Reviewer:***

**Oleksandr TRUNOV**, Professor of the Automation and  
Computer-Integrated Technologies Department, Dr.Sc. (Engin.),  
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The guidelines contain instructions and recommendations  
concerning the structure and formatting of the Master's Thesis,  
explain the defense procedure and the grading system.

UDC 004

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# 1 GENERAL PRINCIPLES

Master's Thesis is the final indicator of the applicant's readiness level for practical activities.

The Master's Thesis aims to consolidate the knowledge gained during the study process, to improve skills of independent work via applying original techniques to mathematical modeling of natural, economical, technological, etc. processes; programming algorithms for solving applied problems.

Master's Thesis must be of a scientific, practical, or innovative nature and reflect the scope of scientific or practical interests that the future specialist will be able to implement in his/her activities.

Master's Thesis is a qualification document, on its basis, the Examination Committee determines the level of qualification of the specialist and his/her ability to work independently in the field of Computer Engineering [1].

The structure and content of the Master's Thesis must be clear, with the logically sequential material presentation. An applicant should pay attention to the accuracy of formulations to avoid possible subjective or imprecise interpretation. A good manner is to strive for simplicity, clarity, and briefness. The author must ensure the novelty of the material, its scientific value, completeness of statements, and correctness of citing. Citing without references is forbidden.

Master's Thesis must be an independent scientific research work, with internal cohesion that reflects the development process and the achievements in the topic. Thus, the main requirements are:

- to be topical and correspond to the current level of scientific development;
- to fully justify the legitimacy and correctness of usage of all the research methods and techniques in every specific case;
- to contain a fundamentally new material, that includes a description of new facts, phenomena, and dependencies, or generalization of previously known principles from a novel point of view.

According to established scientific etiquette, the discussion is given in a third person narrative: "we believe", "in our opinion" etc.

Typical structure of the Master's Thesis in Computer Engineering includes:

- 1) cover page;
- 2) contents section;

***Guidelines for implementing the Master's Thesis for the applicants of the specialty 123 Computer Engineering***

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- 3) abstract;
- 4) abbreviations section;
- 5) introduction;
- 6) the main part (usually divided into chapters, which consist of subchapters, or paragraphs);
- 7) conclusions;
- 8) references list;
- 9) appendices.

As a document, presented for the defense, the Thesis has to include additional documents that will be described below.

## 2 STRUCTURAL ELEMENTS OF THE INTRODUCTION SECTION

Introduction (no more than 5 pages) reveals the essence and the significance of the existing problem in the field, describes the grounds and the initial data for the development of the topic, the current state of the art, the developments of researchers on a given problem (mostly scientific, over the last 5 years), justification of the need for current research. In the Introduction section, the author provides a general description of the work in the following order:

***The relevance of the problem***, which determined the choice of the research field. The expediency of the work should be grounded by analyzing the existing situation in the field and comparing it with known methods and solutions, which explicitly results in the development of the corresponding field of science.

***The object of research*** – a process or a phenomenon under study that generates a problem.

***The subject of research*** – some properties of the object of research, which an applicant needs to investigate.

***Aim of the work and tasks***, which an applicant has to solve to achieve the aim.

***Research methods*** that were used to solve the tasks and achieve the aim.

***Research materials*** – for the work in Computer Engineering these usually are third party software tools that were used to solve the tasks, datasets from third-party sources, etc.

***Scientific novelty*** – a short annotation of new provisions or solutions, which the author personally proposes. It is obligatory to indicate the difference between these provisions and those already known. This structural element is optional.

***Practical value*** of the results.

***Approbation of the results*** (can be theoretical: conference reports or papers published).

### 3 RECOMMENDATIONS CONCERNING THE MAIN PART

If the work is mainly theoretical, the *first chapter* should contain a review of scientific and technical sources for solving the problem (preferably for the last 5 years). It might be useful to provide examples of solving similar problems in the past, usually by other authors.

If the work is more applied, the first chapter should contain the analysis of a subject area and a detailed description of the components of the system under investigation.

