Khmelnytskyi National University

**BACHELOR THESIS**

*Guidelines for writing the paper for Bachelor students*

*majoring in 123 “Computer Engineering”*

*Approved by the department of Computer*

*Engineering and Information Systems*

*Record № 4 of 05.11.2021*

Khmelnytskyi 2021

Bachelor Thesis : Guidelines for writing the paper for Bachelor students majoring in 123 “Computer Engineering” / S. M. Lysenko, T. O. Hovorushchenko, O. S. Savenko, Ye. H. Hnatchuk. B. O. Savenko. Khmelnytskyi : KhNU, 2021. 69 p.

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The layout was made by the editorial and publishing department of Khmelnytskyi National University (Khmelnytskyi, 7/1 Instytutska Street). Approved for print 10.02.2021. Order № 34/20, print run 100 copies, 2021.

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**Introduction**

The certification of graduates for the Bachelor’s degree is carried out by the Examination Board (EB) after they have completed the educational program in order to establish the compliance of their level of knowledge and skills, other competencies with higher education standards. The basis for the certification of a person is the assessment of their level of learning outcomes and their compliance with the requirements of the level of the National Qualifications Framework and the standard content of the educational program of training in a particular major field.

***Bachelor thesis*** is a graduation paper performed in accordance with the educational standard and educational and professional program of bachelors for the purpose of public defense and obtaining a Bachelor’s degree.

While writing the qualification work the future engineer must not only consolidate theoretical knowledge but also gain skills of practical work in the “Computer Engineering” major, gain initial experience in the complex solution of problems of new development, modernization and operation of known software and hardware with the use of modern tools and information technology performing theoretical research of the object of design, justification of the choice of hardware, design of a software and hardware product and development of hardware and application software for various purposes.

Guidelines for writing the paper contain requirements for the volume, structure, content, design and defense of the qualification work, taking into account the peculiarities of the major and future professional activity of bachelors, forms of required documents, examples, samples, etc., as well as explanations and recommendations that give students technical and practical details for completing the qualification work and preparing for its defense.

When performing the thesis students should comply with the requirements for its design in accordance with state standards and regulations of Khmelnytskyi National University.

The authors hope that the present guidelines will help students work efficiently, avoid wasting time when preparing the thesis and help improve its quality.

**The Aim and Objectives of the Bachelor Thesis**

The Bachelor thesis summarizes students’ studies and characterizes their readiness to work in the field of “Computer Engineering”.

The ***aim*** of the Bachelor thesis is to confirm the student’s appropriate educational level, in particular, the ability to solve complex specialized problems or practical problems of computer engineering, characterized by complexity and uncertainty of conditions, using theories and methods of computer engineering .

In accordance with the aim of the Bachelor thesis the student is to solve one of the current practical problems in the field of computer engineering, as well as obtain a specific application result in the form of a complete and functionally suitable software and hardware product.

The main ***objectives*** of the Bachelor thesis are as follows:

- systematization, consolidation and expansion of theoretical knowledge and practical skills in the field;

- development of skills and abilities to conduct targeted search for information in print media and on the Internet;

- application of students’ acquired knowledge and skills in solving specific technical, engineering and production problems in the field of computer engineering;

- development of skills of independent work and mastering the technologies of developing the product at all stages of a life cycle (LC);

- mastering modern methods of designing mathematical, algorithmic software for various software and hardware products;

- development of skills of analytical, graphic and verbal presentation of the text, design of relevant textual, program and illustrative material in the form of project documentation, calculation and justification of decisions, as well as gaining experience in public defense of their development;

- assessment of the level of readiness of the student for independent professional activity in modern conditions.

Working on the Bachelor thesis students must confirm the basic professional competencies defined in the educational program of the major:

- ability to use modern methods and programming languages for the development of algorithmic and other software;

- ability to create system and application software for computer systems and networks;

- ability to ensure the protection of information processed in computer and cyberphysical systems and networks in order to implement the established information security policy;

- ability to use design automation tools and systems to develop components of computer systems and networks, Internet applications, cyberphysical systems, etc.;

- ability to design, implement and maintain computer systems and networks of various types and purposes;

- ability to use and implement new technologies, including smart, mobile, green and secure computing technologies, to participate in the modernization and reconstruction of computer systems and networks, various embedded and distributed applications, with the aim of increasing their efficiency among other tasks;

- readiness to participate in the implementation of computer systems and networks, their installation at facilities for various purposes;

- ability to systematically administer, use, adapt and operate existing information technologies and systems;

- ability to organize workplaces, their technical equipment, placement of computer equipment, use of organizational, technical, algorithmic and other methods and means of information protection;

- ability to present the obtained work results in the form of presentations, scientific and technical reports;

- ability to identify, classify and describe the work of the product, computer and cyberphysical systems, networks and their components using analytical methods and modeling methods;

- ability to solve problems in the field of computer and information technologies, to determine the limitations of these technologies;

- the ability to design systems and their components taking into account all aspects of their life cycle and tasks, including the creation, configuration, operation, maintenance and disposal;

- the ability to justify the choice of methods for solving specialized problems, to critically evaluate the results, to justify and defend the decisions made.

When defending the Bachelor thesis before the examination board, students must show the depth of knowledge, skills and abilities in the process of designing and developing the product as well as the ability to apply them in practical technical, engineering, production tasks in various fields of human activities, with the optimal choice of methods and technologies of computer engineering.

Based on the results of the defense of the Bachelor thesis, the examination board determines the level of theoretical and practical training of the graduate, his / her readiness for independent work in the field and decides on assigning him / her the appropriate educational level and issuing a Bachelor’s degree.

The student who is the author of the Bachelor thesis is responsible for all the information presented in the paper, the use of factual material and other information when working on the Bachelor thesis, the validity and reliability of conclusions and statements.

**2 Bachelor Thesis Work Organization**

The academic process for students of the educational level “bachelor” ends with the graduation work, which is submitted in the form of Bachelor thesis. According to the curriculum of the major the Bachelor thesis is performed in two stages: 1) preparation; 2) defense (including preliminary defense).

The process of writing the Bachelor thesis roughly consists of the following (Table 2.1).

Table 2.1 – Bachelor thesis preparation stages

| Content of the stage | Date due |
| --- | --- |
| 1 Selection and approval of the topic of the Bachelor thesis;  development of tasks for the paper; drafting calendar schedule of the paper | January |
| 2 Study of the subject area in which it is planned to use the product; analysis of the product requirements | January–February |
| 3 Design and development of general architecture and structure of the product, user interface;  the choice of tools for the implementation of the product | February–March |
| 4 Implementation and testing of the product | April |
| 5 Writing the text of the explanatory note and development of graphic materials | May |
| 6 Final editting of the Bachelor thesis taking into account the scientific supervisor’s remarks; laying out the thesis as a document in accordance with the requirements |
| 7 Receiving accompanying documents (supervisor’s review report, reviews, plagiarism certificate); quality control | June |
| 8 Preparation for defense and defense of the Bachelor thesis |

Bachelor thesis is performed by the student independently under the supervision of the scientific advisor. The thesis is supervised by the leading lecturers of the Department of Computer Engineering and System Programming who are appointed by the department and approved by the order of the rector.

The ***student*** is to do the following when working on the thesis:

- choose and discuss the topic with the supervisor and get the task;

- adhere to the schedule;

- regularly attend consultations with the supervisor;

- pass the procedure of preliminary defense at the department;

- present the work in accordance with the requirements;

- defend the work at the EB meeting in accordance with the schedule.

The student ***has the right*** to receive consultations at any period of working on the thesis; to use all the necessary scientific and methodological materials available at the department.

The ***supervisor*** of the Bachelor thesis is to:

- advise students on various issues (choice of topic, development of a design plan, selection of bibliography and other sources, implementation and design of the project, preparation of the work for the defense, etc.);

- determine deadlines for the stages of work;

- schedule consultations and adhere to it;

- monitor the progress and status of work;

- periodically provide information on the implementation of the individual student’s work schedule to the head of the department;

- inform of the implementation of the calendar plan by students at the meetings of the department;

- check the qualification work and evaluate it;

- provide assistance to the student in the preparation for the defense of the thesis.

The ***supervisor has the right*** to submit a proposal to the rector approved by the decision of the department to expel the student as not fulfilling the curriculum in case of violation of the deadlines for the thesis, low quality or non-independent project implementation.

The ***head of the department*** is to:

- organize methodical and information support for the Bachelor thesis;

- monitor the implementation of the schedule of consultations;

- discuss the state of work performance at the meetings of the department;

- resolve contradictory issues that arise between the supervisor and the graduate;

- control the objectivity of performance evaluation;

- issue admittance to the defense.

The head of the department ***has the right*** not to give admittance to the graduate to defend the Bachelor thesis if the qualification paper does not meet the established requirements.

General control over the course of Bachelor thesis is carried out by the graduate department.

**3 Topics for the Bachelor Thesis**

The topics of the Bachelor thesis should be focused on research and development of the product for various subject areas: enterprises, firms and companies in various areas of entrepreneurial activity, educational institutions, services and entertainment, etc.

The topics of the Bachelor thesis must meet the following requirements:

- compliance with the current state of development of science, technology, methods and tools for the prodcut development; topicality; practicality;

- compliance of the object of study with the bachelor’s major;

- complexity, which is sufficient to demonstrate theoretical knowledge and practical skills acquired during education.

Thus, the subject of the Bachelor thesis should correspond to the ***object of the graduate’s professional activity***:

- software and hardware (hardware, programmable, reconfigurable, system and application software) of computers and computer systems of universal and special purposes, including stationary, mobile, embedded, distributed, etc., local, global computer networks and the Internet, cyberphysical systems, the Internet of Things, IT infrastructures, interfaces and protocols of interaction of their components;

- information processes, technologies, tools, methods and systems of automated and automatic design; adjustment, production and operation, design documentation, standards, procedures and means of life cycle management support of the specified software and hardware;

- tools and ways of information processing, mathematical models of computational processes, computational technologies, including high-performance, parallel, distributed, mobile, web-based and cloud-based, green (energy efficient), safe, autonomous, adaptive, intelligent, smart, etc., architecture and organization of operation of relevant software and hardware.

The wording of the topic of the qualification work should be specific, contain the procedure of the activity and the product that will be obtained as a result of the Bachelor paper. In the title of the topic one should avoid formulations that start with the words *Design and development ..., Research of some ways ..., Analysis ...* etc., in which the essence of the problem is not sufficiently reflected and the final outcome of the paper is not defined.

***Example***

| Wrong: | *Design and development of a system of automated counting of the number of people in the room in VHDL* |
| --- | --- |
|  |  |
| Correct: | *System of automated counting of the number of people in the room in VHDL* |

There should be no shortenings of words (phrases) and abbreviations (except for the generally accepted ones) in the title of the topic of the paper. The work is performed individually by one graduate student and it is a complete and and independent product.

The topic of the qualification work can be implemented by several students (***a complex Bachelor thesis***), but each student must have a completed part within the topic. Complex qualification works are devoted to the development of two or more interdependent tasks united by a single goal. The title of the topic of such a qualifying work consists of two sentences: ***General topic. The theme of the student’s qualification work.***

***Example*** (performed by two students)

*Remote control system of the security system of the enterprise. Server part*

*Remote control system of the security system of the enterprise. Customer part*

For students who combine study with work it is recommended to perform the thesis on the materials of the company they work for.

According to the educational program students are advised to focus on the following ***typical areas of work***: computer systems; computer devices; system programming; computer networks; specialized computer systems;

***Examples of typical topics of Bachelor thesis***.

1. The system of remote control of the enterprise security system in the VHDL language.

2. System of automated counting of the number of people in the room in VHDL.

3. Intelligent system of control and management of a “smart” living space.

4. Intelligent control and management system of a “smart”office.

5. Intelligent system of control and management of a “smart” hospital.

6. Intelligent system of control and management of a “smart”museum.

7. Intelligent control and management system of a “smart” farm.

8. Local area network for the enterprise.

9. Synthesis of the Mill automaton given by tables of transitions and outputs.

10. Synthesis of the Moore automaton given by tables of transitions and outputs.

11. Operating device for calculating the product of odd elements of a two-dimensional array.

12. Operating machine for calculating the number of negative elements.

13. Scheme of a 16-bit accumulative adder based on a combination adder for calculating a given number of addends.

14. Scheme of the algebraic addition of integers on basic modules using inverse codes.

15. Scheme of the alignment of orders device for adding numbers with a floating point.

16. Scheme of the firmware control module for the implementation of the operation of division of integers.

The topics of the qualification work are developed by the Department of Computer Engineering and Systems Programming by the beginning of the eighth semester. The student also has the right to propose his / her own topic with the substantiation of the expediency of its development and in agreement with the supervisor of the qualification work. Topics of work are approved by the order of the rector at the request of the head of the department.

**4 Structure and Content of the Bachelor Thesis**

**4.1 General Requirements**

The Bachelor thesis includes an explanatory note, a graphic part and a developed product.

