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COMPUTER ARCHITECTURE

Methodical instructions guidelines for the implementation and design of a course project

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Methodological instructions are intended for the implementation and design of a course project in the educational discipline "Computer Architecture". The purpose and tasks of the course project are the use of theoretical knowledge acquired by students during the study of the course to obtain practical skills in the creation of effective software, using the capabilities of controlling computer modules at the level of input/output control ports, as well as independent solution of a specific professional problem in the specified direction

Since this course project is carried out by students of NTU "KhPI" bachelor's degree 123 "Computer engineering" in the 3rd semester, and is the first course project in the curriculum, the "Methodical instructions" also contain information on the basic requirements for the design of text documents, and provides a holistic view of the subject matter, the order of execution and scope of work, the content of the constituent parts of the documents of the course project on the educational discipline "Computer Architecture".

Intended for full-time and part-time students of speciality 123 "Computer Engineering", it can also be useful for both beginners and experienced programmers in creating effective software.

Table 3. Bibliogr. 9 names

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CONTENT

LIST OF CONVENTIONS, SYMBOLS, UNITS, ABBREVIATIONS AND TERMS

DB	–	Database;
LD	–	list of documents;
SEC	–	State Examination Commission;
DP	–	diploma project;
DW	–	diploma work;
USDD	–	unified system of design documentation;
USPD	–	unified system of program documentation;
CE	–	cmputer engineering;
CEP	–	computer engineering and programming
CS	–	computer science;
SRWS	–	scientific - research work of the student;
NTU « KhPI »	–	National Technical University « KhPI »;
OH	–	occupational health;
CTP	–	computer technology and programming;
DBMS	–	database management system;
SHEI	–	standard of a higher education institution.

INTRODUCTION

Computerization of society has set new challenges in the field of education. A new direction was formed - informatics, which involved scientific substantiation of the laws of information creation and processing, development and creation of computerized systems and environments, e-information fields (networks, banks). The questions of computational mathematics, programming, systems engineering and circuit engineering were combined into an organic whole. The need for interrelated study of these complex problems first arose during the training of specialists in the development and operation of computer systems. Now all computer users should know these questions to some extent, that is, now it concerns all specialists.

In the modern training of specialists in the field of computer engineering, it is possible to conventionally distinguish three periods of study, which consider the following main issues:

1) the first period - the basics of computational mathematics, general issues of algorithmization, one or two programming languages, including assembly language programming, issues of the general organization of the functioning of computer systems are studied;

2) intermediate period - issues of computer system architecture, system engineering and circuit engineering of computer systems, system programming are studied;

3) the final period - the functional and schematic organization of various nodes and modules of computer systems, the organization of functioning of computer networks, system software, CAD and operation of computer systems and networks are studied.

Computer architecture is considered mainly on the example of the most common IBM PC computers today. The main principles of building a discipline are as follows:

- during considering the architecture of computers, the main attention is focused on architectural solutions when building various modules, and the characteristics of specific implementations (list of control signals, technical characteristics of speed, memory capacity, etc.) are practically not considered (the specified characteristics change dynamically, and their current value can be found in the reference literature). Such an approach corresponds to the subject of the discipline, provides an opportunity to present a large amount of material in a reasonable volume and allows to remain relevant in the rapidly changing world of computers;

– the architecture of individual modules is inextricably linked with the ability to manage at a low level (the level of control registers and the address space of input/output ports to which these registers are mapped). The authors are convinced

that the knowledge of module management at the level of registers allows one to fully study the architectural features of the computer and its individual modules in order to use them effectively when creating software;

- in the study guide, for almost all modules, the study of architecture is illustrated with examples of programming at the level of control registers.

These principles give students, in addition to knowledge of architecture, the ability to develop control programs (prototypes of device drivers).

Such a complex approach to the study of the discipline forces students to understand all the nuances of the architectural features of individual PC modules (control programs do not work without this).

These methodological instructions are intended for the implementation and design of a course project in the educational discipline "Computer Architecture". The purpose and tasks of the course project are the use of theoretical knowledge acquired by students during the study of the course to obtain practical skills in the creation of effective software, using the capabilities of controlling computer modules at the level of input/output control ports, as well as independent solution of a specific professional problem in the specified direction

Since this course project is carried out by students of NTU "KhPI" bachelor's degree 123 "Computer engineering" in the 3rd semester, and is the first course project in the curriculum, the "Methodical instructions" also contain information on the basic requirements for the design of text documents, and provides a holistic view of the subject matter, the order of execution and scope of work, the content of the constituent parts of the documents of the course project on the educational discipline "Computer Architecture".

1 GENERAL PROVISIONS

1.1 Purpose and tasks of project

The course project in the academic discipline "Computer Architecture" is carried out by bachelor's degree students of 123 "Computer Engineering" in the 3rd semester. The purpose of the course design is to use the theoretical knowledge gained by students during the course to obtain practical experience in creating effective software.

The design task is an independent solution of a specific professional problem in the specified direction.

1.2 Project topics

Topics of course projects are listed in Section 5. In addition, upon agreement with the project manager, there may be other topics that correspond to the current problems of developing effective software in various applied fields, using the control capabilities of computer modules at the level of control I/O ports.

1.3 Types of course projects

Topics of course projects can be individual or complex. Individual projects are dedicated to solving local engineering problems. Complex projects are devoted to the development of several interdependent engineering tasks united by a single goal.

1.4 Project structure

The composition and content of the course project must correspond to the approved topic and the task received. The content of the diploma project is developed by the student together with the project manager.

2 CONTENTS OF DOCUMENTS BASED ON DESIGN RESULTS

2.1 List of documents

The goal of design is the development of specialized software. In general, based on the results of designing specialized software, the developer compiles software documentation.

Mandatory program documents include:

- technical task;
- explanatory note;
- program text;
- specification.

If necessary, according to the requirements of the manager, other program documents are drawn up:

- operator handbook;
- programmer handbook;
- handbook of the system programmer;
- the program and methodology of testing, etc.

2.2 Description of documents

2.2.1 Title page

The title page of the documentation set contains the topic of the project and the names of the developers (manager and executor). An example of the design of the general title page, other structural elements of the course project and the procedure for their follow-up are given in Addendum A.