It is necessary to pay attention to the development of scientific views on the problem, to analyze up-to-date scientific achievements in the field. The applicant has to express his own opinion concerning existing views and provide his/her own assessment of the existing approaches to the problem.

The *second chapter* usually contains the analysis of the initial problem and its decomposition into local problems. The system connections are projected here, along with the algorithms and methods of solving local problems. For this purpose, one can use his/her own research results, which were obtained earlier in other works, as well as ideas, methodologies, and algorithms from other sources (books, articles, etc.)

If the work is theoretical, the main scientific ideas should go in this chapter, with explicit explanations and proofs. If the work is practical (e.g. applied software), the author should describe algorithms, architectural schemes, class diagrams, entity relationship diagrams, and other illustrations that reveal decisions that were made. The source code should be attached as the appendix to the Thesis.

In the *third chapter* of a Thesis, the author usually presents the value of the new ideas, provisions, or solutions, which were described in the second chapter. A good idea is to present some expository examples, which explicitly illustrate the benefits of using these ideas. The calculations should be illustrated with charts and diagrams. A comparison with alternative methods brings completeness to the research. One should not limit him(herself) with self-developed tools or methods – using well-known methods and trusted software/hardware ensures the validity of the results.

If an applicant presents his/her own software/hardware as part of the Thesis, the third chapter should contain a description of the user interface with screenshots and short guidelines for usage. The user manual, if it was created, should be added as an appendix.

The chapters' structure we described should not be taken dogmatically. For example, one can devote the second chapter to an investigation of the problem from one point of view, and the third – to an investigation from another. The Thesis can consist of 4 or more chapters if necessary.

**Conclusions.** This is a final part of a Thesis, in which one should expose the scientific, practical, economic, or social value of the results. Also, the author should give the high-level assessment of the ideas presented, analyze his/her contribution to this specific research area, formulate general conclusions, suggestions, and practical recommendations, make a motivated forecast regarding the development of the problem in the future. Usually, charts, schemas, or tables are not relevant for this part.

**The references** list is an obligatory part of the Master's Thesis. It is a thematic systemized collection of bibliographic data about used, cited, and recommended literature. It may contain textbooks, manuals, journal articles, web resources, and other sources. The preferred order is according to referencing order throughout the Thesis; alphabetical order is also acceptable. The references list is given in the original language. A publication item of a reference list consists of two parts: a title (usually that is author's or authors' names) and a description. The description must contain information about the main title, the publisher, year of publishing, the serial number of the volume and issue (if applicable), number of pages. Examples of referencing can be found in Appendix J of these Guidelines. The reference to the source is given in square quotes with a sign ";". The range of sources are combined with the sign "–" (see Appendix I).

**Appendices** should include auxiliary materials, which, if they were included in the main part of the Thesis, would litter the text. The auxiliary materials include intermediate mathematical considerations or calculations, software source code, user manuals, less relevant methodologies, which were developed, additional illustrations to those in the main part. Appendices are given in the order of referencing them throughout the Thesis and are numbered with capital Latin letters.

## **4 INSTRUCTIONS FOR THE MASTER'S THESIS FORMATTING**

When formatting a Master's Thesis, it is necessary to use instructions and recommendations from DSTU 3008:2015 [2], DSTU 8302:2015 [3] (for references), and DK 011-96 Chapter 25: Units Used in Informatics [4] (for units of measurement).

Master's Thesis is a book-orientation document, page format A4, numbered in the heading of the page on the right. The total amount of pages should not be more than 80, including all tables, schemes, figures, appendices, etc.

The Thesis must be printed, not handwritten. There are no strict demands regarding the text formatting, but the print must be suitable to read, as an example, the following formatting can be used:

- a) font – Times New Roman;
- b) line interval – 1,5;
- c) font size – 14 pt;
- d) paragraph size – 15–17 mm (5–6 symbols);
- e) fields sizes no less than: left – 20 mm, right – 10 mm, top – 20 mm, bottom – 20 mm.

The text must be printed in black color. Figures, diagrams, screenshots, illustrations, etc. can be colored.