***The explanatory note*** is a text document that provides a rationale, calculation and description of the analytical, design and software decisions made in the research work. It should reveal the creative idea of the work, methods, software and hardware and technologies for creating the product, used algorithms and technologies for solving the problem, description of the product implementation, experiments (testing of the product ), their analysis and conclusions, etc. and, if necessary, accompanied by tables, illustrations, graphs, diagrams, etc.

The note should consist of the following structural elements:

- title page (Appendix A);

- tasks for the Bachelor thesis (Appendix B);

- abstract;

- list of documents;

- contents;

- abbreviations and symbols (if necessary);

- introduction;

- main part;

- conclusions;

- list of reference sources;

- appendices.

***The explanatory note*** should have a total volume of 55 pages (without appendices). The number of appendices is not regulated.

***The graphic part*** of the qualification work includes drawings, schemes, algorithms, models, etc., which are necessary for the student during the defense of the qualification work. The composition of the graphic material and its volume is agreed with the supervisor for each graduate individually in accordance with the theme of the Bachelor thesis and must correspond to the content of the work.

The graphic part is performed as a mandatory appendix to the explanatory note in the form of presentation slides and is presented by multimedia means.

In coordination with the supervisor of the qualification work, the graphic part may also contain posters of A1 or A2 size sheets. The content of the illustrative material should sufficiently reflect the main provisions of the qualifying work that are submitted for defense.

**4.2 Title Page**

The title page is the first page of the explanatory note. It contains data that is presented in the following sequence:

- name of the university, faculty and department;

- title of the document (in capital letters);

- document code;

- signatures of the document developer and responsible persons;

- year of the document creation.

The code is formed in accordance with DSTU GOST (National Standards of Ukraine All-Union State Standard) 2.201-80 (Figure 4.1):

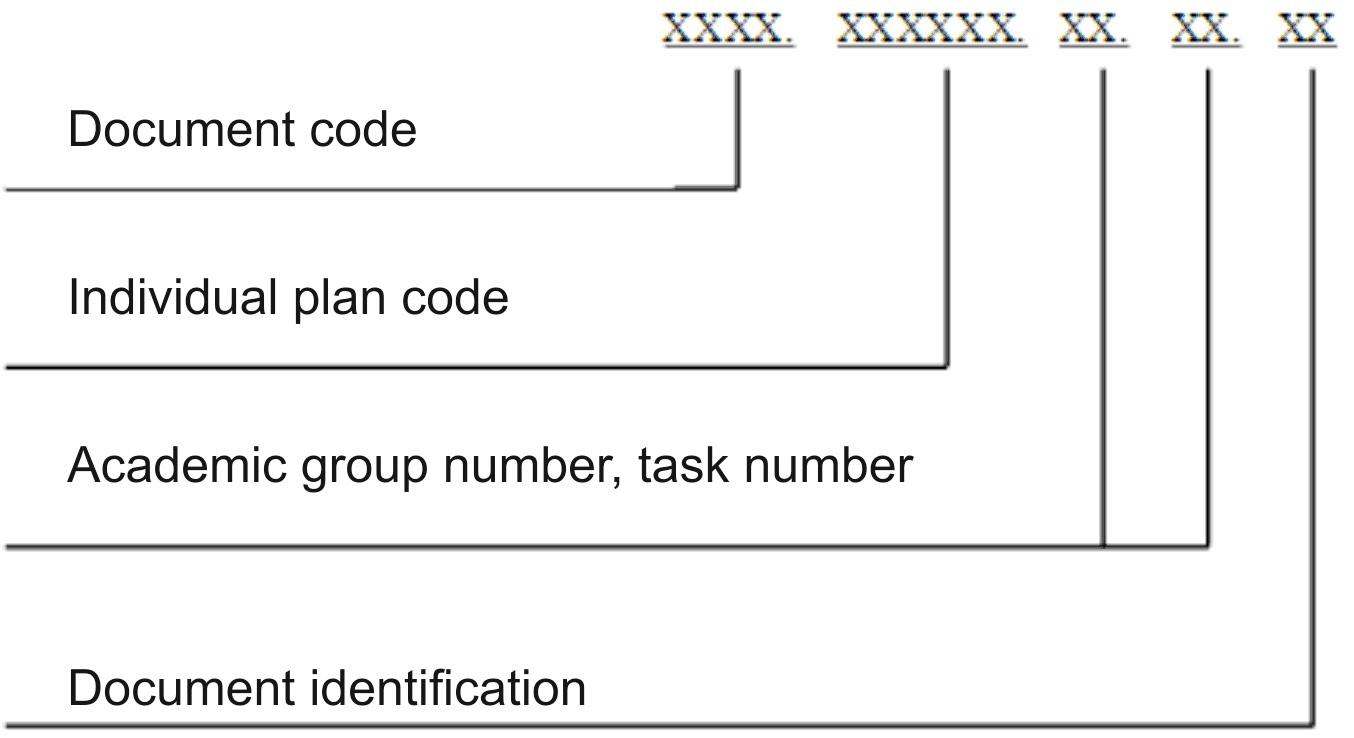


Figure 4.1 – The order of code making for the Bachelor thesis

***Example***

BPCE.013542.02.13.PZ

The template of the title page is given in Appendix A.

**4.3 Task for the Bachelor Thesis**

The task is the source document for the Bachelor thesis. This document is made by the supervisor in accordance with the chosen topic and issued to the student. The tasks are signed by the supervisor and the graduate student. The head of the department approves the task.

The task for the qualifying work is printed on both sides of A4 sheet or issued on a standard form.

The template of the task for the Bachelor thesis is given in Appendix B.

**4.4 Abstract**

The abstract provides a brief description of the main aspects of the qualification work and it should contain: the topic; last name, first name, patronymic name of the author; last name, first name, patronymic name of the supervisor; the number of pages of the explanatory note and graphic part, the number of figures, tables, appendices, sources according to the list of references; list of keywords; a brief description of the work performed; the author’s signature and date of submission of the thesis for defense.

Keywords are given in capital letters in a line with the direct alphabetic order of words in the nominative singular and separated by commas.

The main text of the abstract should describe the purpose of the thesis, methods and tools of computer engineering used to achieve the aim, brief information about the results, their practical significance, degree of implementation and scope, as well as conclusions and suggestions for further development. The size of the abstract is up to 500 words, it should be written on a separate A4 sheet. A sample annotation is given in Appendix C.

**4.5 List of Documents**

The list gives the number of materials of the thesis and enumerates them.

**4.6 Contents**

The table of contents includes “List of abbreviations” (if any), “Introduction”, numbers and titles of all sections, subsections and paragraphs of the explanatory note, “Conclusions”, “List of reference sources”, appendices, indicating the page numbers that contain the beginning of the structural element.

**4.7 Abbreviations and Symbols**

This structural element is optional. It should only be used if there are more than five abbreviations in the explanatory note and the section is usually called “List of abbreviations”. It should be arranged in a column in alphabetical order: on the left the abbreviations are given first in English / Ukrainian, then in other languages (if available), and on the right – their full forms.

An example of a list of abbreviations is given in Appendix D.

**4.8 Introduction**

The introduction highlights the main trends and the state of the subject area; it outlines the problem that the Bachelor paper is aimed at solving and the tasks that need to be solved. It presents the current state of a specific task of computer engineeringwhich is solved in the work and its relevance. In addition, a justification for the need to solve the problem, scope and purpose of development should be provided.

The ***topicality*** of the problem is the importance, essentiality, compliance of the topic of the qualification work with the modern needs of a certain industry and the prospects of its development, the practical tasks of the relevant field of activity.

The topicality can be determined by the objective need for creating a new product, the modernization of the product in specific subject areas, the commercial attractiveness of the results of the qualification work, etc.

The introduction also formulates the ***aim and objectives*** of the qualification work. The formulation of the aim should logically follow from the substantiation of the relevance of the topic of the work and reflect the final design result. Therefore, the formulation of the aim should reflect what the developed automation system is needed for, for example, ***“Develop software and hardware… that enables to increase efficiency” or “Create computer technology… that reduces computational complexity of...” or “Develop a system to support decision-making in ...”***.

Achieving this aim is carried out by detailing it with the help of a systematized plan of purposeful actions – objectives (tasks) of the qualification work.

It is recommended to formulate the tasks as follows: ***“to carry out analysis…”, “to establish the features of the subject area...”, “to analyze...”, “to identify...”, “to determine the dependencies...”, “to develop (a system, models, algorithms...)”, “to perform software and hardware implementation...”, “to test...”, etc.***

When defining objectives, keep in mind that none of them can repeat the aim or be wider than it. The aim is achieved through the solution of tasks, and therefore each of them must advance the research to the intended goal. As a result, the outcome obtained from solving all problems must meet the goal.

The general purpose of the introduction is to focus the reader’s attention on the indicated area of computer engineering. Approximate volume is 2-3 pages.

A sample of the “Introduction” section is given in Appendix E.

**4.9 Main Part**

Regardless of the topic of the Bachelor paper the main part of the explanatory note should reflect the main processes of the life cycle of the software and hardware product: analysis, design, implementation and testing. This part should reflect the stages of the product development and contain information on the subject area, architecture and structure of the product, selected tools and features of implementation and testing of the product, necessary conditions and features of its application, etc. The approximate total volume of the main part of the explanatory note is 55–65 pages.

According to the main LC processes, this part of the explanatory note should include the following three sections:

***1 Research of the subject area and problem statement***

***2 Development of the product***

***3 The product implementation and testing of the developed product***

Structuring of each section is carried out by sections / units / sub-units and is agreed with the supervisor.

The structure and content of Part “1 Subject area research and problem statement” are typical for any topic of the qualification work. The section should analyze the situation in the organizational, technical and software peculiarities of the selected subject area, analyze the literature and Internet sources, make a list of practical tasks to be performed during the qualification work, i.e. make a detailed problem statement. The structure of this section can be as follows:

***1.1 Thorough analysis of the subject area, its structural and functional features***

***1.2 Analysis of available software and hardware in the subject area***

***1.3 Defining requirements for the automation system and development of the technical requirement specifications***

Subsection ***“1.1 Content analysis of the subject area, its structural and functional features”*** should review and describe the subject area for which the development of the product is made.

The study of the subject area is carried out to identify problems and unresolved issues in terms of implementation of the product, information processes, technologies, methods, techniques and systems of automated and automatic design, methods and techniques of information processing, mathematical models of computational processes, computing technologies, etc. . Based on the results of the analysis of the subject area the student describes the problem that will be solved with the help of the proposed software and hardware.

Subsection ***“1.2 Analysis of the available software and hardware of the subject area”*** should provide analysis of software and hardware that are already used in the subject area and are related to the topic of the qualification work. The purpose of this review is to study the experience of leading companies-developers of automation systems and the use of their solutions in the performance of the task. This will contribute to the fact that the product developed in the work will meet the modern needs of the market.

Analysis for each product should reveal the purpose of the product; the name of the developer; human-machine interfaces; advantages and disadvantages, etc. The list of disadvantages and advantages of products should be summarized in a comparative table. Knowing these features for similar software and hardware, you should logically choose from them the closest to those that need to be implemented.

Subsection ***“1.3 Analysis of requirements for the product and development of the technical requirement specifications"*** should define and describe the requirements for the product under development based on the analysis of the subject area. It is recommended to list only basic requirements necessary for understanding the problem. A detailed statement of the requirements for automation systems should be made in the form of a document “Technical requirement specifications” (TRS) which is included in the Appendix. An example of the TRS (DSTU GOST 19.201-78) is given in Appendix F. The section should end with brief conclusions.

***Example***

*The analysis of the existing software and hardware of the subject area has been carried out, as a result of which it is defined...;*

*Functional and non-functional requirements for the product have been identified....*

***The estimated volume of section 1 should not exceed 30%*** of the total volume of the main body of the explanatory note.

Part 2 ***“Development of the product”***. After analyzing the subject area and determining the requirements for the product, you need to explore possible ways of solving the tasks. In other words, if in the process of analysis it is necessary to answer the question: “What should the product do?” the design stage will answer the question: “How to implement it?”

During the development of the project, design solutions are substantiated, which enables implementing the requirements of the technical specifications and ensuring the compatibility and interaction of various components of the product, etc. The real system models obtained at the analysis stage are expanded and adjusted in this section so that they can be implemented in hardware or software.

The design of the product usually consists of the following stages: ***sketch project*** (architectural design); ***technical design*** (detailed design).

The main tasks of developing the structure of the product:

- singling out hardware or software subsystems and displaying external functions of the product on them;

- identifying ways of interaction between subsystems.

Depending on the type of structure, the product may be split into levels that will further require additional descriptions during decomposition and design.

The design of the product structure is crowned up with a description which reflects the fixed design solutions, logical and physical structure of the system as well as ways of interaction of objects.

After designing the system structure and defining the principles of structure management you can immediately perform the decomposition of subsystems on the module. In fact, this work can be considered an introduction to detailed design which specifies the structural solutions. The decomposition task is the task of determining the internal content of each subsystem (component). The result of its solution is the formation of the structure of the subsystem – a set of modules and the relations of their interaction.

Taking into account the decisions made at this stage, further detailing of functional specifications is carried out: the structure of the product, object model, logical and physical models of databases, key methods and algorithms, design of human-machine user interface, etc.