Note. In Addendum A, the combination KH-92XX means the group in which the student studies, for example, KH-921a, and the combination XXXX - the number of the Gradebook.

2.2.2 Abstract

The abstract for the set of documents contains a short list of problems solved during the design. The abstract must be written in Ukrainian and English. If necessary and at the request of the manager, the abstract is drawn up in other languages, for example, German. An example of an abstract is given in Addendum A.

3 REQUIREMENTS FOR DESIGN OF PROGRAM DOCUMENTS

The composition and content of program documents are established by State standard GOST 19.101. Program documents are drawn up in accordance with the requirements of the Unified System of Program Documentation.

3.1 Composition of program documents

Program documents consist of:
- introductory part;
- the main part;
- addendum.

3.1.1 Introductory part

The introductory part of the program document consists of:
- approval page;
- title page;
- abstract in Ukrainian and English. An abstract must be present if it is mandatory for this document. In other cases, the need for annotation is determined by the manager and the student;
- content;
– a list of conventions, symbols, units, abbreviations and terms (the need for this element is determined by the project manager).

3.1.2 Main part

The main part of the program document consists of:
- introduction;
– the main text part (sections of the document);
- conclusions;
– recommendations (the need for this part is determined by the project manager);
- a list of sources of information.

3.1.3 Addendums

The composition of the addendums is determined by the project manager and the student.

3.2 Types of program documents

Table 1 shows the types of documents depending on the stage of development and their codes.

Table 1 – Types of program documents

Code	Type of document	Stage of project development			
		Technical task	Sketchy	Technical	Operating
-	Specification	-	-	|	*
12	Program text	-	-	*	+
13	Program description	-	-	+	+
34	Operator handbook	-	-	+	+
81	Explanatory note	+	+	-	-
90	Technical task	+	-	-	-
91-99	Other documents	-	+	+	+

Conventions:

* – the document is mandatory;

| – the document is mandatory for complexes that have independent application;

+ – the need to draw up the document is determined at the stage of development and approval of the technical task;

- – do not make the document.

Notes:

1. According to the requirements for text documents, they are executed with a line spacing of 1.5, but when performing course design, it is allowed to develop a document with an interval of 1.0.

2. According to the requirements for text documents, each section of the text must start on a new page, but if the volume of the section is small, it is allowed to place several sections on one page.

3.2.1 Technical task

The technical task is developed in accordance with the requirements of the USPD GOST 19.201-78.

During the course design, some sections and subsections of the technical task are not included in the document in accordance with the requirements of the USPD.

An example of a technical task for course and diploma project is shown in Addendum A.

3.2.2 Explanatory note

3.2.2.1 Content and design requirements. The explanatory note contains:
– approval page;
– title page;
- abstract;
- content;
- the main part.

3.2.2.2 Sections of the main part. The main part of the document contains sections:

a) introduction, which includes: the name of the program and (or) a convention of the development topic; documents on the basis of which the development is being carried out with the indication of the organization and the date of approval;

b) purpose and field of application, indicating: the purpose of the program; a brief description of the application area of the program;

c) technical characteristics, which includes subdivisions:

– formulation of the task for program development, description of applied mathematical methods and, if necessary, description of assumptions and limitations associated with the chosen mathematical apparatus;

– a description of the algorithm and (or) the operation of the program with the justification of the choice of the scheme of the algorithm for solving the problem, possible interactions of the program with other programs;

– description and justification of the choice of the method of organization of input and output data;

– description and justification of the choice of the composition of technical and software tools on the basis of calculations and (or) analyses, distribution of data carriers used by the program;

d) expected technical and economic indicators, where the technical and economic indicators determining the preference of the selected option of the technical solution, as well as, if necessary, the expected operational indicators are shown;

e) sources used in development, containing a list of scientific and technical publications, normative documents and other scientific and technical materials, which are referenced in the main text;

e) addendumes in which tables, justifications, methods, calculations and other documents used in the development are placed.

If necessary, the document includes schemes of algorithms that are performed in accordance with the requirements of the USDD GOST 19.701-90.

An example of the content of the explanatory note is given in Addendum A.

4 BASIC REQUIREMENTS FOR THE DESIGN OF TEXT DOCUMENTS

4.1 General instructions

Text documents (program documents, etc.) are drawn up on sheets of A4 format (210 x 297 mm). If necessary, (images of diagrams, tables, pictures) you can use sheets of A3 format (297 x 420 mm), folded to A4 format. Documents are typewritten (with the help of computer technology - in the Times New Roman font of the Word text editor, size 14 points and one and a half line spacing) on one side of a sheet of white paper, in the Ukrainian language.

The size of the fields: upper - 20mm, left - 25mm, lower - 20mm, right - 15mm.

Pictures (including algorithm schemes), tables, are drawn by machine, pencil, or black paste.

4.2 Rules for design of text documents

4.2.1 References to normative literature

References to normative literature (standards, rules, technical conditions, instructions) and other sources (books, articles, patents, or copyrights for inventions) in the text of the explanatory note must be made if they contain information confirming the validity of the accepted solutions, calculation methods, selection of formulas, coefficients, normative values. During referencing, you must indicate in square brackets the serial number of the list of references given at the end of the note, for example [1], [3,5,7].

4.2.2 Numbering of pages

Page numbering is throughout (including addendumes). The first page of the note is the title page (it is not numbered), the second is the task, the third is the abstract, the fourth is the content, etc.

Page numbers are given in Arabic numerals in the upper right corner without a point.

It's necessary to insert page numbers from the second sheet of the Introduction.

4.2.3 Construction of the text

Text documents must be written in accordance with State standard DSTU 3008-95.

A text document can contain continuous text and text divided into columns (specifications, tables, etc.).

It is not allowed to embellish the text by changing the font, underlining words, phrases, or names of rubric elements, using colorful letters, etc.

Structural elements of the text are: section, subsection, paragraph, subparagraph.

The structural elements of the sections: "CONTENTS", "LIST OF CONVENTIONS, SYMBOLS, UNITS, ABBREVIATIONS AND TERMS", "INTRODUCTION", "CONCLUSION", "LIST OF SOURCES OF INFORMATION" are not numbered, and their names serve as headings of structural elements.

Each section of the text must start on a new page and have sequential numbering within the entire note with Arabic numerals without points, for example: 1, 2, 3, etc.