If the applicant has developed a software, or its part, or introduced changes into existing source code, the listings should be attached as appendices. It is not necessary to include all the source code, rather some snippets of important parts, for example:

- implementation of algorithms proposed by the author;
- interface definitions (if a digital library is proposed as a result);
- general framework structure;
- for some iterative methods – the outermost cycle of function calls.

Example styles for formulas are the following:

- a) general settings: font – Times New Roman Cyr, 14 pt, indentation 0,5 cm, aligned to center, tabulation to the right 1,7 cm;
- b) Greek letters and special symbols: font – Symbol, 14 pt;
- c) indexes – 8 pt, subindices – 7 pt.

When using formulas, it is necessary to adhere to certain technical and spelling rules. The large, long, and cumbersome formulas, as well as those which contain summation, product, integral symbols, are subjects to place in a separate line. This also applies to all numbered formulas. To save some space, several short formulas of the same kind can be placed in one line, rather than in several lines. Small and simple formulas, which do not have some independent meaning, are given directly in the text. Meanings of the symbols and numerical coefficients have to be given right after the formula, one symbol, or coefficient per line. The first line of the meanings can start with the word “where” to preserve the readability of the text.

If the formula does not fit in one line, it should be wrapped after one of the following signs: equals (=), plus (+), minus (–), multiplication (x), division (:).

The formulas, that are referenced in the following text, should be numbered with Arabic numerals. Formula number consists of the chapter number and a number of a formula inside the chapter, divided by a dot. Formula number is aligned to right and given in brackets, e.g. (3.1) – first formula in the third chapter. If the formula is wrapped in two or more lines, the number is given in the last line. If there is no room for the number in the line, one can move it to a new line. If the formula is in the frame, the number is given outside the frame on the right side opposite the central line of the formula. An example of a formula is given in Appendix I.

Thesis chapters are ordered according to the contents section and each of them starts with a new page.

The titles of all the structural parts of the Master’s Thesis, that are “CONTENTS”, “ABSTRACT”, “ABBREVIATIONS”, “INTRODUCTION”, “CONCLUSIONS”, “REFERENCES”, are printed in uppercase aligned to the center. Chapter titles are preceded with the chapter number and title in uppercase aligned to the center too without the dot sign in the end. The new chapter starts with a new line.

Subchapter titles are printed with the paragraph indentation without the dot sign in the end. If the title consists of several sentences, they are separated with a dot. Subchapter titles are printed in lowercase (except for the first letter – uppercase) and numbered with the number of a chapter and a dot, e.g. “1.1” or “3.2”.

All the pages must have Arabic numbers (except the cover page). The numbering is continuous, starting from the cover page and ending with the last page, including all the Figures, Tables, and Appendices. The cover page has number 1, thus the Contents page starts with number 2. The page number is placed in the upper right corner.

Tables must be unified with a single style and numbered in order. Every table must be equipped with a header above it. A header starts with the word "Table" followed by a table number, which consists of a chapter number and number of a table itself, e. g. "Table 1.3".

Usually, the table is placed straight after the first mentioning in the text, that explanting of the data presented in the table, for example "...as shown in Table 3.1". When wrapping the table onto the following page, the second title should be "Continuation of Table 1.3" without repeating the name of the table. Above the last part of the table should be the heading "End of Table 1.3". If the cell is supposed to be empty, it is better to put the "-" sign for the explicit illustration of missed values. Every table should be accompanied by some short analysis or comment. An example of a table is given in Appendix G.

All the illustrations (schemes, plots, diagrams, etc.) are referred to as Figures. In the case of reference to a figure, the word Figure usually is abbreviated to Fig. They are numbered with the number of the chapter and the number of the figure itself, for example, Fig. 3.1 – the first figure of the third chapter. The figures should be placed immediately after referencing them in text. Under the figure, the word Figure is given in full with the number of the figure and the name of the figure through the "-" sign. After the number, the description of the figure is given.

If the figure is taken from the website of the vendor, developer, or seller, then it is necessary to provide a link to the original source in the references. The source number from the references must be indicated in square brackets after the figure title. The examples of figures can be found in Appendix H.

The appendices are numbered with capital Latin letters in the upper right corner, for example, "Appendix D". If the Tables or Figures are present in the appendix, their numbers must include the Appendix letter instead of the Chapter number, for example: Table A.1, Fig. C.3.