When developing the structure of the automation system it is necessary to do the following:

- identify the main modules and information resources (and justify this choice) that the product consists of;

- describe the functional purpose of the main modules and information resources, their relations as well as data exchange.

The development of the structure of the product can be based on some design template.

The project of the human-machine interface includes:

- elements of the human-machine interface necessary for performance of functions;

- connection of interface elements with each other;

- application of interface elements, etc.

The description of the human-machine user interface should be accompanied by diagrams of screen forms, menu systems, dialogs, etc.

This section also analyzes the methods of computer engineering for the implementation of the product, indicating the advantages and disadvantages in the context of their use for the project. As a result of the analysis the optimum variant is defined.

At the end of the section you should make brief conclusions.

The approximate volume of the section is 2–40% of the total volume of the main part of the explanatory note.

Part 3 ***“The product implementation and testing of the product”.*** Implementation of the product involves the creation of a workable and functionally suitable product on the basis of the developed project. This section addresses issues directly related to the design of the product, namely:

- description of the product modules (with specific names) and their purpose, as well as features of data transfer between them;

- description of the implementation of modules of hardware or software of the product;

- description of the process of creating a database[[1]](#footnote-0)\* (with necessary illustrations);

- description of functional, electrical, basic schemes;

- description of the implementation of the human-machine interface;

- instructions for users (with relevant illustrations) which present information about the principles and conditions of the product use, a description of the human-machine user interface, the sequence of actions of the operator when working with the product, conditions necessary for using software and hardware means, etc.);

- technical characteristics of the developed product (requirements for the hardware and operating system (OS); necessary RAM and disk memory; special devices; additional programs required for the operation of the product, etc.).

Conclusions should be drawn at the end of the section.

The third part should contain a study aimed at proving the efficiency of the developed product and its compliance with the technical requirement specifications (i.e. functional suitability). The section should define the testing strategy, describe and justify the selected testing methods and techniques (black and white box methods, functional and non-functional testing, performance testing, load testing, data level testing, usability testing, etc.), formulate requirements for conducting experiments, determine the scope of each experiment in accordance with functional specifications and restrictions, etc. The ultimate goal is to compare the expected and actual test results.

If necessary, specify the levels of testing – modular, integration and system testing.

The section may also contain a description of the tools used for automated testing.

Test cases must be in real time and be sufficient to verify the operability and correct operation of the product. Accordingly, each element of the product should have a list of all situations that need to be checked for both “correct” and “incorrect” source data. The data used in the testing of the product should be described in detail, indicating the source of their input. Data from primary documents, normative and reference documentation, as well as data generated automatically can be used.

The expected results always describe the correct operation of the product, and it may well involve the display of messages about incorrect actions of the operator or about some critical situations.

The section should also indicate the order of testing, provide verification procedures indicating the expected results in the proper operation of the product as well as description of the main results obtained after the product testing.

After completing the test cases, a report on the test results is made and it contains information on each completed test case and the result of its execution – success or failure. The record of the result of passing each test case contains the following information: its identifier; brief description; listing of all input and expected output values of the test case; listing of all real initial values of the test case; for each pair “expected and actual initial value” – information about the coincidence or discrepancy of these values; notification of whether or not a test case has been passed.

For more clarity, the final test data should be presented in the form of tables and graphs.

Note. Based on the test results, you can create a document “Test Report” and include it in the Appendix section.

At the end of the third part students provide brief conclusions about the test results, as well as the degree of the product efficiency and its compliance (non-compliance, partial compliance) with the requirements of the technical requirement specifications:

***Example***

*As a result of experiments... it was found that...;*

*The basic functionality is implemented in accordance with the requirements for the product and is fully / partially operational;*

*There are some issues with... but they are not critical.*

***The approximate volume of the section is 3–40%*** of the total volume of the main part of the explanatory note.

**4.10 Conclusions**

This structural element is the final result of the qualification work and should contain summary of the work performed. It provides a description of the methods and tools used to achieve the aim; a description of the work performed to solve the tasks (all steps are described in their relationship, in compliance with the sequence of their implementation and how they determine the results obtained at each stage of work); the results obtained; a general conclusion based on the design results.

It is also advisable to say what benefits the implementation of the developed product will give to users (for example, it will save time, save human and financial resources, increase management efficiency, speed up and improve the quality of customer service, etc.). It is also worth noting in which other practical areas it is advisable to use the developed product, present the results of implementation if there are such (implementation acts, abstracts of reports at conferences, etc.), as well as foresee possible areas for further work.

All materials should be summarized as a result of the work performed as well as meet the defined objectives of the qualification work.

The results can be formulated on the basis of the conclusions drawn at the end of each section, but they should not be confused with a mechanical summary of these conclusions.

The total volume of “Conclusions” is 2-4 pages.

**4.11 List of References**

The structural element “List of references” should contain a list of sources used in the qualification work. Such sources can include books, periodicals (journals), regulatory and technical documents (standards, patents, catalogs), electronic resources and more. This structural element shall not include Wikipedia, Studopedia pages, websites with abstracts and other similar resources.

The main text should have references to all sources, so the list of sources is arranged in the order of references to them.

**4.12 Appendices**

The appendices contain material that illustrates or supplements the main text of the document (drawings, large format tables, descriptions of algorithms, program listings, automation system testing protocols, implementation acts and other materials that help to reveal the idea and ways of carrying out the work).

The appendices can have the following status: obligatory; reference.

The ***reference*** appendix provides background information (initial data for the project, forms of documents, etc.).

The ***obligatory*** appendix provides certain provisions to avoid overloading the main text (technical requirement specifications, models and algorithms, program listings, presentation materials, etc.).

The main text of the document should have references to all appendices, so the appendices are arranged in the order of reference to them.

All appendices must be listed in the table of contents with their designations and names (the status of the appendix does not need to be indicated).

**5 Layout Requirements**

**5.1 Main Requirements to the Explanatory Note**

The general requirements for the explanatory note are the logical sequence of the material, the clarity and specificity of the development results, the essence of the task and the purpose of the qualification work, research methods, decisions, validity of conclusions and so on. The text should not be overloaded with uninformative material, descriptions of well-known methods. The text of the explanatory note should be concise, clear and well edited.

The following words and phrases should be used in the text when speaking of requirements: “must”, “it follows”, “it is necessary”, “it is required”, “it is only allowed”, “it is not allowed”, “it is prohibited”, etc. When stating other provisions, words such as “maybe”, “as a rule”, “if necessary”, etc. should be used. It is allowed to use the narrative form of presentation of the text using the following words: “apply”, “consider”, “recommend”. In the explanatory note it is not recommended to present the material from the first person singular: “I have identified...”, “I believe...”, “I think...”, “In my opinion...”, etc., the text should use impersonal forms.

The text is presented in accordance with the norms of the modernspelling and vocabulary, using the style of official speech, suitable for official documents. The text should use the terms, symbols and definitions established by current standards, and in case of their absence there should be generally accepted words in the scientific and technical literature. It is also not desirable to use foreign words and terms if there are equivalent words and terms in the language the work is written in.

The text of the document should have numbers spelled instead of their numeral expression (for example, “four signs” but “3 MHz”); numbers 10, 11, ... are written in numbers.

In the text of the document it is not allowed to use the following symbols (except for formulas, tables and figures):

- symbol “∅” as a symbol of diameter (you must write the word “diameter”); when indicating the size or marginal deviations of the diameter in the figures its numerical value must be preceded by the sign “∅”;

- mathematical signs without numerical values for example: “>” (more), “<” (less), “=” (equal to), “≥” (more or equal to), “≤” (less than or equal to), “≠” (not equal to), as well as “№” (number), “%” (percent) and “°C” (degrees Celsius);

- mathematical sign “minus” (−) before a negative value (you must write the word “minus”).

When stating the permissible values of deviations from norms and requirements, the phrases “should not be greater than”, “less than”, “should not exceed” should be used.

When giving the largest or smallest values you should use the phrase “should be no more than”, “not less than”.

It is allowed to use the following elements in the text of the document:

- common shortenings: min. – minimal; max. – maximum, etc.;

- shortenings: abs. – absolute; p. – page; UAH – hryvnia and other abbreviations used with numerical values.

If the text adopts a special system of shortenings or abbreviations of words or names, the list of used abbreviations should be given after the contents in the structural element “List of abbreviations”.

**5.2 Requirements to the Layout of the Main Body of the Text**

Requirements for Bachelor thesis are regulated by state standards of Ukraine and university regulations.

The explanatory note of the qualification work should be made on A4 sheets (210 mm × 297 mm) using forms 9 and 9a of the standard DSTU GOST 2.106-96. If necessary, you can use A3 sheets (297 mm × 297 mm). Title blocks should be made according to DSTU GOST 2.104:2006 (f.2 for “List of documents’ and “Contents”, f.2a for other pages).

***Note***. The title page, tasks for the paper, abstract and appendices are made on ordinary A4 sheets (without the title blocks).

For blocks the distance from the frame to the borders of the text at the beginning and end of the lines should be at least 3 mm (5 mm is recommended). The distance from the top or bottom line of the text to the top or bottom frame should be at least 10 mm (10 mm is recommended).

The distances of the block frame to the edges of the sheet should be as follows: from the left edge – not less than 20 mm, from the right, top and bottom – 5 mm.

The following page margins are recommended for the title page, abstract and appendices: top and bottom – 20 mm, left – not less than 20 mm, right – 10 mm; for the task of the paper – all margins of 20 mm.

It is also recommended to comply with the following requirements: main font – Times New Roman; font typeface – normal (except for the names of structural elements and section headings); font size – 14 pt; font color – black; line spacing – 1.5 (one and a half intervals); alignment of the main text – full justification; paragraph indentation – 1.25 cm.

It is not allowed to place only one word in the last line of the paragraph. If this is the case, the paragraph text should be reorganized accordingly or a condensed space between characters should be used (but not more than 0.2 pt).

**5.3 Page Numbering of the Explanatory Note**

The pages of the explanatory note are numbered in ***Arabic numerals*** (without a period at the end), following the continuous numbering throughout the document, including appendices. In the blocks, the page number is placed in the frame on the right in the ***Sheet*** field.

For appendices, the numbering continues, but the page number is placed in ***the header on the right***.

The title page is included in the general numbering of pages (with number 1), but the page number is not put on it.

“Tasks for the diploma project” (with number 2) and “Abstract” (with number 3) are also included in the general numbering of pages of the document, but the page number is not put on them.

“List of documents” is written on form 9 DSTU GOST 2.106-96, while the title blocks are made according to the requirements of DSTU GOST 2.104: 2006 (f. 2). “List of documents” is a separate document that is not included in the total number of pages of the explanatory note, has number 1, which is put in the box on the right in the field ***Sheet***. The total number of “List of documents” pages (usually 1) is also entered in the Sheets field.

A sample template “List of documents” is given in Appendix H.

“Contents” is performed on f. 9 and 9a GOST 2.106-96, while the title blocks are made in accordance with the requirements of the standard DSTU GOST 2.104: 2006 – f. 2 for the first page of the “Contents”, f. 2a (with a “small” title block) – for the next page of the “Contents” (if any), as well as for subsequent pages.

The table of contents is included in the total number of pages of the document. The first page of contents has the page number (number 4 in the field ***Sheets***) in the frame on the right put as well as the total number of pages of the explanatory note (in the field ***Sheets***).

Examples of contents and template f. 2a (for the following pages) are given in Appendices I and J respectively.

**5.4 Requirements to the Text Presentation**

***5.4.1 Text Division***

The text of the document, depending on its content, is divided into parts, sections, subsections, paragraphs numbered in Arabic numerals: parts – within the entire document, sections – within each part, subsections – within the section, paragraphs – within the subsection. Each part starts from a new page. The section number is written without a period at the end.

The section number must consist of a part number, full stop and a section number; do not put a full stop at the end of the number. For example, 2.1 is the first section of the second part.

Subsections are numbered in Arabic numerals within each section. The subsection number must consist of the part, section, subsection numbers separated by periods (but without a period at the end). For example, 2.1.3 is the third subsection of the first section of the second part.

The structural elements “Abstract”, “List of Documents”, “Table of Contents”, “List of Abbreviations”, “Introduction”, “Conclusions”, “List of Reference Sources” are not numbered.

Headings of structural elements and parts should be written in **CAPITAL LETTERS** in bold without a full stop at the end. It is possible to place them in the middle of the line (in this case – without a paragraph indent).

Headings of sections, subsetions and paragraphs should be written with a paragraph indentation in capital letters without a full stop at the end. You can’t break words with a hyphen in any title.

The space between the heading and subsequent or previous text must be at least ***double-spaced***. There is ***no special spacing*** between the lines of the heading and between two headings, it is the same as in the body of the text.

You cannot place the heading of a part / section / subsection at the bottom of the page if there are fewer than two lines of text after the heading. If this is the case, it is allowed (within individual pages) to change the line spacing, but not more than 0.02 (recommended multiplier values are from 1.48 to 1.52).

***5.4.2 Lists***

Lists can be used within parts / sections / subsections. The items on the list are in the form of one sentence.

If the list has one level of subordination then each item is preceded by a sign “-“ (“dash”). If there is more than one level of subordination, the first level is marked by small letters, the second level – by Arabic numerals, the third level – by “-“. A parenthesis is used after the number or letter of the list.