The subsection numbering consists of the section number and the serial number of the subsection, separated by a point. Do not put a point after the subsection number, for example: 1.1, 1.2, etc.

If there are paragraphs in the text, then within each section (subsection) they must have sequential numbering and their number consists of the section number and the serial number of the subsection, paragraph, separated by a point. Do not put a point after the paragraph number, for example: 1.1, 1.2 or 1.1.1, 1.1.2, etc. In the case when the text is divided only into paragraphes, they should be numbered with serial numbers, with the exception of addendumes.

Subparagraphes of the text are numbered separately within each paragraphes. Their numbers consist of the section number, ordinal numbers of the subsection, paragraphes and subparagraphes, separated by a point, for example: 2.1.1.1, 2.1.1.2, 2.1.1.3, etc. If there are no subsections in the section and there are paragraphes and subparagraphes, the number of the latest consists of the section number, serial numbers of the paragraphes and subparagraphes, separated by a point, for example: 1.2.5 (fifth subparagraphes of the second paragraphes of the first section). Do not put a point after the subparagraphes number.

Each section, subsection, paragraph and subparagraph should have a short title that corresponds to the content. The headings of the structural elements of the explanatory note and its sections are placed in the middle of the line and written in capital letters, while subsections, paragraphs and subparagraphs begin with a paragraph indent and are written in small letters (except for the first capital letter). Headings are not underlined and a point is not put at the end. The transfer of words in titles is not allowed. If the title consists of two or more parts, they are separated by a point.

The distance between the title and the following and previous text should be at least two lines.

It is not allowed to place the name of the section, subsection, paragraph and subparagraph at the bottom of the page if only one line of text is located after it (prohibition of "hanging lines").

4.2.4 Presentation of the text

The presentation of the text should be short, clear, which excludes subjective interpretation. The text is presented in accordance with the standard and technical terms adopted in the scientific and technical literature, that is, the text is presented in the third person in the present tense, using verbs of indefinite form. For example, instead of "I accept" or "we accept", it is necessary to write "it was accepted", "the calculation data is presented...", "the section considers..." etc.

Abbreviations of words in the text and captions under the illustrations are generally not allowed. DST 2.316-81 defined exceptions that allow shortening of individual words and phrases of the text. Main exceptions:

etc. - only at the end of the phrase;

comp. (compare), tab., fig., p. (page), art. (article) - for references and footnotes in the full text.

If a special system of abbreviations or naming words is adopted in the note, then the list of adopted abbreviations mast be given in the document.

The turnover "from...to" in the text should be avoided. It can be replaced by a limit of 5–10; or by points 40...60. Turnover is used only in the case of a transition from a positive to a negative value, for example: "from 50 to -80". Abstract numbers up to 9 are written in words, over 9 - in numbers (three curves; 10 sections, etc.).

Numbers with dimensions are written only in numbers, for example, 3 km, 5 kg, etc. Fractional values are entered only with numbers - "1/4 h" etc.

Ordinal numerals, as a rule, are indicated with case endings: 7th day, 2nd line; 1st, 2nd and 5th graphs. You can write quantitative numerals without case endings, for example, "on 20 sheets", "April 21", etc.

Numerical values in the text are written only from 0.1 to 1000. For larger values, multiple units are entered (kilo - 10^3; mega - 10^6; giga - 10^9; tera - 10^{12}; peta - 10^{15}; eska - 10^{18}), and for smaller values - fractional units (santa – 10^{-2}; milli – 10^{-3}; micro – 10^{-6}; nano – 10^{-9}; pico – 10^{-12}; femto – 10^{-15}; atto – 10^{-18}).

4.2.5 Designing illustrations

In the explanatory note, only such illustrations (pictures, graphs, diagrams, photographs) should be placed that enrich, help to more fully and deeply perceive the content of the project, in addition to insignificant illustrations that do not correspond to the main task. When citing illustrations by other authors, it is necessary to strictly comply with the requirements of the current legislation on

copyright, that is, to give a reference to the literary source from which this illustration was taken.

As a whole, the illustrations of the explanatory note should be a system, each illustration should correspond to the text and vice versa.

The illustrations included in the explanatory note must comply with the requirements of the USDD and USPD standards.

The number of illustrations should be sufficient to explain the taught material. Illustrations can be located in the text of the note immediately after the link to them or on the next page. In addition, they can be given in addendumes.

Illustrations may be made on white or graph paper with a black pencil or ampoule.

You can put photos, photocopies, etc. in the note. It is not recommended to place pictures larger than A4 format (210×297 mm) in the note. When posting photos smaller than the specified format, they must be pasted on standard sheets of white paper.

All illustrations given in the note, regardless of the type and method of their execution, are marked with the word "Fig." and numbered with Arabic numerals within the entire text or each section (if there are a large number of them). In the case when illustrations are numbered within a section, the illustration number consists of the section number and the serial number of the illustration, separated by a point. The number of the illustration in the text is indicated as follows: Fig. 1. or Fig. 2.1. (the first illustration of the second section).

When referring to an illustration in the text, its full number should be indicated, for example, fig. 1, fig. 1.5. Repeated references to previously mentioned illustrations are given with the word "see", for example, (see fig. 4) or (see fig. 1.2).

If there is one illustration in the note, it must be numbered taking into account the above provisions.

Illustrations must have a thematic name that begins with a capital letter, without a point at the end and is placed below the illustration. If necessary, the illustrations are supplemented with explanatory data.

Example:

Fig. 1.15. The scheme of the elements of the cassette:
a) film unwinder; b) rollers; c) drive roller.

A graph is a geometric representation of the relationship between quantities using lines on a plane in Cartesian rectangular coordinates. When studying and managing processes of various nature, the following types of graphs are used: illustrative and informational, analytical, calculation and others. The next recommendations should be followed when performing such graphs.

Graph axes are made with a solid line of standard thickness (DST 2.303-68) without using arrows at their ends. For the convenience of constructing and reading

the graph, a coordinate grid should be used, which is made with lines twice as thin as the axis lines.

Numerical values do not have to be placed near each line of the grid, but it is convenient to place them through one such line. The curves of the graphs are made with lines with a thickness equal to the thickness of the main line. It is recommended to draw different curves in the same coordinate axes with lines of different types (solid, dash-dotted, dashed), mark them with serial numbers with the following interpretation, and mark them with points of different configurations (triangles, squares, rectangles, circles).