The title page must be signed by the Author and the Supervisor.

## **5 PREPARATION AND ORGANIZATION OF THE MASTER'S THESIS DEFENSE**

Master's Thesis as a complex printed document, presented for the defense, must contain additional documents. Together with the materials of the Thesis, they have to be presented in the following order:

- 1) cover page (see Appendix A for the template);
- 2) assignment for the Master's Thesis (see Appendix B for the form);
- 3) materials of the Thesis (contents, abstract, abbreviations list, introduction, main part, conclusions, references, appendices);
- 4) information about checking the Master's Thesis for plagiarism;
- 5) review page with the Reviewer's signature (see Appendix C for the form);
- 6) conclusion of the Scientific Supervisor (see Appendix D for the form);
- 7) conclusion of the Department (see Appendix E for the form).

Master's Thesis should be made in softcover, single-side, sewn on the left (except for review, conclusion, and assessment sheets – simply put them inside), numbered in the heading of the page on the right.

The procedure of the defense of a Master's Thesis is defined by regulations provided by the Ministry of Education of Ukraine and the Petro Mohyla Black Sea National University (PMBSNU). An applicant is responsible for the Thesis to pass the following steps:

- signature of the Author and the Scientific Supervisor;
- Review from a third-party department or organization (Appendix C);
- Conclusion of the Scientific Supervisor (Appendix D);
- Conclusion of the Department (Appendix E);
- presentation at the Committee meeting.

In a due time defined by the Department, an applicant has to submit the printed and sewn Thesis to the Department along with the digital version of the Thesis and a software (if applies), usually on the USB flash.

The Scientific Supervisor examines the Thesis and prepares the Conclusion according to the predefined template (Appendix D).

In the Conclusion, the Supervisor states applicant's activity, initiative, creativity, level of independence, and readiness to work in the professional field. Also, the Conclusion must include estimation of relevance of the topic

## ***Guidelines for implementing the Master's Thesis for the applicants of the specialty 123 Computer Engineering***

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of research, elements of novelty, level of theoretical results, practical value, the validity of the recommendations, and proposals offered in the Thesis. At the end of the Conclusion, the Supervisor makes a conclusion regarding the possibility of admitting the work to defense.

After discussion during pre-defense (2–3 weeks before the final defense in front of the Examination Committee), the Department decides whether to allow the applicant to present the work for the defense. If the Thesis is allowed for the defense, Head of the Department fills in the form of the Conclusion (Appendix E) and chooses a Reviewer – a person with relevant knowledge and experience in a corresponding field. Usually, this is a professor from a different department or institution of PNBSNU or a professional with an academic degree from some company or organization.

Having examined the Assignment, Assertion and the Thesis, according to the template (Appendix C), the Reviewer evaluates the content of the Thesis and the document itself, provides necessary comments and asserts a work, using a 4-level scale: “Excellent”, “Good”, “Satisfactory”, “Unsatisfactory”. A negative review is not a sufficient reason to reject the Thesis. The Department is eligible to organize and hold a preliminary defense of a Thesis.

Along with the supervisor's conclusion and review, the Master's Thesis must be uploaded to the PMBSNU Moodle system in a timely manner. The Master's Thesis is defended at an open meeting of the examination committee. For this, the applicant must prepare a report: speech, supporting materials and answers to the reviewer's comments. A computer presentation is the most suitable support material because it provides more tools to convey important information to the audience. The presentation should be short (up to 15 slides). At the beginning, the applicant must reveal the relevance of the topic, describe the purpose, object and subject of the research, motivate the choice of the research method. The main part of the presentation is a description of the research process itself, the methods used and the results obtained. In the final part, it is necessary to emphasize the practical value and/or novelty of the current research, provide recommendations for the further development of the research, discuss the possible use of the results in a certain field.

The defense process follows several steps. First, the applicant presents his work (up to 15 minutes). Then the Secretary of the Committee reads the external Review, and the applicant can give a response to the Reviewer's remarks. After that, the Committee members and all the present persons can ask questions aiming to determine applicant's qualification in the field of Computer Engineering in general, and specifically in the subfield related to

the topic of the Master's Thesis. The answers should be clear, with explicit reasoning, complete, but not too long, since the total time of the defense is limited to 30 minutes.