The text of each item in the list should begin with a paragraph indent relative to the previous level of subordination and end with the symbol “;”. The positions of the list of the first level of subordination begin with a paragraph indent relative to the main text. Put a colon at the end of the text (or the position of the list of the previous level) before the list. At the end of the last position of the list put a full stop.

Each position of the list should start with a lowercase letter (except when the list begins with a word, which, according to the rules of spelling, should be written with a capital letter).

The general format of a list is given in Figure 5.1.

1. first level items:
2. second level items:

* third level items;
* third level items;
* …

1. second level items;
2. first level items:
3. second level items;
4. second level items;
5. second level items;
6. first level items.

Figure 5.1 – General format of a list

***Example***

***– one-level list***

*The following items must be present in the program description:*

*- general provisions;*

*- functional purpose;*

*- description of the logical structure;*

*- technical means used;*

*- input and output data;*

*- instructions for use.*

***– multi-level list***

*The following items must be present in the program description:*

*а*) *general provisions*:

*1*) *development tools*;

*2*) *design languages*:

*– programming languages*;

*– markup languages*;

*б*) *functional purpose*;

*в*) *description of the logical structure*;

*г*) *technical means used*;

*д*) *input and output data*;

*е*) *instructions for use*:

*1*) *for system administrator;*

*2*) *for users*.

***5.4.3 Formulas and Equations***

Formulaa are included in the sentence as its part, so there are punctuattion marks used in accordance with the rules of punctuation. Small formulas that have no independent meaning and are not referenced in the text go in the lines of text. More complex formulas are placed on separate lines in the center. There should be ***one blank space*** above and below each formula (equation).

It is recommended to use the formula editor (Microsoft Equation 3.0 or MathType) to write formulas and equations.

The main parameters of the formulas:

- style – mathematical;

- font – Times New Roman, straight, 14 pt (exceptions: for the variables – *italics*; for the matrix-vector – straight **bold**);

- large index – 9 pt;

- usual index – 7 pt;

- large symbol (for example, symbols of sum, product) – 18 pt;

- regular symbol – 14 pt.

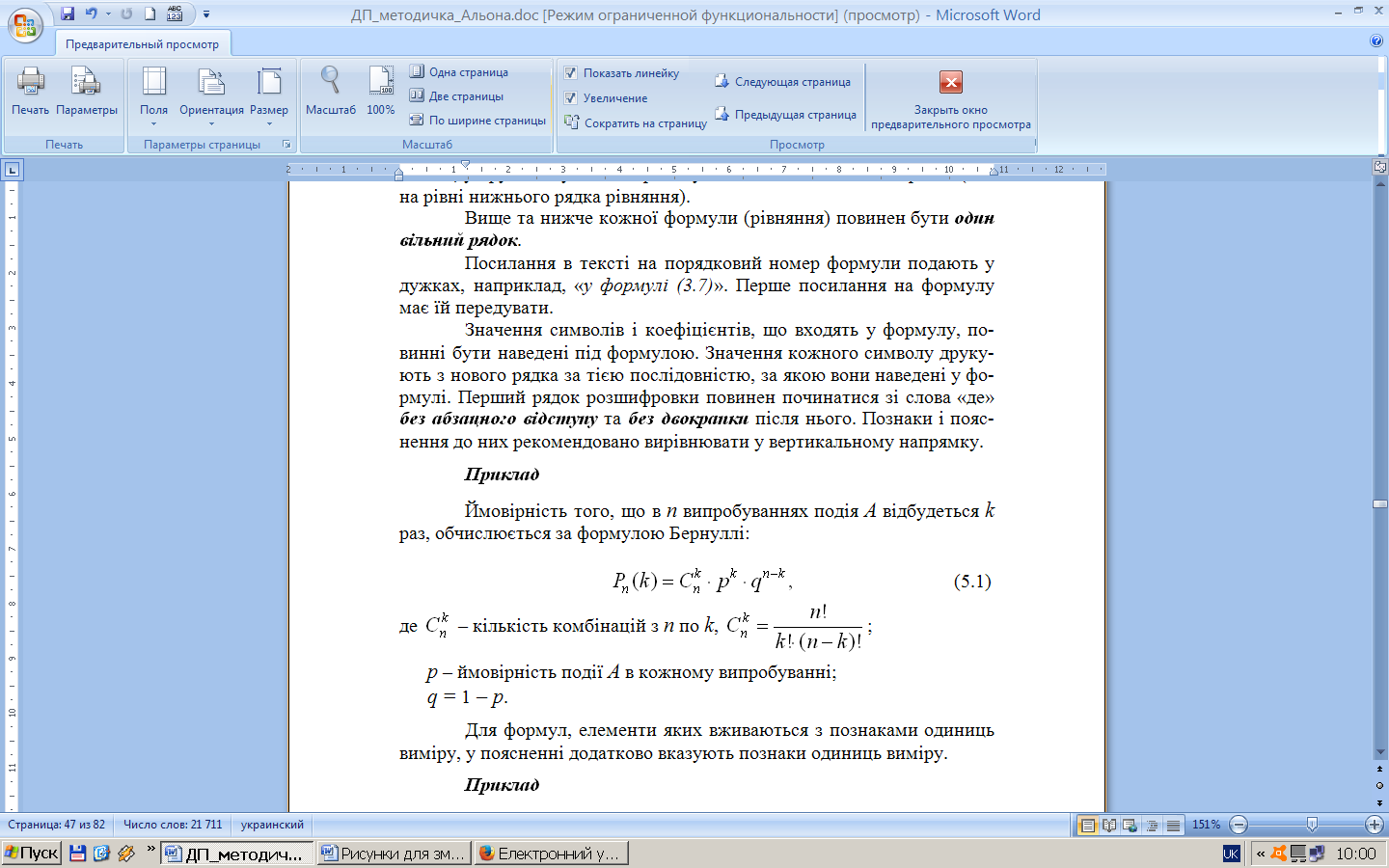
Formulas that are referenced in the text are placed in a separate line and numbered with Arabic numerals throughout the text. In the case of a large number of formulas, numbering is used within the part. In this case, the formula number must consist of a part number and a sequence number of the formula, separated by a period. The formula number is placed at the level of the formula (or at the level of the bottom line of the equation) to which it refers, in parentheses in the right position of the page. If there is only one formula in the text, it is numbered accordingly (1).

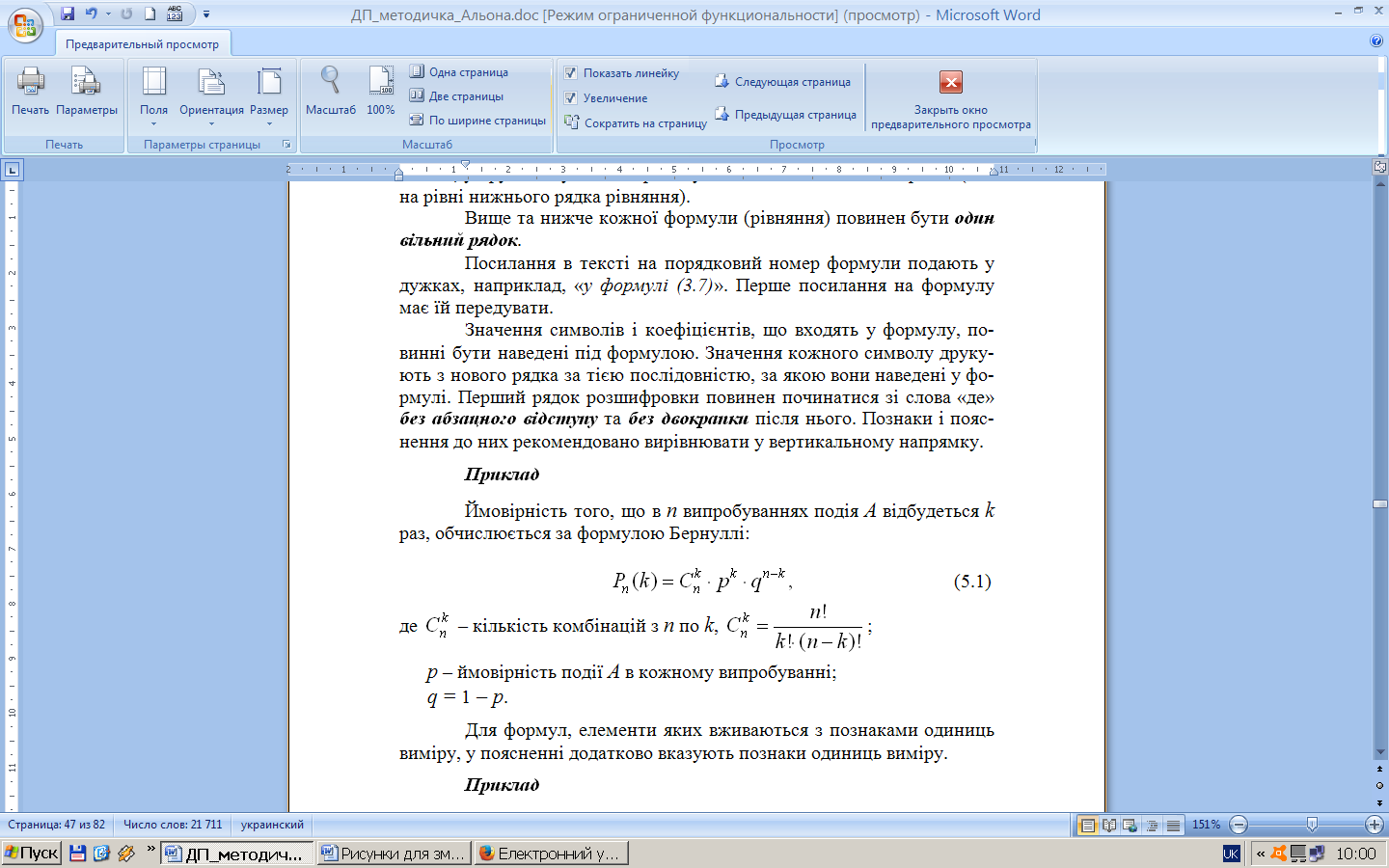
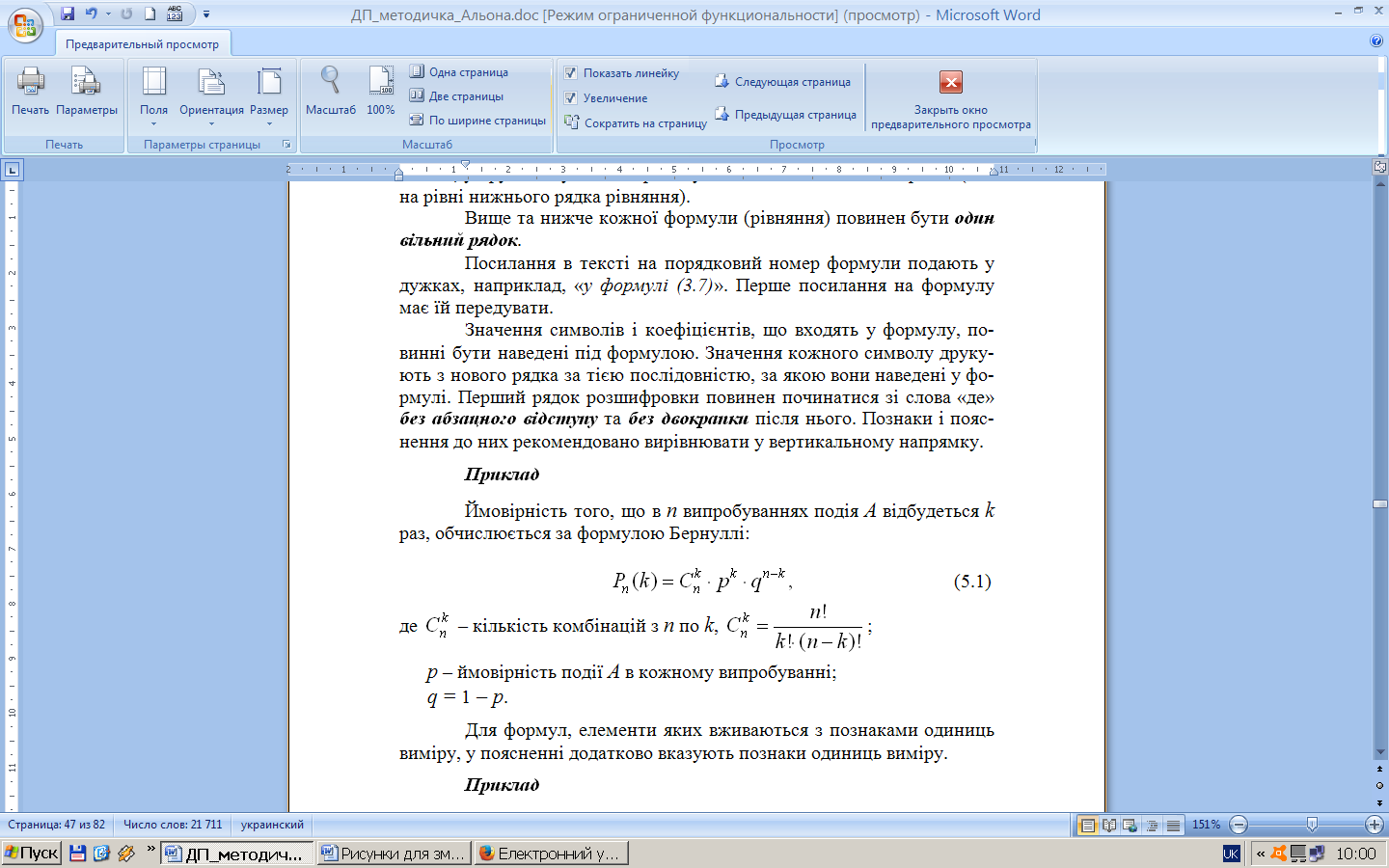
The punctuation marks between formulas that follow each other and are not separated by text can be a “comma” or a “semicolon” directly on the formula (up to its number). To save space, several short formulas of the same type can be written in one line.