The size of the points should be 1.5-2 times the thickness of the graph line. If the line is drawn directly through the points, then breaks must be provided for them in the curve. When the points on the graph are the result of experimental studies and, as a result, there is a scatter of data, the curve should be drawn so that the points are evenly spaced on both sides of it.

The scales on the horizontal and vertical axes may be arbitrary and different. However, not only the visibility of the graph, its accuracy, but also the efficiency of using the graph field depends on the choice of scales. Therefore, scales are chosen in such a way that a curve or a family of curves occupies the entire field of the graph.

You can start the scale from any number, not necessarily from zero. If both scales start from zero, then zero is set once at the intersection of the axes of the graphs. Multi-digit numbers should be converted into one-, two- or three-digit numbers by using decimal multiples or decimal units

Numerical values of quantities are placed to the left of the ordinate axis (vertical axis) and below the abscissa axis (horizontal axis). It is allowed to use several scales.

4.2.6 Construction of tables

The digital material obtained as a result of similar calculations, the list of equipment, various technical and economic indicators of the enterprise, characteristics of the object and other data are drawn up in the form of tables. Information that cannot be reproduced in other ways (in the form of diagrams, graphs, nomograms, etc.) is presented in tabular form.

The table is placed after the first mention of it in the text or on the next page. In the explanatory note, the tables must correspond to the sample according to State standard DSTU 3008-95. If there are several tables in the text, they are numbered with Arabic numerals throughout the document. An inscription of the type "Table 2" or "Table 1.2" (the second table of the first section) is placed to the left above the table without quotation marks and points.

All tables should be referenced in the text, for example, (Table 2) or (Table 3.1). When re-referencing - (see table 2) or (see table 1.4) If there is one table in the text, it is assigned a number in accordance with the above requirements.

The number of columns and rows, the inclusion of subheadings and other features of the table structure are determined by the needs of each specific case. Table column headings begin with uppercase letters, and subheadings begin with lowercase letters if they form one sentence with the heading. If the subheadings have an independent meaning and are not part of the same sentence with the heading, then they are written with a capital letter. At the end of the headings and subheadings of the tables, do not put punctuation marks and indicate them in the singular.

To shorten the text of headings and subheadings, individual concepts can be replaced by letter designations if they are placed in the text or shown in the illustrations.

Indicators with the same letter designation are grouped sequentially in the order of increasing indices, for example, L1, L2, L3, etc.

The height of the rows of the table should be at least 8 mm.

When transferring part of the table to the following pages, the word "table", the title and the serial number of the table are indicated once to the left above the first part, above the other parts it is written: "Continuation of table ___" with the corresponding number indicated.

To facilitate the compilation of tables and references in the text of the note, column numbering is allowed (Table 2).

Example:

Table 2 – Normative parameters of technical equipment of various types

Parameter name	The norm for types			
	P-25	P-75	P-150	P-300
1	2	3	4	5
Maximum throughput, dm^3/s, no less	25	75	150	300
Mass, kg, no more	10	30	60	200

If the parameters have different dimensions, they are indicated in each row or column of the table, for example, "Mass, kg", "Melting temperature, 0C". With one dimension of the parameters, the abbreviated designation of the unit of measurement is placed above the table.

When the table contains columns with parameters expressed mainly in one unit of physical quantity, but there are indicators of parameters with a different dimension, an inscription of the predominant unit of measurement is placed above

the table, and information about other units of physical quantities is given in the headings of the corresponding columns (Table 3).

Table 3 – Dimensions in mm

Conditional passage Dc, mm	D	L	L1	L2	Mass, kg
50	160	180			160
80	195	210	525	600	170
100	215	230	530	610	190

If the parameters of one column have the same values in two or more subsequent rows, then it is allowed to enter this parameter in the table for these lines only once (see Table 3).

If all the data in a row are given for one physical quantity, then its unit of measurement is indicated in the corresponding row of the side of the table (Table 2).

The words "more", "less", "not less", "within" should be placed next to the name of the corresponding parameter of the indicator (after the unit of the physical quantity) in the side of the table (see Table 2) or column header.

In the absence of a digital or other given corresponding row of the table, a dash must be placed. The numbers in the columns of the table must have the same number of decimal places with the addition of zeros if necessary, and they are arranged so that the classes of numbers in all columns are exactly one below the other.

Units of measurement of angular values (degrees, minutes, seconds) in the absence of horizontal rows are indicated only in the first line of the table. If there are such rows in the table that separate digital data, the units of measurement of angular values are placed in all rows.

Fractional numbers are given in the form of decimal fractions, except for sizes in inches, which are written as follows: 1/2``, 1/4``, 1/8``.

4.2.7 Writing formulas

In formulas, conventional letter designations (symbols) of mechanical, chemical, mathematical and other quantities should be used only established by the relevant standards and those recommended in the textbooks of the relevant disciplines.

As a rule, one basic letter designation should be used for each physical quantity: for length - l, width - b, height - h, thickness - δ, radius - r, diameter - d, area - F, volume and capacity - V , specific volume – v, acceleration – a, rotation frequency – ω, mass – m, density – ρ, moment of inertia – J, force – P, work – W,

energy – E, dynamic viscosity – η, kinematic viscosity - v, electric current - I, electric voltage - U, e.m.f. – E, active power – P, full power – S, etc.

When performing calculations, the used formula or equations are written in a separate line with a mandatory indication of the literary source from which they are taken, and are placed immediately after the text in which they are mentioned, in the middle of the page.

In the explanatory note, all formulas should be numbered sequentially with Arabic numerals. If there is a large number of formulas, double ordinal numbering by sections is used. The number of the formula consists of the number of the section and the serial number of the formula, separated by a point.

The sequence numbers of all formulas indicate the level of the formula in parentheses at the far right. For a formula that is a fraction with a horizontal dash, the number is placed in the middle of the main line, for a formula consisting of many lines, the number is placed against its last line. When numbering a group of formulas, the serial number is placed against the center of the bracket from the right edge of the page.