After the defense, the Committee members continue the discussion in private and assert every Master's Thesis. Different aspects are considered: the difficulty of the tasks, quality of the implementation, amount and the value of the results, completeness, and correctness of the answers, ability to present results in the document, and orally, bring ideas to the audience and advocate them.

The Master's Thesis is graded in 100 points scale, with the projection to ECTS according to the following Table 5.1.

Table 5.1 – Rating scale of the Master's Thesis

<b>Grade</b>	<b>ECTS</b>
90–100	A
81–89	B
71–79	C
61–69	D
51–59	E
<51	F

The applicants, who are willing to receive a grade “100”, should have their results discussed in the scientific community, i. e. publish a paper in a corresponding scientific journal or participate in a relevant conference.

## REFERENCES

1. Information and documentation. Scientific and technical reports. Structure and rules of putting into official form. DSTU 3008:2015. Kyiv : UkrNDNC, 2016. 26 p. [in Ukrainian].
2. Information and documentation. Bibliographic reference. General principles and rules of composition. DSTU 8302:2015. Kyiv : UkrNDNC, 2016. 16 p. [in Ukrainian].
3. Classifier of the system of designations of measurement and accounting units. DK 011-96 : valid from 01.07.1997. State Committee for Standardization, Metrology and Certification. URL: <https://zakon.rada.gov.ua/rada/show/v0008217-97#Text> (Last accessed: 01.09.2024) [in Ukrainian].
4. Standard of higher education in specialty 123 Computer engineering for the second (master's) level of higher education : order of the Ministry of Education and Science of Ukraine No. 330 of March 18, 2021. Kyiv : Ministry of Education and Science of Ukraine, 2021. 15 p. [in Ukrainian].
5. Koumaris N. Programming STM32 Based Boards with the Arduino IDE. URL: <https://www.electronics-lab.com/project/programming-stm32-based-boards-arduino-ide/> (Last accessed: 01.09.2024).

**APPENDIX A**  
**Cover page template**

**MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE**  
**PETRO MOHYLA BLACK SEA NATIONAL UNIVERSITY**

Computer Sciences Faculty  
Computer Engineering Department

**Master's Thesis**

<TOPIC OF THE THESIS>

Author: applicant of group <code of the group>  
on specialty 123 Computer Engineering

<First name> <LAST NAME>

Supervisor

<First name> <LAST NAME>

Mykolaiv – <year>

## **APPENDIX B**

### **Template of an assignment for the Master's Thesis**

#### **PETRO MOHYLA BLACK SEA NATIONAL UNIVERSITY**

Computer Sciences Faculty  
Computer Engineering Department  
Specialty 123 Computer Engineering

#### **APPROVE**

**Head of the Computer Engineering Department**

<Degree>, <Academic rank>

\_\_\_\_\_ <First name> <LAST NAME>

Signature

" \_\_\_\_ " \_\_\_\_\_ 202\_\_

### **A S S I G N M E N T**

#### **FOR THE MASTER'S THESIS TO THE STUDENT**

<First name(s)> <Last name>

1. Topic of the Thesis: <Topic of the Thesis>, supervisor <Degree>, <Academic rank> <Last name> <First name(s)> approved by the PMBSNU Rector's order № <number>, date <date>.
2. Submission deadline: <date>.
3. Initial data for the work: <insert here models of used equipment, methods, hardware, software, etc.>.
4. Outline of the work (list of tasks for implementation):
  - <task>;
  - <task>;
  - .....
  - <task>.
5. List of obligatory graphic material (with exact indication of mandatory drawings)
  - <item>;
  - <item>;
  - .....
  - <item>.