The values of the symbols and coefficients included in the formula must be given under the formula. The values of each character are printed from a new line in the order in which they are given in the formula. The first line of the description should begin with the word “where” ***without a paragraph indent and without a colon after it***. It is recommended to align the signs and their explanations in the vertical way.

***Example***

The probability event *A* will occur *k* times that in *n* tries is calculated by Bernoulli’s formula:



where is the number of combinations of *n* with *k,* ;

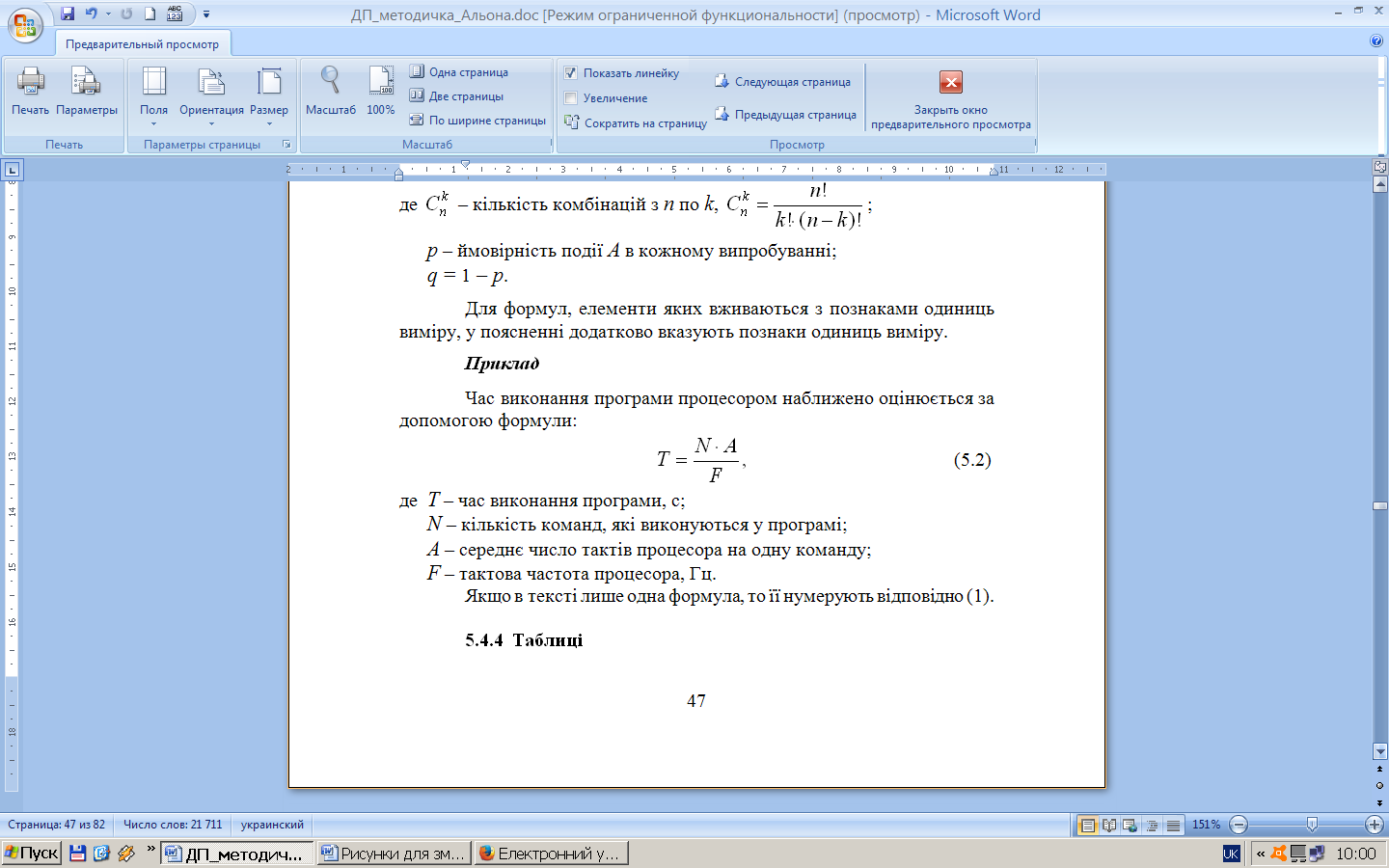
*p* is the probability of event *A* happening in every try;

*q*=1 – *p.*

For formulas the elements of which are used with the units of measurement symbols the explanation additionally indicates the symbols of such units.

***Example***

The execution time of the program by the processor is estimated using the formula:



where *T*  is the time of program execution (run), s;

*N* is the number of commands in the programme;

*A* is the average number of processor cycles per command;

*F* is processor speed, Hz.

References to the formula are given as follows: ***“in formula (3.7)”; “…from equations (1.3) - (1.5)”.*** The first reference to the formula must precede the formula.

***5.4.4 Tables***

Tables in general should have the form shown in Figure 5.2. The simplest table is a table with columns and rows without breaking or merging them.

Table \_\_\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Number Table Title

| Head |  |  | |  | | | Column headings |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | | Column subheadings |
|  |  |  |  |  | | Rows |
|  |  |  |  |  | |
|  |  |  |  |  | |
| Stub column | Columns | | | |  |  |

Figure 5.2 – General table format

The table should be placed after the first mention of it in the text or (if it is not placed on the same page) on the next page; if necessary it can be put in appendices. It is allowed to place the table along the long side of the sheet (landscape layout of the sheet).

There is ***one blank space*** before and after the table.

The tables are numbered in Arabic numerals (except for the tables in the appendices). It is allowed to number them within a part in which case the table number consists of a part number and a table sequence number separated by a period (for example, “Table 1.2” is the second table of the first part). If there is only one table in the document it is numbered “Table 1”. The title is written with the first capital letter and placed above the table to the left of the paragraph indent. At the end of the name do not put a full stop, for example, ***“Table 4.1 – Comparative characteristics”***. It is not allowed to place the table name on the last line of one page and the table on another page.

***Note***. The line numbering is given next to the text in the first column without a period at the end of the number. The special column on the left headed № (“***Order number***”) in the tables is given as an ***exception*** and is marked as “N. n.” (“***Next number***”).

***Example***

Table 5.1 – Results of antiviral diagnosis

| Agent *Аі* | Update of antivirus databases, days | Duration of continuous operation, h | Result of antiviral diagnosis,% |
| --- | --- | --- | --- |
| *А*3 | 1 | 8 | 48 |
| *А*6 | 2 | 6 | 52 |
| *А*11 | 2 | 44 | 58 |
| *А*15 | 7 | 12 | 54 |
| *А*22 | 4 | 3 | 55 |
| *А*31 | 1 | 55 | 46 |

When moving part of the table to another page, the word “table” as well as its number and name are written only once on the left above the first part of the table; other parts of the table have the heading with a paragraph indent that says ***“Table… continued”*** or ***“End of table”*** and its number (for example, ***“Table 1.2 continued”*** or ***“End of table 1.2”***). In this case, it is recommended to replace the table head on the other parts with column numbers, respectively, by placing these numbers in the first part. The lower limiting horizontal line is given only at the end of the table.

***Example***

Table 5.2 – Results of antiviral diagnosis

| Agent *Аі* | Update of antivirus databases, days | Duration of continuous operation, h | Result of antiviral diagnosis,% |
| --- | --- | --- | --- |
| *А*3 | 1 | 8 | 48 |
| *А*6 | 2 | 6 | 52 |
| *А*11 | 2 | 44 | 58 |
| … | … | … | … |

Table 5.2 continued

| Agent *Аі* | Update of antivirus databases, days | Duration of continuous operation, h | Result of antiviral diagnosis,% |
| --- | --- | --- | --- |
| *А*31 | 1 | 8 | 48 |
| *А*61 | 2 | 6 | 52 |
| … | … | … | … |

End of table 5.2

| Agent *Аі* | Update of antivirus databases, days | Duration of continuous operation, h | Result of antiviral diagnosis,% |
| --- | --- | --- | --- |
| *А*125 | 7 | 12 | 54 |
| *А*232 | 4 | 3 | 55 |
| *А*341 | 1 | 55 | 46 |

The size of the font for headings in rows and columns of tables and explanatory data in tables can be set by the author of the Bachelor thesis. It is allowed to use the font size smaller than in the main text (but not less than 12 pt). Tables can also use single spacing. Each table must be referenced in the text with its number. The reference to the table must precede the table itself.

***Examples***

*The list of components of the Moore automaton is presented in table 5.2.*

*The required results were obtained as a result of hardware testing (Table 3.4).*

***5.4.5 Figures***

Graphs, diagrams, drawings, photos, etc. are called figures. Each figure (illustration) must correspond to the text and vice versa. Figures should be placed in the document immediately after the text where they are mentioned for the first time or on the next page (and if necessary – in the appendices), symmetrically to the text (the position of the figure is to be set as “in line with text”). The distance from the figure to the preceeding and follwing text is one blank space

***Note***. Big size illustrations can be made on A3 sheets and placed in the appendices.

All figures must have the same caption “Figure” which is placed under the figure symmetrically to it. They are numbered in Arabic numerals (except for the figures in the appendices). It is allowed to number them within each part; in this case the figure number consists of the part number and the figure number separated by a period (for example, ***“Figure 2.5 – Figure name”*** is the fifth figure of the second part). If there is only one figure in the document, it is named ***“Figure 1”***. The caption to the figure should reflect its content and be concise. The name is written in capital letters without a period at the end. Axamples of figures are given in section 4.9.1 – figures 4.2–4.5. If you need to add explanatory data to the figure, they are placed after the graphic material before the title of the figure.

***Example***

A block diagram has been made to reflect the general concept of the developed system constructed and it is given in Figure 5.3.

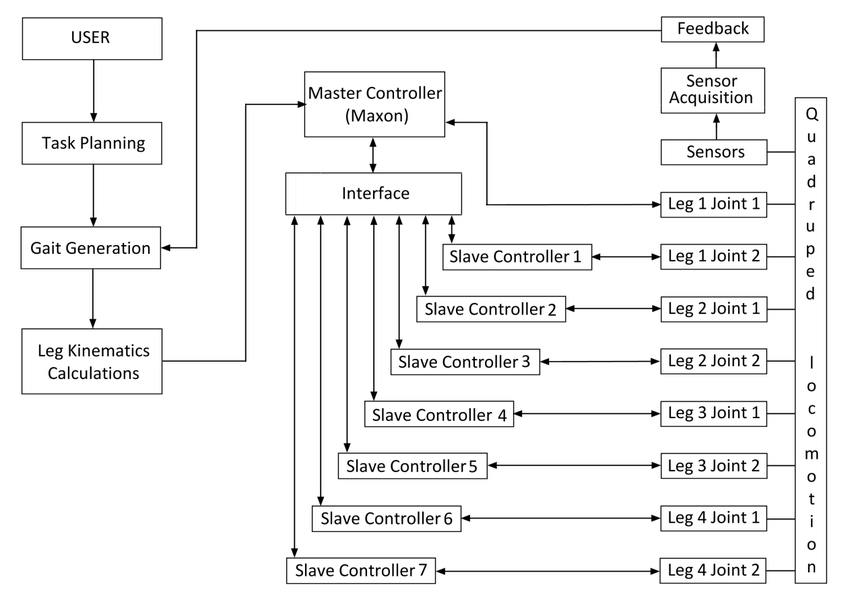


Figure 5.3 – The control architecture of quadruped robot

The suitable font size for explanatory data in the figure can be set by the author for saving space. All figures must be referenced in the text.

***Example***

*Electric servo rotary type Tower Pro MG-90 (Figure 3.16) has been used to accurately rotate the main components of the supporting mechanisms of the walking platform*

*A diagram is made to reflect the functionality of the developed software package and the conceptual model of the system (Figure 4.1)*

***Note*.** A figure (as well as a table or formula) cannot appear in the text before the first reference to it. In further text the element can be referenced to in the text as many times as necessary.

Figures can be ***black and white or color***.