Numbered formulas are placed in separate lines. Simple unnumbered formulas are allowed to be placed inside the text. For example, "...at F2/F1 > 15, the process takes place with an increase in temperature...".

For the sake of economy, it is allowed to place several small formulas on one line, and not one above the other. Example,

$$E=A+У+3+D;\ P=A+F;\ Q=P–E.$$

Formulas derived from each other and not separated by text are separated by commas.

Example:

$$f1(x, y)=S1 \quad \text{and} \quad S1 \leq S1max, \tag{4.1}$$

$$f2(x,y)=S2 \quad \text{and} \quad S2 \leq S2max \tag{4.2}$$

If the next formula is a variant of the main formula given earlier, it is allowed to number it with an Arabic number and a direct lowercase letter of the Russian alphabet typed close to the number, for example, (37a), (37b), etc.

The values of the symbols and numerical coefficients included in the formula must be given directly below the formula. The decoding should include all the notations placed in both the left and right parts of the formula. The sequence of deciphering the letter designations of quantities must correspond to the sequence of their location.

The first line of the decoding must begin with the word "de" without a colon after it, and a comma must be placed after the formula (equation).

If the decoding of the designation does not fit in one line, then its second and next lines must start from the left edge of the first word of the decoding of the first line. It is recommended to put a semicolon at the end of each decoding, and a period at the end of the last decoding. The units of measurement of physical quantities in each transcript should be separated from the text by a comma. It is necessary to align the decryption column by the "hyphen" sign.

Example:

$$\sigma_{зг} = \frac{M_{зг}}{W}, \qquad (4.3)$$

where $\sigma_{зг}$ – bending voltage in the tine, МПа;

$M_{зг}$ – bending moment, H.mm;

W – resistance moment, mm^3.

When repeating in the following formulas the designations of the values given in the previous ones, their decoding is not mandatory. However, their decoding is allowed if the formulas are far from each other.

References in the text to the formula are made as follows: "in formula (5)" or "in formula (2.5)".

To write the letters of unit relations, it is allowed to use a slash - m/s, a straight line - $\frac{m}{s}$, or by multiplying the numerator by the negative power of the denominator – m·s^{-1}. If there are several units in the denominator, they are indicated by the product, putting it in parentheses, for example: "J/(kg K)".

In formulas, you should first use round ( ), in the second - square [ ], in the third - curly { }, in the fourth - angle brackets < >.

Example:

$$y'' = < \frac{w_c^2}{J} + \{ \int_0^z dz [\int_0^y \rho F_y dz + \sum_{i=1}^{z} m_i y_i f(Z_i)] \} > + c \qquad (4.4)$$

A colon is placed in front of formulas only when it is required by the construction of the text located in front of the formula, for example,

a) "...can be presented in the form:

$$w = w_0^{\alpha} \cdot u^{\beta}, \qquad (4.5)$$

herefrom

$$\alpha + \beta = 1. \qquad (4.6)$$

Coefficients in formulas should be written before the literal expression along with it, for example,

$B=860Ne/Q_{HP}$ (right)

i $B=(Ne\cdot 860)/Q_{HP}$ (wrong)

A point on the middle line, as a sign of multiplication, is not placed before and between the letter designations of physical quantities, before and after parentheses, between coefficients in parentheses, before and after fractional expressions or between several fractions, before the signs of a radical, integral, and also argument of the trigonometric function.

Example:

$$A = \frac{m_i G \cos\varphi tg\alpha}{rn} \frac{l}{k} \frac{s}{p}, \tag{4.7}$$

$$N = 25\alpha N(n-1)(n^2+2), \tag{4.8}$$

$$Q_m = \mu f_2 \rho \sqrt{v_1^2 + 2(p_1 - p_2)/\rho + 2q(z_1 - z_2)}, \tag{4.9}$$

The multiplication sign must be placed between numerical coefficients when the argument of the trigonometric function is followed by a letter notation, as well as to separate the coefficients from expressions related to the signs of the logarithm, integral, radical, etc.

Example:

$$\alpha \sin\alpha \cdot b\cos\beta, ... \alpha\sqrt{nr+p} \cdot btg\alpha, \tag{4.10}$$

If following a trigonometric function, radical, logarithm, etc. there is a coefficient, which is a literal expression, it is recommended, if it does not violate the defined sequence, harmony or conclusion of the mathematical analysis, to swap the coefficients and thus get rid of the multiplication sign. Example:

$$\left.\begin{matrix} bxtgwt \\ r\sqrt{\alpha \sin\alpha} \end{matrix}\right\} \text{(is recommended)} \qquad \left.\begin{matrix} tgwt \cdot bx \\ \sqrt{\alpha \sin\alpha} \cdot r \end{matrix}\right\} \text{(is not recommended)}$$

The main sign of multiplication is a point on the middle line "·". The multiplication sign in the form of an diagonal cross "×" is used most often for dimensions, when transferring a mathematical dependence from one line to another on the multiplication sign, for the vector product of vectors. Example:

– overall dimensions of the technical facility $5 \times 8 \times 4$ m;

– the area of the production premises $4 \times 3{,}5$ m;

– is the vector product of vectors $\vec{A} \times \vec{B}$.

The sign of the root of the radical ($\sqrt{\ }$) should be written so that its horizontal dash completely covers the entire subordinate expression.

It is recommended to write down the formulas in the form of one line, while using the slash of the fraction instead of the straight line, in all cases where this does not harm their perception, for example,

$$K_c = \tau_k /(\tau_{nk1} + \tau_{nk2} + \tau_{nk3}) . \quad (4.11)$$

If the formula is so long that it does not fit on one line, it is partially moved to another line. First of all, the transfer should be done on the signs of the equation and the ratio between the left and right parts of the formula ($=, \approx, <, >, \leq, \geq$ etc.), in the second - on points (...), addition and subtraction signs ($+, -, \pm$), in the third - on the sign multiplication using a diagonal cross ($\times$). When hyphenating, the specified characters are written at the end of one line and at the beginning of the next.

Transfers on the division sign are not allowed when dividing indices, exponents, as well as expressions related to the signs of the logarithm, integral, trigonometric functions, sum ($\sum$) and product ($\prod$).