6. Consultants (per chapter)

Chapter number	Name and position of the Consultant	Date and signature	
		Task was given	Task was accomplished

7. Assignment issue date: <date.month.year>.

**CALENDAR PLAN**

No.	Stage title	Stage runtime	Notes
1		<from> – <to>	
2		<from> – <to>	
3		<from> – <to>	

Applicant \_\_\_\_\_ <First name(s)> <LAST NAME>  
Signature

Supervisor  
<Degree>, <Academic rank> \_\_\_\_\_ <First name(s)> <LAST NAME>  
Signature

## **APPENDIX C**

### **Review template**

#### **REVIEW**

for the Master's thesis of the student of the group 60Xmi  
of Petro Mohyla Black Sea National University

<Last name> <First name(s)>

"TOPIC OF THE MASTER'S THESIS"

by specialty 123 Computer engineering

<Comments>

But the following critical remarks should be made to the qualifying work submitted for review:

- 1) the first remark;
- 2) the second remark...

At the same time, regardless of the comments made, applicant <Last name> <First name(s)> demonstrates a level of knowledge that corresponds to the qualification requirements of the master's level in specialty 123 Computer Engineering. Thus, the master's qualification work "<TOPIC OF THE MASTER'S THESIS>" on Specialty 123 Computer Engineering can be evaluated as "<The grade using a 4-level scale>", and after defending Master's Thesis applicant <Last name> <First name(s)> deserves awarding the degree of Master of Computer Engineering.

#### **Reviewer**

<Degree>, <Academic rank>,

<Position> of the <Department name>\_\_\_\_\_ <First name(s)> <LAST NAME>

Signature

**APPENDIX D**  
**Conclusion of the scientific supervisor template**

**Conclusion of the scientific supervisor**  
about the Master's thesis

Applicant <Last name> <First name(s)> completed the qualification work on the topic "<TOPIC OF THE MASTER'S THESIS>".  
<Comments>

I believe that the completed qualifying work can be admitted to the defense.

**Supervisor**  
<Degree>, <Academic rank> \_\_\_\_\_ <First name(s)> <LAST NAME>  
Signature  
" \_\_\_\_ " \_\_\_\_\_ 202\_\_\_\_

## Report about checking for plagiarism of the Master's Thesis template


## REPORT

about checking for plagiarism  
of the Master's Thesis on the topic:  
"<TOPIC OF THE MASTER'S THESIS>"


applicant of group 605mi on specialty 123 Computer Engineering  
**<Last name> <First name(s)>**

The work was checked for plagiarism by the service: <Title of the anti-plagiarism service>.

The result of the plagiarism check of the Master's Thesis text: the similarity is <percentage of similarity> %.


[bristol.ac.uk](https://bristol.ac.uk)

Bristol Mykha Sea National University  
 Дата вступу: 19/03/2024  
 Дата роздрукування: ---


 Документ готовності

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## МІТТАДАНІ

Завдання

Слайди: Guidelines\_in\_Master\_Thesis2024.pdf (40/60) (4/60)

Автори:

Журнал: I. M., Олександр К. О.

Наданий викладач: /Генератор/

Ім'я: Ірина Жиральська

Назва:

Petro Mykha Sea National University

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## Тривога

У цьому розділі ви можете відслідковувати свою тривожність відповідно до опитування в тесті на тривожність, яке проводиться на основі тесту на тривожність, який є частиною тесту на тривожність. Якщо ви не можете пройти тест, ви можете пройти тест на тривожність, який є частиною тесту на тривожність. Якщо ви не можете пройти тест, ви можете пройти тест на тривожність, який є частиною тесту на тривожність.

Завдання було	0
Інтерпретація	0
Максимальне	10
Більше знати	0
Попередження (SmartMark)	143

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## Обсяг знаних відповідностей

Користувач повинен знати, який обсяг тесту на тривожність, який є частиною тесту на тривожність, який є частиною тесту на тривожність. Якщо ви не можете пройти тест, ви можете пройти тест на тривожність, який є частиною тесту на тривожність. Якщо ви не можете пройти тест, ви можете пройти тест на тривожність, який є частиною тесту на тривожність.