***5.4.6 Writing the Program Code and Its Fragments***

Listing of program codes is usually made in appendices. If necessary fragments of code that are key to solving the problem can be given in the main part of the explanatory note in the form of a text for better description of the implementation of the automation system. The text of the program (as well as its fragment) should be readable with proper structuring and formatting of the code and the use of comments. Listings of the code and its fragments are usually given in monospaced font (for example, **Courier New**), are left-aligned without paragraph indents. It is allowed to reduce the font size (up to 10 pt), as well as use one line spacing.

A fragment of the program code is written with ***one blank space*** to the previous and the following text.

***Example***

Here is an example of a program fragment:

**namespace DiplomaForms.PcapDotNet**

**{**

**public class InfoFromFile**

**{**

**private RepositoryContext \_context;**

**private List<LetterFrequency> \_letterFrequencies;**

**public InfoFromFile()**

**{**

**\_context = new RepositoryContext();**

**\_letterFrequencies = \_context.Frequencies.Where(x => x.Source.Equals("zeus.txt")).ToList();**

**}**

**Dictionary<uint, int> NDom { get; set; }**

**public void WriteToCsv(List<FeaturesPool> pools)**

**{**

**List<CsvData> csvData = new List<CsvData>();**

**NDom = new Dictionary<uint, int>();**

**foreach (var item in pools)**

**{**

**var ip = item.DestinationIpV4Address.ToValue();**

**if (NDom.Any(x => x.Key == ip))**

**NDom[ip] += 1;**

**else**

**NDom.Add(ip, 1);**

**}**

**foreach (var item in pools)**

**{**

**csvData.Add(new CsvData()**

**{**

**Ndom = NDom.Where(x => x.Key == item.DestinationIpV4Address.ToValue()).FirstOrDefault().Value,**

**Sbit = item.IsDnsResponse,**

**Ttl = item.TtlDnsAnswer,**

**Length = item.QueryDomainName.Length,**

**Digits = item.QueryDomainName.Count(Char.IsDigit),**

**W = GetWeight(item.QueryDomainName),**

**Name = item.QueryDomainName**

**});**

**}**

**using (var writer = new StreamWriter("file.csv"))**

**{**

**using (var csv = new CsvWriter(writer, CultureInfo.InvariantCulture))**

**{**

**csv.WriteRecords(csvData);**

**}**

**}**

**}**

***5.4.7 References***

The text of the explanatory note may contain references to its structural elements and other sources.

When referring to structural elements indicate the numbers of parts, sections, subsections, figures, formulas, tables, appendices. References should be made using such expressions as ***“in part 3”, “according to 3.3.2”, “(Figure 2.5)”, “in Figure B.1”, “according to Table 1.3”, “according to formula (2.2)”, “(Appendix D)”***, etc.

References may use common and standardized shotenings of words (***“according to Fig. 3.4”***). As a rule, references with a shortened word are made to illustrations (tables, formulas) mentioned earlier. References in the text to the sources should be indicated by a number in the list of references in square brackets.

***Examples***

*…in aticle* [*6*]*…*;

*…in works* [*1–4*]*…*;

*…a model is used …* [*8*].

***5.4.8 Requirements to the List of Reference Sources***

Bibliographic descriptions in the “List of reference sources” are given in accordance with the standards of library and publishing. Each source has its own order number and the whole list has a continuous numbering. A bibliographic description of a particular source is included in the list of references only once. Use different methods of grouping sources, the main of which are alphabetical and numbered (according to the first mention of the source in the text). It is recommended to provide bibliographic descriptions in the list of sources in the order in which the sources are first mentioned in the text.

References should be made in the appropriate places in the text. Numbers of descriptions in the list of sources should correspond to their references in the text. Appendix E provides examples of bibliographic descriptions.

***5.4.9 Requiremenets to Appendices***

Appendices are given as a continuation to the main document. They are named by consecutive capital letters of the English alphabet, starting with the letter A, for example, “APPENDIX D”. If there is only one appendix in the document, it is titled “APPENDIX A”.

Each appendix should start with a new page with the word “APPENDIX” at the top in the center of the page and be numbered (in capital letters). The next line in the center should give the status of the appendix in small letters; then, after a blank space write the title of the application in the middle (**in bold** in **CAPITAL LETTERS**).

The text of each appendix can be divided into sections, subsections, paragraphs, sub-paragraphs, which are numbered within each appendix. The numbers are preceded by the letter designation of this appendix: ***“A.1”, “B.2.4”***.

If the appendices contain figures, tables, formulas, they are also numbered throughout each appendix (“Figure A.3”, “Table C.1”, “formula (D.2)”). If there is only one figure (table, formula) in the appendix it is numbered as follows: ***“Figure A.1”, “Table D.1”, “formula (C.1)***”.

Continuous numbering of figures, tables, formulas throughout all appendices is not allowed (unlike in the main text).

When referring to the figures, tables and formulas from the appendices in the text of the explanatory note (or appendices) it should be written: ***“… in figure A.2”, “(see Fig. A.2)”; “…in table B.3”; “… according to formula (B.4)”***.

The texts of program code listings in appendices can be made different using a different type of font and / or other font size (but not less than 10 pt). It is possible to reduce the line spacing to 1.

If the appendix contains a document that has an independent meaning (for example, technical requirements, presentation materials) it can be preceded by a page with the word “APPENDIX” in capital letters in the center and its letter name, status and title ( according to the same rules). The page with this information is also numbered.

The number and content of appendices is determined by the graduate student in agreement with the project superrvisor.

**5.5 Requirements to the Graphic Part**

Presentation materials are made in the form of slides with the help of appropriate software (such as Microsoft PowerPoint) and involve the use of equipment during the defense of the Bachelor thesis.

The style of slides is chosen by the graduate student.

Printed slides (A4 sheets) are included in the appendices.

If the “Poject Task” requires a graphic part in the form of demonstration posters, it is made out on sheets of A2drawing paper and is accompanied by the title block and additional columns in accordance with the requirements of DSTU GOST 2.104: 2006 – f. 2. This graphic part is performed with the help of computer tools and software packages (Case-tools, Corel Draw, etc.). The sheets are numbered – the number is put in the title block on the right in the ***Sheet*** field. (1, 2, ...). Also write the total number of sheets (in the ***Number of Sheets*** field). The sheets are signed by the student, the supervisor of the qualification work, the quality controller and the head of the department.

**6 Getting Ready to the Bachelor Thesis Defense**

**6.1 Preparing Documents**

The student is to submit the complete and bound work (in hardcover) to the department at least five days before the date of defense. The explanatory note is to be signed by the responsible persons; the pages are bound in the sequence specified in section 4.1.

The following pages are to be added to the explanatory note:

1 Supervisor’s review report.

2 Reviews of the Bachelor thesis.

3 Plagiarism certificate.

4 Graphic materials (if they are planned).

5 Other documents (certificate of implementing the results, scientific articles, etc.), if any.

***Note***. The explanatory note is given to the reviewer for independent evaluation. The reviewer should read the theoretical and practical parts of the qualification work and evaluate the paper in the form of a written review. The list of reviewers is approved by the head of the department.

The supervisor’s review report, review, plagiarism test certificate and other documents are enclosed in an envelope that is glued to the inside cover of the explanatory note. Admission of the thesis to the defense is proved by the signature of the head of the department on the title page of the explanatory note. Work that is not signed so shall not be allowed to be defended.

***Note***. The head of the department has the right to admit the student to defense in case of a negative review report from the head. A negative review from the reviewer is also not a reason of non-admission to the defense.

***6.2 Revision and Plagiarism Test***

According to the Regulations on Academic Integrity at Khmelnytsky National University all qualification works are subject to a mandatory plagiarism test.

Checking the level of borrowing in the qualification work is carried out not later than three days before the defense of the project and is performed by a responsible person appointed by the head of the department.

The functions of the responsible person are:

- uploading the qualification work (explanatory note) to the Anti-Plagiarism system and carrying out its computer check for plagiarism;

- issuing a certificate based on the results of the inspection;

- archiving the qualification work in the repository;

- preserving confidentiality of information about the qualification work.

The person in charge of plagiarism check accepts the completed thesis signed by the supervisor, in printed form, as well as its electronic version in the format of \* .rtf, \* .doc, \* .docx, \* .pdf. The responsible person carries out a random check for a match between the printed and electronic versions of the qualifying work. If the printed and electronic versions do not match, the qualifying work is returned to the applicant to eliminate the discrepancies.

After checking the explanatory note for plagiarism, the person in charge of the procedure issues a certificate which is attached to the work.

Maximum coincidence with one other work is to be no more than 40% is allowed. The number of errors in the project should not exceed 20%, and in the case of using specific terminology (which may not be included in dictionaries) – 30%. Also, the work is to have at least 60,000 characters (300 words). In case of detection of plagiarism that exceeds the established standards (specified in the certificate) the student is not admitted to the defense of the qualification work until the violations are eliminated and the work re-checked for plagiarism. No more than three tests of one qualification work are allowed.

**6.3 Quality Control**

The task of quality control is to ensure compliance with the norms, requirements and rules established by standards and other normative documents. The main requirements are set out in section 5 of these guidelines. The department appoints a responsible person – a ***controller*** – to carry out quality control.

Prior to the submission of the qualification work for quality control, the materials must be printed out and signed by the student and the supervisor. For the purpose of high-quality control and correction of errors, the explanatory note should be completed approximately 7 days before the beginning of the defense of the thesis. Changes and corrections specified by the quality controller and related to the violation of current standards and other normative and technical documents are mandatory and must be made by the student. The compliance of the work with the requirements of current standards is certified by the controller. It is not allowed to correct or change the documents signed by the controller without his / her knowledge.

The controller is responsible for compliance with the requirements of current standards and other regulatory and technical documents on a par with the developers of the documentation.

**6.4 Preparing a Report**

The report should briefly and technically competently reflect: the essence of the task; substantiation of the relevance of the topic, the aim and objectives of the thesis, the purpose of the development; the essence of the analysis; functional structure of the development; design results; main characteristics of the developed product; conclusions (brief results of the whole project, possible ways of further improvement, use or implementation). The report should include three interrelated parts: ***the introduction, the main part and the conclusions***.

The ***introduction*** should begin with an address to the examination board members and a presentation of the topic of the thesis, for example: ***“Dear members of the examination board! The topic of the presented Bachelor thesis is…”***. After that it is necessary to define the subject field the work belongs to, to highlight the topicality of the development, to specify the aim and the main tasks of the project.

The ***main part*** briefly describes possible variants of solving the task; explains how the problem was solved, justifies the decisions; reveals main results of the project; demonstrates the level of solving the tasks as well as main characteristics of the developed product.

***Conclusions*** should focus on the main results of the project, achieving the goal of the qualification work, the practical significance of the work, recommendations, etc. Conclusions and recommendations should be presented in a generalized form, avoiding unnecessary details. The report should end with the words: ***“Thank you for your attention.”***

The proposed structure of the report is generalized and can be specified and changed depending on the content of the qualification work, the results obtained and the presented visual (demonstration) materials.

**6.5 Preparing Visual Materials**

Visual (demonstration) materials should consistently illustrate the report and ensure complete coverage of all provisions of the qualification work. The first slide of the presentation should contain the name of the department, the topic of the thesis, the surname and name of the student, surname, initials, scientific degree and the academic title of the supervisor of the thesis.

The second slide has a clearly formulated statement of the problem, aim and objectives of the project. The following slides (1–2) provide information on the topicality of the task, the results of the analysis of existing solutions and the conclusions made on the basis of this analysis (list of analogues of the developed software and hardware with indication of their shortcomings and limitations).

Next slides include design results: methods, formulas, content of the work performed (models, algorithms, a block diagram of the developed automation system, formats and algorithms for data transmission and processing, human-machine interface).

Finally, clear and concise conclusions are given, indicating the results of the qualification work and their practical value. The presentation and the report must be agreed in time. The student’s speech should be approximately 7-10 minutes.

**6.6 Preparing to Answer Questions**

Questions during the defense of the thesis are asked by the members of the examination board and the people present and as a rule they cover the topic of the qualification work and the results given in the explanatory note and report. Therefore, the student must know the work, the essence of the materials, have a good understanding of the principles of the developed automation system and so on.

The number and nature of questions largely depend on the quality of the report. The student should be prepared for unexpected questions such as: ***“Why do you need it?”*** or questions that deal with details that the student did not work with. It is not necessary to answer: ***“The customer demanded it” or “I do not know”.*** It is better to show erudition and ingenuity, for example: ***“It was not part of the task of the paper.”***

Questions that are not clear to the student should be clarified.

**6.7 Report Rehearsal**

The rehearsal of the report is very important in terms of time management. During the rehearsal of the report it is recommended to use all the equipment that will be needed during the defense of the thesis as well as all the necessary visual (demonstration) materials. Particular attention should be paid to the preparation and configuration of the necessary equipment to demonstrate the developed software and hardware.

**7 Defense of the Bachelor Thesis**

Public defense of the Bachelor thesis is the final stage of work on the project during which the students must demonstrate professional qualities, ability to show the results of their work as well as to present the developed product.

The defense of the qualification work is carried out before the ***examination board (EB)*** that is formed by the order of the rector.