If, with a short denominator, the part of the numerator of the fraction with a horizontal line does not fit on one line per page, it is recommended to write the numerator as a polynomial in parentheses and replace the horizontal line with a slash as a division sign or bring the formula to the form in which the unit divided by the denominator is multiplied by numerator. In both cases, the formula is broken by a hyphen on the plus or minus sign of the polynomial. For example, a formula

$$y = \sqrt{a_1 x + a_2 x^2 + a_3 x^3 + ... + a_n x^n} , \quad (4.15)$$

can be written in the following way:

$$y = (a_1 x + a_2 x^2 + a_3 x^3 + ... + a_n x^n)^{1/2} , \quad (4.16)$$

In this case, the transfer is carried out on the "+" or "-" sign of the polynomial.

4.2.8 Making notes

In the notes to the text and tables, only reference information that explains it is indicated. Substantial parts of the text, as well as definitions necessary for understanding the essence of the issue under consideration, are not allowed to be placed in the notes. Notes are not given on the drawings.

Notes are placed immediately after the text, table, and illustration to which they relate.

The word "Note" is printed with a capital letter from a paragraph indentation, it is not underlined, a point is placed after the given word and the text of the note is given with a capital letter in the same line.

If there are several notes, a colon is placed after the word "Notes". Notes are numbered with Arabic numerals with a point after the number. Each note is written on a new line from the paragraph. Note text begins with a capital letter.

Example:

Notes:

1. The mode is described in more detail in Section 5.

2. ...

4.2.9 Preparation of the conclusion

Conclusions and proposals are the final stage of the course project. In the conclusions, it is necessary to analyze the results of the diploma project, the adopted ways of achieving the goal of the task, to give brief technical characteristics of the object developed in the process of project implementation. It is important to indicate that the developed object (system, device, program, database, model) fully satisfies the thesis. In the conclusion, it is possible to indicate ways of further improvement of the development, aimed at increasing its technical and economic indicators.

The volume of conclusions should not exceed one or two pages of an explanatory note with end-to-end numbering of each conclusion.

4.2.10 Drawing up a list of information sources

The list of literary sources should be given at the end of the explanatory note, starting on a new page, under the heading "List of sources of information". It includes those sources that the student used in the process of the project and to which there are references in the text.

Literary sources in the list are presented in the sequence of their mention in the text of the explanatory note. Serial numbers of descriptions in the list are references in the text (numbered references).

Bibliographic descriptions in the list are given in accordance with the current standards for library and publishing.

References to literary sources are given in the language in which they were published.

The bibliographic reference contains the following elements:

a) for books: surname and initials of the author (or authors); title of the book; place of publication - with one capital letter "M.", "K", "L." respectively for the cities of Moscow, Kyiv and Leningrad (old name) and the full name of other cities

without the word "city"; publishing house; year of publication and total number of pages of the source.

Examples:

One, two or three authors:

A.I. Povoroznyuk Computer architecture: lab. workshop / A. I. Povoroznyuk, N. V. Mezentsev, O. A. Povoroznyuk, - Kharkov: Kursor, 2016. - 131 p.

Four authors:

Basics of creating flexible automated production / L.A. Ponomarenko, L.V. Adamovych, V.T. Muzychuk, A.E. Gridasov / Ed. B.B. Timofieva. - K.: Technics, 2019. - 144 p.

Five or more authors:

Modern intellectual technologies of functional medical diagnostics: a monograph / Avrunin O.G., Bodyanskyi E.V., Kalashnyk M.V. etc. - Kharkiv: KhNURE, 2018. - 236 p.

b) for journal articles: surname and initials of the author(s); full title of the article; name of the magazine; year of publication; issue of the magazine; magazine number; the number of pages of the article.

Example:

1. Povoroznyuk A. I. Formalizing the stages of mammographic examinations in the design of a medical decision support system / Anatoly I. Povoroznyuk, Oksana A. Povoroznyuk, Khaled Shekhna // Herald of Advanced Information Technology – Odesa, ONPU 2020; – Vol.3 No.4: P. 279-291.

2. Povoroznyuk A. Application of a Multiplicative Model with Linear Partial Descriptions in Self-organization Methods / A. Povoroznyuk, O. Povoroznyuk, and others // CEUR Workshop Proceedings 2711, CEUR-WS.org 2020. – P. 31-42 http://ceur-ws.org/Vol-2711/paper3.pdf.

c) for theses of reports: surname and initials of the author (authors); full name of theses; name and venue of the conference; conference date; organization; number of theses pages.

Example:

1. A. Povoroznyuk. Modeling of mammographic examination procedures in medical decision support systems / A. Povoroznyuk, O. Povoroznyuk, H. Shekhna // "Information technologies and computer modeling"; materials of articles of the International Scientific and Practical Conference, Ivano-Frankivsk, May 18-22, 2020. – Ivano-Frankivsk: Mr. Goliney O.M., 2020. – p. 94-95.

2. A. I. Povoroznyuk Functional model of mammographic examinations / A. Povoroznyuk O. Povoroznyuk, H. Shekhna // Theses of reports of the 15th International Conference "Control and Management in Complex Systems" (CMCS-2020), Vinnytsia, October 8-10, 2020 http://ir.lib.vntu.edu.ua //handle/123456789/30620 a

d) for patents (author's certificates) for inventions: name of the document – patent (Pat.), author's certificate (A.c.); number; country of the applicant; class of invention; name; initials and surname of the authors; publication date; ballot number

Example:

Pat. 31264A of Ukraine MKY5 V 60T11/04. A method for improving the quality of traction and a device for its implementation/ V.E. Gaidukov, V.Kh. Daleka, M.D. Parrot - Publ. 15.12.2020, Bull. No. 12.

d) for methodological instructions: name of the instruction, surnames and initials of the authors, place of publication, publisher, year of publication, number of pages

Example:

A. I. Povoroznyuk Computer architecture. Methodical instructions for the implementation and design of a course project for full-time and part-time students in the field 123 "Computer engineering" / A. I. Povoroznyuk, O. A. Povoroznyuk, G.E. Filatova - Kharkiv: NTU "KhPI", 2022. - 64 p.

4.2.11 Forming addendums

Addendums are drawn up as a continuation of the project on its following pages.