---

25.25%

10.71%

0.71

25

Завдання, для яких ви отримали відповідь 2

37.37%

10.71%

0.71

3737

Всього питань

1.50%

0.00%

0.00

23934

Всього питань

## Підбиття до списку запитів

Нижче наведено список запитів. Ви можете знайти в розділі «Відбиття до списку запитів». Якщо ви не можете знайти запит, ви можете знайти запит, який є частиною тесту на тривожність, який є частиною тесту на тривожність. Якщо ви не можете знайти запит, ви можете знайти запит, який є частиною тесту на тривожність, який є частиною тесту на тривожність.

10 відповідних фраз

Всього тесту

Applicant \_\_\_\_\_ <First name(s)> <LAST NAME>  
Signature

Supervisor  
 <Degree>, <Academic rank> \_\_\_\_\_ <First name(s)> <LAST NAME>  
 Signature

" " 202

## **APPENDIX F**

### **Abbreviations page sample**

#### **ABBREVIATIONS**

DOF	– Degrees of Freedom (the number of parameters of the system that may vary independently).
FEM	– Finite Element Method (a numerical method for solving problems of engineering and mathematical physics).
HTML	– Hypertext Markup Language (the standard markup language for creating web pages and web applications).
IT	– Information Technologies (the use of computers to store, retrieve, transmit, and manipulate data).
m-file	– MATLAB code file.
png	– Portable Network Graphic (a raster-graphics file-format that supports lossless data compression).

## APPENDIX G

### Tables formatting samples

Optimal values of the parameter  $\alpha^*$  and the corresponding number of iterations  $n^*$  are given in Table 2.1 for different  $E_B/E_F$  – the ratio of Young modulus of the subdomains. To compare we calculate the number of iterations  $n_g$  used by the gradient descent algorithm to solve the same problem.

Table 2.1 – Optimal values of the iteration parameter

$\frac{E_B}{E_F}$	<i>Problem A</i>			<i>Problem B</i>		
	$E^*$	$n^*$	$n_g$	$E^*$	$n^*$	$n_g$
0,125	0,70	6	4	0,60	8	8
0,250	0,50	9	6	0,42	12	10
0,500	0,35	14	8	0,27	18	14
1,000	0,23	20	12	0,16	32	24
2,000	0,13	40	18	0,08	62	42
4,000	0,07	70	32	0,04	116	72
8,000	0,04	124	54	0,02	194	142

Table 2.2 presents the values of the stress concentration coefficients, obtained with FEM ( $K_I^{FEM}$ ) and DDM ( $K_I^{DDM}$ ), compared to the analytical solution ( $K_I^A$ ).

Table 2.2 – Stress concentration coefficients

$K_I^A$	$K_I^{DDM}$	$K_I^{FEM}$
3,04	3,031	3,044

## APPENDIX H

### Figures formatting samples

Figures 3.1–3.2 illustrate numerical results with different sets of the obtained images can be combined into a whole using the coordinates obtained by cross-correlation.

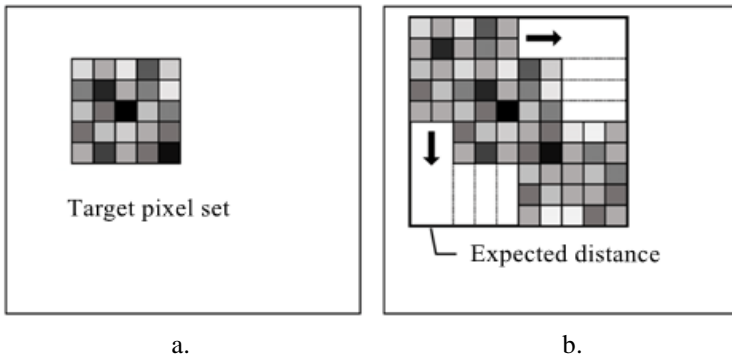


Figure 3.1 – Pixel-wise cross-correlation combined with image velocimetry method: a – initial image; b – deformed image