***Note***. Defense of a complex qualification work, as a rule, is planned and carried out at one examination board meeting. Students who have performed a comprehensive job should be fully acquainted with its general part and ready for questions from board members not only on individual but also on the general part of the qualification work.

Students who have fulfilled all the requirements of the curriculum, submitted the work on time, received a positive review and feedback from the supervisor, passed the procedure of quality control and plagiarism testing as well as preliminary defense according to the established schedule are admitted to the defense of the Bachelor paper.

On the day of defense the student must submit all the documentation for the thesis to the Executive Secretary of the EB. The defense of the paper is carried out at an open meeting of the EB with the participation of at least half of its members in the mandatory presence of its chairman.

The defense of the qualification work includes the student’s oral report, answers to the questions of the EB members, answers to the remarks of the reviewer and the supervisor of the work.

The procedure for defending the qualification work is as follows:

- introducing the student and submitted documents by the EB Secretary;

- student’s report on the essence of the work (it is desirable not to read and accompany it with a slide show or video);

- student’s answers to questions from EB members;

- reviewer’s speech or announcement of the review;

- student’s responses to the reviewer’s comments;

- supervisor’s speech or presentation of the supervisor’s report;

- student’s responses to the supervisor’s remarks;

- discussion of the project and its defense by the EB and agreement on the final grade for the thesis.

The procedure for the defense of the qualification work is recorded by the EB Secretary. The decision of the EB on the assessment of knowledge and skills acquired in the defense of the qualification work as well as on the assignment of qualifications and awarding a degree is taken at a closed meeting of the EB by open voting by a simple majority of EB members. With the equal number of votes “for” and “against” the vote of the chairman of the EB is decisive.

***Note***. The student’s personal contribution is subject to evaluation so the report should pay special attention and clearly indicate what parts use the student’s personal developments and where the publicly available elements and components of third-party developers are used.

The results of the defense of the qualification work are announced on the same day after completing all relevant documents and minutes of the EB meeting.

A student who has successfully defended the qualification work is awarded the appropriate level of higher education by the EB decision, a Bachelor’s degree is awarded and a state-standard higher education document is issued as well as a supplement to the European diploma.

If the assessment of the defense of the qualification work is unsatisfactory, the student is expelled from the university and receives an ***academic certificate***.

The student has the right to re-defend the qualification work within three years after expulsion from the university. In this case, on the basis of the application and at the request of the dean of the faculty, by order of the rector, the student (on the basis of a signed contract) is renewed for the period of diploma preparation and defense with the indication of the topic and the name of the supervisor.

In cases where the defense of the thesis and / or the quality of the paper is considered unsatisfactory and the volume is insufficient the EB may give a chance to re-defend the work on the same topic after it has beed corrected and completed or write a project on a new topic. These conditions are noted in the minutes of the EB meeting and in the rector’s order to expel the student.

If the defense of the qualification work did not take place for serious reasons (proved by relevant documents that the student submits to the EB), the rector of the university may extend the student’s deadline until the next session of the EB but not more than for one year. In case of disagreement with the received grade the student has the right to submit an ***appeal***. The procedure for its submission and consideration by the Appeals Commission is regulated by the Regulations on Attestation of Higher Education Applicants at Khmelnytskyi National University.

After the defense the thesis is transferred to the university archives.

**8 Evaluation Criteria**

According to the Regulations on control and evaluation of learning outcomes of students at KhNU the qualification work is evaluated according to the national four-point scale and the ECTS scale. The system of evaluation of the thesis is based on the following criteria: assessment of the quality of the content of the explanatory note; its layout and defense.

Criteria for assessing ***the quality of the content of the explanatory note***:

- relevance of the topic and practical significance of the project;

- compliance of the content with the topic of the qualification work;

- compliance of the work with the project task;

- objectivity of coverage of the topic with the creative use of modern sources of information;

- completeness of the study of the subject area;

- clarity and completeness of the problem research;

- presence of new ideas and solutions;

- validity of the choice of methods and means of solving the problem;

- the level of development and software solutions and their justification;

- application of modern technologies and programming languages;

- clarity and quality of illustrative material;

- the degree of independence of the student;

- presence / absence of duplication, descriptive material, stereotypical decisions that do not affect the essence of the obtained results.

Criteria for evaluating ***the layout of the explanatory note***:

- compliance of the layout with current standards;

- logical connection of the text with the graphic material;

- general and professional literacy, conciseness and logical sequence of presentation of the material.

Criteria for assessing ***the quality of the thesis defense***:

- quality and completeness of the report at the defense: compliance with its topic and aim; knowledge and understanding of the material, sequence, logic, literacy of its presentation; ability to substantiate the decisions made, to briefly explain the purpose and operation of the developed product, to draw conclusions, etc.;

- correctness and completeness of answers to questions at the defense: the ability to formulate a well-grounded answer to questions, answer non-standard questions, justify one’s own point of view in problematic situations.

When evaluating the Bachelor thesis the supervisor’s and the reviewer’s opinions are also taken into account.

The student receives the grade of ***“excellent”*** if he /she has completed the work in full, in compliance with all requirements, and made a competent, logical presentation of the report, gave correct and complete answers to questions (including non-standard ones); demonstrated deep and complete mastery of the content of the material; ability to connect theory with practice, substantiate own judgments, draw conclusions; possession of diverse skills, techniques and competencies. The explanatory note fully meets the requirements for its content and design and covers all the provisions of the project. The developed software and hardware product corresponds to the technical requirements and is fully functional; modern means of development are used.

The grade ***“good”*** is given to the student when he / she performed the work in full, in compliance with the requirements, and demonstrates solid knowledge of the material, competently and essentially presents it at the defense, does not make significant inaccuracies in answering questions, correctly applies theoretical provisions when solving practical problems, has the necessary skills and techniques to reach the aim. The explanatory note sufficiently meets the requirements and reveals the key provisions of the work. The developed software and hardware product corresponds to the technical requirements, performs the main functions; modern means of development are used.

The grade ***“satisfactory”*** is awarded to the student who has completed the work on the task but made inaccuracies in its performance; during the defense showed knowledge of the basic material to the extent necessary for professional activities; mastered and acquired practical skills, mainly copes with practical tasks, but violates the logical sequence in the presentation of the material, has errors in answers, has difficulty answering modified questions. The explanatory note mostly meets the requirements and reveals most of the provisions of the work. The developed software and hardware product performs most of the functions or its implementation is performed in a simplified form.

The grade ***“unsatisfactory”*** is given when the student performed poor work and showed unsystematic knowledge at its defense, can not distinguish between primary and secondary issues, makes mistakes in defining concepts, distorts their content, chaotically and uncertainly presents the material, can not apply knowledge in solving practical tasks. The explanatory note does not meet the requirements, does not sufficiently describe the task. The software and hardware product performs an insufficient number of functions or does not correspond to the technical requirements or goes beyond the topic.

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5. Licensing Terms for Educational Activities. Resolution of the Cabinet of Ministers of December 30, 2015 № 1187 (as amended by the resolution of the Cabinet of Ministers of May 10, 2018 № 347).
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16. Text Documents. General Requirements. SOU 207.01: 2017 / Yu. Boiko, H. Krasylnykova, L. Pershyna, T. Kosianchuk. – Khmelnytskyi: KhNU, 2017. 45 p.

**APPENDICES**

APPENDIX А

(reference materials)

**TITLE PAGE TEMPLATE**

Khmelnytskyi National University

Faculty of Programming

and Computer and Telecommunication Systems

Department of Computer Engineering and System Programming

BACHELOR THESIS



\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Education level

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Title

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Field of study         12 – Information Technology\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Major 151 – Computer Engineering\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Educational program Computer Engineering

Code \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Written by:

student of the \_\_\_ year, group \_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature Initials, surname

Supervisor \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature Initials, surname

Quality controller \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature, date Initials, surname

Admitted to the defense by:

Head of the Department of

Computer Engineering and

System Programming \_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature, date Initials, surname

\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_ 20\_\_\_

Khmelnytskyi, 20\_\_\_

APPENDIX B

(reference materials)

**BACHELOR THESIS TASK TEMPLATE**

KHMELNYTSKYI NATIONAL UNIVERSITY

Faculty Programming and Computer and Telecommunication Systems

Department Computer Engineering and System Programming\_\_\_\_\_\_\_\_

Eeducation leevel Bachelor’s\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Field of study 12 – Information Technology\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Major 123 Computer Engineering\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Educational program Educational and professional program for Bachelor’s degree

APPROVED:

Head of the department\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_.\_\_\_\_ 20\_\_\_

BACHELOR THESIS TASK

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Student’s first name, surname

1. Thesis title \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Thesis supervisor \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

First name, patronymic name, surname, scientific title and academic rank

Approved by the university rector’s order of \_\_\_ \_\_\_\_ 20\_\_ № \_\_\_

2. Date of submitting the thesis to the department: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. Project initial data \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. Outline of the explanatory note (list of tasks to be solved and developed) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. List of graphic materials (specifying obligatory drawings) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

APPENDIX B continued

6. Consultants of Bachelor thesis parts

| Part | Consultant’s surname, initials, job title | Signature, date | |
| --- | --- | --- | --- |
| Task issued by | Task accepted by |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

7. Date of handing out the task \_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_ 20\_\_.

CALENDAR PLAN

| Stages (sections) of the Bachelor thesis | Dates due | Notes |
| --- | --- | --- |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| ... |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

Student \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature Initials, surname

Supervisor \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature Initials, surname

APPENDIX C

(reference materials)

**“ABSTRACT” SAMPLE**

**ABSTRACT**

Topic of the Bachelor thesis: “System of Automated Counting of the Number of People in the Room in VHDL”.

Author of the thesis: Petrenko Petro Petrovych.

Supervisor: Lysenko Serhiy Mykolaiovych.

Explanatory note: 60 pages, 12 figures, 5 tables, 4 appendices, 15 sources.

Graphic part: 15 presentation slides.

PROGRAMMED LOGICAL INTEGRATED CIRCUIT, DIGITAL INTEGRATED CIRCUIT, AUTOMATION SYSTEM, VHDL.

The aim of the paper is to develop a system of automated counting of the number of people in the room in VHDL.

A system of the automated record of the number of people present in a room has been developed in VHDL language. The developed control system is implemented on the basis of Altera Cyclon V programmable logic integrated circuit. The developed control system is realized by means of VHDL – a description language used to describe hardware. It makes it possible to count people in a room implementing a graphical human-machine process control interface based on the operator’s graphical touch panel.

Stdent’s signature Date

APPENDIX D

(reference materials)

**“LIST OF ABBREVIATIONS” EXAMPLE**

**LIST OF ABBREVIATIONS**

| ACPI | – | Advanced Configuration and Power Interface |
| --- | --- | --- |
| BIOS | – | Basic Input-Output System |
| CN | – | Computer Netwwork |
| CS | – | Computer System |
| CUDA | – | Compute Unified Device Architecture |
| DB | – | Data Base |
| FAT | – | File Allocation Table |
| HTML | – | HyperText Markup Language |
| ICT | – | Information and Communication Technologies |
| ISDN | – | Integrated Services Digital Network |
| LC | – | Life Cycle |
| OLE | – | Object Linking and Embedding) |
| OS | – | Operating System |
| TRS | – | Technical Requirement Specifications |
| USB | – | Universal Serial Bus |
| WWW | – | World Wide Web |

APPENDIX E

(reference materials)

**APA STYLE REFERENCING**

***Reference Citations in Text***

In APA style, in-text citations are placed within sentences and paragraphs so that it is clear what information is being quoted or paraphrased and whose information is being cited.

***Works by a single author***

The last name of the author and the year of publication are inserted in the text at the appropriate point.

from theory on bounded rationality (Simon, 1945)

If the name of the author or the date appear as part of the narrative, cite only missing information in parentheses.

Simon (1945) posited that

***Works by multiple authors***

When a work has two authors, always cite both names every time the reference occurs in the text. In parenthetical material join the names with an ampersand (&).

as has been shown (Leiter & Maslach, 1998)

In the narrative text, join the names with the word “and”.

as Leiter and Maslach (1998) demonstrated

When a work has three, four, or five authors, cite all authors the first time the reference occurs.

Kahneman, Knetsch, and Thaler (1991) found

In all subsequent citations per paragraph, include only the surname of the first author followed by “et al.” (Latin for “and others”) and the year of publication.

Kahneman et al. (1991) found

***Works by associations, corporations, government agencies, etc.***

The names of groups that serve as authors (corporate authors) are usually written out each time they appear in a text reference.

(National Institute of Mental Health [NIMH], 2007)

When appropriate, the names of some corporate authors are spelled out in the first reference and abbreviated in all subsequent citations. The general rule for abbreviating in this manner is to supply enough information in the text citation for a reader to locate its source in the Reference List without difficulty.

(NIMH, 2007)

***Works with no author***

When a work has no author, use the first two or three words of the work's title (omitting any initial articles) as your text reference, capitalizing each word. Place the title in quotation marks if it refers to an article, chapter of a book, or Web page. Italicize the title if it refers to a book, periodical, brochure, or report.

on climate change (“Climate and Weather,” 1997)

Guide to Agricultural Meteorological Practices (1981)

Anonymous authors should be listed as such followed by a comma and the date.

on climate change (Anonymous, 2008)

***Specific parts of a source***

To cite a specific part of a source (always necessary for quotations), include the page, chapter, etc. (with appropriate abbreviations) in the in-text citation.