In the appendums placed at the end of the explanatory note, supporting materials may be included, such as:

– additional illustrations and tables;

– intermediate mathematical proofs, formulas, calculations;

– texts of computer programs;

– structures and contents of input and output data (files, copies of screens with program results in text and graphics);

– user interface;

– instructions, testing methods;

– an additional list of sources to which there were no references in the project, but which may be of interest.

Each addendum begins with a new page and has a title written in lowercase letters from the first capital letter, symmetrically to the text. In the middle of the line above the title, in small letters, except for the first capital letter, the word "Aaddendum___" and a capital letter indicating the addendum are indicated.

Addendums should be marked consecutively with capital letters of the Ukrainian alphabet, with the exception of Є, З, І, Ї, Й, О, Ч, Ь.

Example:

Addendum A
Structure of input and output data

Addendum B
Methods of solving systems of equations

The text of each addendum can be divided into sections, subsections, paragraphs and sub paragraphs with corresponding numbering according to the above requirements. Each number is preceded by a designation of the addendum (a letter) and a point, for example, A.2 - the second section of addendum A; B.3.1 – subsection 3.1 of addendum B; D.4.1.2 – paragraph 4.1.2 of addendum D, etc.

One addendum is designated as addendum A, and if there is only one table, illustration, formula, or equation in it, they are necessarily numbered, for example, fig. A.1, table A.1, formula (A.1).

The numbering of the pages of the note and addendums must be continuous, and all addendums must be listed in the content of the explanatory note.

When referring to an illustration, table, formula or equation in the text of the addendum, it is recommended to write: "in fig. A.2"; "in table B.3"; "by formula (B.1)"; "in equation (D.5)".

5 INDIVIDUAL TASKS

The task number corresponds to the student's number in the journal. Each task contains four theoretical questions and one practical task.

Answers to theoretical questions are presented in the form of an abstract with indicating the architectural features of the module under consideration, its modes of operation and control capabilities at the level of input/output ports.

The answer to the practical task is presented in the form of an algorithm scheme and a program in any high-level programming language (C++, C#).

The total volume of answers to the individual task (the volume of the main part of the explanatory note) must be at least 15 pages of text prepared in the Word editor with subsequent printing on paper.

INDIVIDUAL TASK #1

1. Conveyor processing and associative search. Implementation in MP Intel.
2. Organization of Extended, Expanded and shadow memory.
3. Keyboard subsystem. Structural scheme and purpose.
4. Video controller. Programming of undocumented video modes.
5. Develop a program that prohibits working with the keyboard for 100 ticks (there is the generation of the "explosion" sound at this time).

INDIVIDUAL TASK # 2

1. Architecture of PC bus system. L, M, S and X buses. Their purpose and main functions.
2. Architecture of the FPU software model.
3. Architecture of the 8042 keyboard controller.
4. Control of LPT - port in EPP mode.
5. Develop a program that, analyzing FAT, determines the amount of free space and max. size of the continuous free region.

INDIVIDUAL TASK #3

1. MP Pentium 4 architecture.
2. Card isolation by PnP technology.
3. Video adapters. Architecture. Groups of control registers
4. Architecture of COM port control registers.
5. Develop a program that: finds red points in a given area of the screen using reading mode 1.

INDIVIDUAL TASK #4

1. Segmented organization of memory in protected mode.
2. Necessity and organization of dynamic RAM regeneration

3. Programming of keyboard controllers 8042, 8048. Command byte assignment.

4. Video memory management. Recording mode 0. Assignment of registers.

5. Develop a program that determines the long name of a given short file name and displays it on the screen.

INDIVIDUAL TASK #5

1. Architecture of computers with a magistral interface.

2. Physical organization of ROM microcircuits, static RAM, dynamic RAM.

3. Symbol, background and border color control (EGA VGA SVGA).

4. Video memory management. Recording modes 1, 2. Assignment of registers.

5. Develop a program that reads the registers of initial addresses and initial cycle counters of channels 4-7 of the DMA controller and plays the melody G (3 s.)-E (3 s.) -D (4 s.).

INDIVIDUAL TASK #6

1. Architecture of paging memory organization. Page directory and page table assignments.

2. FPU commands and their architecture.

3. Organization of the keyboard block. Formation of scan codes.

4. Image of pixels. The structure of video memory in graphic modes.

5. Develop a program that hatches a part of the screen with slanted lines using write mode 0 and a rotation register.

INDIVIDUAL TASK # 7

1. Architecture of computers with a radial interface.

2. The essence of memory stratification. Time diagram.

3. Algorithm of the interrupt handler from the Int9 keyboard.

4. Software and hardware shifts of graphic screens. Paging video memory organization.

5. Develop a program that, when starting, sets the alarm clock to the current time +10 seconds, and when the alarm goes off, plays the melody D (3 s.) - F (4 s.)-H (2 s.).

INDIVIDUAL TASK # 8

1. Segmented organization of memory in protected mode. Structure of selectors and descriptors.

2. The essence of the page mode of operation of the memory chip. Time diagram.

3. Organizing the keyboard buffer in RAM. Buffer expansion.

4. Using RG rotation to organize the "sprite".

5. Develop a program that determines the number of hidden files in the root directory.

INDIVIDUAL TASK # 9

1. Microarchitecture of MP Pentium.

2. Page organization of memory. Work with 4 Mbyte pages.

3. Structure of the root directory and subdirectories. Working with long names.

4. Video memory management. Recording mode 3. Assignment of registers.

5. Develop a program that fills with the given color 1 closed area of the screen, witch is bordered by color 2 .

INDIVIDUAL TASK #10

1. MP Pentium 3 microarchitecture.

2. Explain the principle of RTC real-time clock and its programming possibilities.

3. Features of the 12-bit FAT organization.

4. Video memory management. Reading modes 0. Assignment of registers.

5. Develop a program that reads the interrupt request register of the PIC controller, and if there is a request from the keyboard, emits a buzzing sound "C" for 40 ticks of the timer.

INDIVIDUAL TASK # 11

1. Plug and Play technology and its implementation in the ISA/EISA bus.

2. Organization of interrupts from the RTC real-time clock. "Indifferent" alarm time.

3. Logical organization of a floppy disk (hard disk partition). Main areas.

4. Video memory management. Reading modes 1. Assignment of registers

5. Develop a program that finds files created in September 2022 in the root directory.

INDIVIDUAL TASK # 12

1. System bus of modern PCs.

2. Microarchitecture of MP Pentium II.

3. Architecture and management of the hard disk controller. Structure of commands .

4. Purpose and operation of latch registers in video adapters.

5. Develop a program that performs a hardware shift of the graphic screen to the right and left (loads a graphic image from a file).