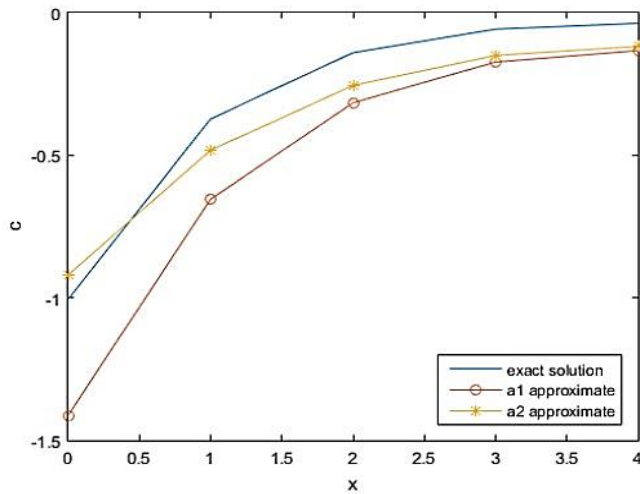


Figure 3.2 – Numerical results,  $q_1 = 1$ ,  $q_2 = 0$

At the data collection stage, the search server queries each access point for RSSI survey results as shown in Fig. 3.3.

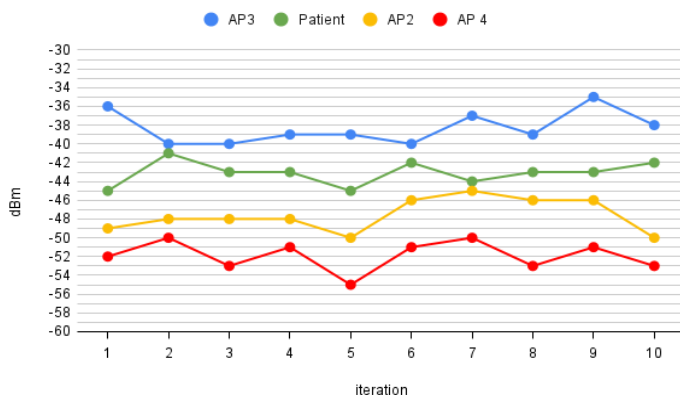


Figure 3.3 – Example of signals emitted from AP1, detected at AP2, AP3, and AP4 and Patient

The results, including the list of access points and their corresponding RSSI, are stored in a database (DB) on the server.

The STM32 board is shown in Fig. 3.4.

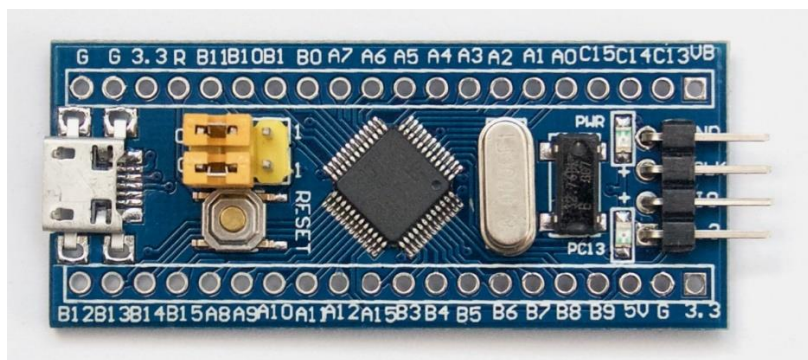


Figure 3.4 – Blue Pill Board [5]

## APPENDIX I

### Formulas formatting and reference to the source samples

The contrastive loss method, like the triplet loss method, is a distance-based function commonly used for training vector representations and often used in conjunction with the Siamese neural networks. The contrastive loss method can be described by equation (2.1):

$$L = \frac{1}{2N} \sum_{n=1}^N y d^2 + (1 - y) \max(\text{margin} - d, 0)^2, \quad (2.1)$$

where  $d$  is the Euclidean distance between two samples and is equal to  $\|a - b\|_2$ ;  $y$  corresponds to a match, where  $y = 0$  means that the two samples do not match; margin is a set threshold.

The loss function (2.1) was derived from the Jan LeCun function for dimensionality reduction by investigating an invariant mapping [12; 18; 24–28].

## **APPENDIX J**

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## **FOR NOTES**

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*Educational edition*

***Kateryna OBUKHOVA,  
Iryna ZHURAVSKA***

# **Guidelines for implementing the Master's Thesis for the applicants of the specialty 123 Computer Engineering**

*Methodological recommendations*

**Volume 448**

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