(Stigter & Das, 1981, p. 96)

De Waal (1996) overstated the case when he asserted that “we seem to be reaching ... from the hands of philosophers” (p. 218).

If page numbers are not included in electronic sources (such as Web-based journals), provide the paragraph number preceded by the abbreviation “para.” or the heading and following paragraph.

(Mönnich & Spiering, 2008, para. 9)

***Reference List***

References cited in the text of a research paper must appear in a Reference List or bibliography. This list provides the information necessary to identify and retrieve each source.

***Order***: Entries should be arranged in alphabetical order by authors' last names. Sources without authors are arranged alphabetically by title within the same list.

***Authors***: Write out the last name and initials for all authors of a particular work. Use an ampersand (&) instead of the word “and” when listing multiple authors of a single work. e.g. Smith, J. D., & Jones, M.

***Titles***: Capitalize only the first word of a title or subtitle, and any proper names that are part of a title.

***Pagination***: Use the abbreviation p. or pp. to designate page numbers of articles from periodicals that do not use volume numbers, especially newspapers. These abbreviations are also used to designate pages in encyclopedia articles and chapters from edited books.

Two additional pieces of information should be included for works accessed online.

***Internet Address***: A stable Internet address should be included and should direct the reader as close as possible to the actual work. If the work has a digital object identifier (DOI), use this. If there is no DOI or similar handle, use a stable URL. If the URL is not stable, as is often the case with online newspapers and some subscription-based databases, use the home page of the site you retrieved the work from.

***Date***: If the work is a finalized version published and dated, as in the case of a journal article, the date within the main body of the citation is enough. However, if the work is not dated and/or is subject to change, as in the case of an online encyclopedia article, include the date that you retrieved the information.

***Examples***

***Articles in journals, magazines, and newspapers***

References to periodical articles must include the following elements: author(s), date of publication, article title, journal title, volume number, issue number (if applicable), and page numbers.

***Journal article, one author, accessed online***

Ku, G. (2008). Learning to de-escalate: The effects of regret in escalation of commitment. *Organizational Behavior and Human Decision Processes, 105(2),* 221-232. doi:10.1016/j.obhdp.2007.08.002

***Journal article, two authors, accessed online***

Sanchez, D., & King-Toler, E. (2007). Addressing disparities consultation and outreach strategies for university settings. *Consulting Psychology Journal: Practice and Research, 59(4),* 286-295. doi:10.1037/1065- 9293.59.4.286

***Journal article, more than two authors, accessed online***

Van Vugt, M., Hogan, R., & Kaiser, R. B. (2008). Leadership, followership, and evolution: Some lessons from the past. *American Psychologist, 63(3),* 182-196. doi:10.1037/0003-066X.63.3.182

***Article from an Internet-only journal***

Hirtle, P. B. (2008, July-August). Copyright renewal, copyright restoration, and the difficulty of determining copyright status. *D-Lib Magazine, 14(7/8).* doi:10.1045/july2008-hirtle

***Journal article from a subscription database (no DOI)***

Colvin, G. (2008, July 21). Information worth billions. *Fortune, 158(2),* 73-79. Retrieved from Business Source Complete, EBSCO. Retrieved from [http://search.ebscohost.com](http://search.ebscohost.com/)

***Magazine article, in print***

Kluger, J. (2008, January 28). Why we love. *Time, 171(4),* 54-60.

***Newspaper article, no author, in print***

As prices surge, Thailand pitches OPEC-style rice cartel. (2008, May 5). *The Wall Street Journal,* p. A9.

***Newspaper article, multiple authors, discontinuous pages, in print***

Delaney, K. J., Karnitschnig, M., & Guth, R. A. (2008, May 5). Microsoft ends pursuit of Yahoo, reassesses its online options. *The Wall Street Journal*, pp. A1, A12.

***Books***

References to an entire book must include the following elements: author(s) or editor(s), date of publication, title, place of publication, and the name of the publisher.

***No Author or editor, in print***

Merriam-Webster's collegiate dictionary (11th ed.). (2003). Springfield, MA: Merriam- Webster.

***One author, in print***

Kidder, T. (1981). *The soul of a new machine*. Boston, MA: Little, Brown & Company.

***Two authors, in print***

Frank, R. H., & Bernanke, B. (2007). *Principles of macro-economics (3rd ed.).* Boston, MA: McGraw-Hill/Irwin.

***Corporate author, author as publisher, accessed online***

Australian Bureau of Statistics. (2000). *Tasmanian year book 2000 (No. 1301.6).* Canberra, Australian Capital Territory: Author. Retrieved from [http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/CA2568710006989...](http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/CA25687100069892CA256889000CA9FC/) $File/13016\_2000.pdf

***Edited book***

Gibbs, J. T., & Huang, L. N. (Eds.). (2001). *Children of color: Psychological interventions with culturally diverse youth.* San Francisco, CA: Jossey-Bass.

***Dissertations***

References for dissertations should include the following elements: author, date of publication, title, and institution (if you accessed the manuscript copy from the university collections). If there is a UMI number or a database accession number, include it at the end of the citation.

***Dissertation, accessed online***

Young, R. F. (2007). *Crossing boundaries in urban ecology: Pathways to sustainable cities (Doctoral dissertation).* Available from ProQuest Dissertations & Theses database. (UMI No. 327681)

***Essays or chapters in edited books***

References to an essay or chapter in an edited book must include the following elements: essay or chapter authors, date of publication, essay or chapter title, book editor(s), book title, essay or chapter page numbers, place of publication, and the name of the publisher.

***One author***

Labajo, J. (2003). Body and voice: The construction of gender in flamenco. In T. Magrini (Ed.), *Music and gender: perspectives from the Mediterranean* (pp. 67-86). Chicago, IL: University of Chicago Press.

***Two editors***

Hammond, K. R., & Adelman, L. (1986). Science, values, and human judgment. In H. R. Arkes & K. R. Hammond (Eds.), *Judgement and decision making: An interdisciplinary reader*(pp. 127-143). Cambridge, England: Cambridge University Press.

***Encyclopedias or dictionaries and entries in an encyclopedia***

References for encyclopedias must include the following elements: author(s) or editor(s), date of publication, title, place of publication, and the name of the publisher. For sources accessed online, include the retrieval date as the entry may be edited over time.

***Encyclopedia set or dictionary***

Sadie, S., & Tyrrell, J. (Eds.). (2002). *The new Grove dictionary of music and musicians* (2nd ed., Vols. 1-29). New York, NY: Grove.

***Article from an online encyclopedia***

Containerization. (2008). In *Encyclopædia Britannica*. Retrieved May 6, 2008, from [http://search.eb.com](http://search.eb.com/)

***Encyclopedia article***

Kinni, T. B. (2004). Disney, Walt (1901-1966): Founder of the Walt Disney Company. In *Encyclopedia of Leadership* (Vol. 1, pp. 345-349). Thousand Oaks, CA: Sage Publications.

***Research reports and papers***

References to a report must include the following elements: author(s), date of publication, title, place of publication, and name of publisher. If the issuing organization assigned a number (e.g., report number, contract number, or monograph number) to the report, give that number in parentheses immediately after the title. If it was accessed online, include the URL.

***Government report, accessed online***

U.S. Department of Health and Human Services. (2005). *Medicaid drug price comparisons: Average manufacturer price to published prices* (OIG publication No. OEI-05-05- 00240). Washington, DC: Author. Retrieved from <http://www.oig.hhs.gov/oei/reports/oei-05-05-00240.pdf>

***Government reports, GPO publisher, accessed online***

Congressional Budget Office. (2008). *Effects of gasoline prices on driving behavior and vehicle markets: A CBO study* (CBO Publication No. 2883). Washington, DC: U.S. Government Printing Office. Retrieved from <http://www.cbo.gov/ftpdocs/88xx/doc8893/01-14-GasolinePrices.pdf>

***Technical and/or research reports, accessed online***

Deming, D., & Dynarski, S. (2008). *The lengthening of childhood* (NBER Working Paper 14124). Cambridge, MA: National Bureau of Economic Research. Retrieved July 21, 2008, from <http://www.nber.org/papers/w14124>

***Document available on university program or department site***

Victor, N. M. (2008). *Gazprom: Gas giant under strain*. Retrieved from Stanford University, Program on Energy and Sustainable Development Web site: <http://pesd.stanford.edu/publications/gazprom_gas_giant_under_strain/>

***Audio-visual media***

References to audio-visual media must include the following elements: name and function of the primary contributors (e.g., producer, director), date, title, the medium in brackets, location or place of production, and name of the distributor. If the medium is indicated as part of the retrieval ID, brackets are not needed.

***Videocassette/DVD***

Achbar, M. (Director/Producer), Abbott, J. (Director), Bakan, J. (Writer), & Simpson, B. (Producer) (2004). *The corporation*[DVD]. Canada: Big Picture Media Corporation.

***Audio recording***

Nhat Hanh, T. (Speaker). (1998). *Mindful living: a collection of teachings on love, mindfulness, and meditation* [Cassette Recording]. Boulder, CO: Sounds True Audio.

***Motion picture***

Gilbert, B. (Producer), & Higgins, C. (Screenwriter/Director). (1980). *Nine to five* [Motion Picture]. United States: Twentieth Century Fox.

***Television broadcast***

Anderson, R., & Morgan, C. (Producers). (2008, June 20). *60 Minutes* [Television broadcast]. Washington, DC: CBS News.

***Television show from a series***

Whedon, J. (Director/Writer). (1999, December 14). *Hush* [Television series episode]. In Whedon, J., Berman, G., Gallin, S., Kuzui, F., & Kuzui, K. (Executive Producers), Buffy the Vampire Slayer. Burbank, CA: Warner Bros.

***Music recording***

Jackson, M. (1982). Beat it. *On Thriller* [CD]. New York, NY: Sony Music.

***Undated Web site content, blogs, and data***

For content that does not easily fit into categories such as journal papers, books, and reports, keep in mind the goal of a citation is to give the reader a clear path to the source material. For electronic and online materials, include stable URL or database name. Include the author, title, and date published when available. For undated materials, include the date the resource was accessed.

***Blog entry***

Arrington, M. (2008, August 5). The viral video guy gets $1 million in funding. Message posted to [http://www.techcrunch.com](http://www.techcrunch.com/)

***Professional Web site***

National Renewable Energy Laboratory. (2008). *Biofuels*. Retrieved May 6, 2008, from <http://www.nrel.gov/learning/re_biofuels.html>

***Data set from a database***

Bloomberg L.P. (2008). *Return on capital for Hewitt Packard 12/31/90 to 09/30/08*. Retrieved Dec. 3, 2008, from Bloomberg database.

Central Statistics Office of the Republic of Botswana. (2008). *Gross domestic product per capita 06/01/1994 to 06/01/2008* [statistics]. Available from CEIC Data database.

***Entire Web site***

When citing an entire Web site (and not a specific document on that site), no Reference List entry is required if the address for the site is cited in the text of your paper.

Witchcraft In Europe and America is a site that presents the full text of many essential works in the literature of witchcraft and demonology (<http://www.witchcraft.psmedia.com/>).

For more detailed information on APA citation style such as information on articles in press, journal special issues and supplements, translations, et cetera, see the [Publication Manual of the American Psychological Association](http://cornell.worldcat.org/oclc/316736612) and the [APA Style Guide to Electronic References](http://cornell.worldcat.org/oclc/162653855).

**Contents**

Introduction 3

1 The Aim and Objectives of the Bachelor Thesis 4

2 Bachelor Thesis Work Organization 6

3 Topics for the Bachelor Thesis 7

4 Structure and Content of the Bachelor Thesis 10

4.1 General Requirements

4.2 Title Page

4.3 Task for the Bachelor Thesis

4.4 Abstract

4.5. List of Documents

4.6 Contents

4.7 Abbreviations and Symbols

4.8 Introduction

4.9 Main Part

4.10 Conclusions

4.11 List of References

4.12 Appendices

5 Layout Requirements 20

5.1 Main Requirements to the Explanatory Note

5.2 Requirements to the Layout of the Main Body of the Text

5.3 Page Numbering of the Explanatory Note

5.4 Requirements to the Text Presentation

5.4.1 Text Division

5.4.2 Lists

5.4.3 Formulas and Equations

5.4.4 Tables

5.4.5 Figures

5.4.6 Writing the Program Code and Its Fragments

5.4.7 References

5.4.8 Requirements to the List of Reference Sources

5.4.9 Requiremenets to Appendices

5.5 Requirements to the Graphic Part

6 Getting Ready to the Bachelor Thesis Defense 33

6.1 Preparing documents

6.2 Revision and Plagiarism Test

6.3 Quality Control

6.4 Preparing a Report

6.5 Preparing Visual Materials

6.6 Preparing to Answer Questions

6.7 Report Rehearsal

7 Defense of the Bachelor Thesis 36

8 Evaluation Criteria 38

Reference Sources 40

Appendices 41

1. \* In case the project has one. [↑](#footnote-ref-0)