INDIVIDUAL TASK # 13

1. Plug and Play technology and its implementation in the PCI bus.
2. Structural scheme of the timer and assignment of timer channels. What is the minimum and maximum time interval for which the timer channel can be programmed and why.
3. Color indexing in EGA, VGA, SVGA adapters.
4. SCSI bus architecture.
5. Develop a program that reads the ISR priority request register for PIC-controller interrupts, and if there is a request from the hard disk, plays the melody E(2 s.) – G (3 s.) – C (4 s.).

INDIVIDUAL TASK # 14

1. Organization of multitasking. Task switching algorithm.
2. SSE, SSE2 technology and its implementation.
3. Formation of images on a video monitor in text mode. Management of sweep options. Sign generator.
4. Printer management.
5. Develop a program that displays a text line on the screen and smoothly changes the color of the characters of the line from black to bright red, passing through 256 shades.

INDIVIDUAL TASK # 15

1. Transmission modes from system buses.
2. Modes of operation of the timer channels and its programming.
3. Management of the hard disk controller. I/O address space and structure of commands.
4. USB bus architecture.
5. Develop a program that draws a prism and, when Z is pressed, rotates it by 10 degrees around the Z axis.

INDIVIDUAL TASK #16

1. Organization of the protected mode of the MP. Privilege levels. Assignment of call gateways and child segments.
2. Peculiarities of operation of the timer channels in read-on-the-fly and read-back modes.
3. Physical organization of hard drives. Track and sector format.
4. LPT - port management in ECP mode.
5. Develop a program that prohibits the operation of the second stage of the PIC controller for 200 ticks of the timer (at this time, the generation of a "G" buzzing sound with a frequency of 1/10).

INDIVIDUAL TASK # 17

1. Switching tasks in protected mode. TSS segments. Organization and purpose.
2. Generation of sounds and melodies with and without the use of a timer.
3. Physical organization of hard drives. Zonal structure. Internal and external geometry.
4. Control of LPT - port in EPP mode.
5. Develop a program that, analyzing the keyboard buffer, reacts on pressing capital letters of the Latin alphabet (displays them on the screen), and when pressing D, G, C plays the corresponding note (D-D, G-G, C-C) during 20 timer ticks.

INDIVIDUAL TASK # 18

1. Radial architecture of mainframes. An example of implementation.
2. Technology and organization of MMX
3. Flexible magneto-optical disks ZIP. Principles of organization.
4. Bresenheim's algorithm for line imaging.
5. Develop a program that responds to the scan codes of keys 1, 2, 3, and when they are pressed, plays the corresponding note (1-H, 2-C, 3-A) during 30 ticks of the timer.

INDIVIDUAL TASK #19

1. Microarchitecture of MP 8086-80486.
2. Architecture and principle of operation of the DMA controller.
3. Magneto-optical disks. Principles of organization.
4. Linear organization of video memory and organization in the form of bit planes. Examples.
5. Develop a program that, based on the known name of a deleted non-fragmented file, restores this file.

INDIVIDUAL TASK # 20

1. Microarchitecture of MP Pentium Pro.
2. Control information and programming of the DMA controller.
3. Optical discs. Principles of organization.
4. Structure of video memory in graphic modes. Color indexing.
5. Develop a program that draws an inclined straight line 3 pixels thick on the screen (a modification of the Bresenheim algorithm).

INDIVIDUAL TASK # 21

1. Means of MP caching. Purpose and characteristics.
2. Organization of the DMA subsystem in a PC. Assignment of page registers.

3. Operation of the video system in text mode. Selection of font tables in EGA, VGA, SVGA adapters.

4. COM port management.

5. Develop a program that, when entering text from the keyboard, performs input and moves the cursor on the screen from top to bottom (as in Chinese).

INDIVIDUAL TASK # 22

1. Data types and instruction structures in the MP Intel.

2. Organization of interrupts in PC, PIC controller architecture.

3. Creating special characters and expanding character sets in text mode.

4. LPT port management.

5. Develop a program that programs the alarm to go off at 15 minutes 20 seconds of every hour, and when the alarm goes off, it plays the melody C (4 s.) – D(3 s.) - E(2 s.).

INDIVIDUAL TASK # 23

1. Purpose and operation of the TLB translation acceleration buffer in MP 80*86.

2. Organization of banks and modes of operation of RAM microcircuits.

3. Purpose of the BOOT sector.

4. Data storage areas of video adapters. Architecture and purpose.

5. Develop a program that displays the full name in a font, all letters of which are rotated 180 degrees, after each letter the cursor increases in size.

INDIVIDUAL TASK # 24

1. Architecture of memory page organization. Work with a 36-bit physical address.

2. Organization of masked hardware interrupts in the PC. Operating modes and control information of the PIC controller.

3. Organization of logical partitions (C, D, E...) on a hard magnetic disk.

4. Images of 3-dimensional objects on the screen. Projections.

5. Develop a program that draws a "sprite" and moves it on a colorful background.

INDIVIDUAL TASK # 25

1. Purpose and principle of operation of memory cache.

2. Interrupt controller programming, OCW and ICW assignment.

3. File reading algorithm using ROOT and FAT.

4. Modification of the Brezenheim algorithm for the representation of thick lines.

5. Develop a program that fills the 2nd video page from the file, and when pressing the keys 1, 2, 3, 4 makes the corresponding quarter of the screen invisible (use palette register programming).

LIST OF INFORMATION SOURCES

1. Поворознюк А. И. Архитектура компьютеров. Архитектура микропроцессорного ядра и системных устройств: Учебное пособие. Ч.1. / А. И. Поворознюк – Харьков: "Торнадо", 2014. – 355 с.

2. Поворознюк А. И. Архитектура компьютеров. Архитектура внешней памяти, видеосистемы и внешних интерфейсов: Учебное пособие. Ч.2. / А. И. Поворознюк – Харьков: "Торнадо", 2014. – 296 с.

3. A.I. Povoroznyuk Computer architecture: methodological instructions for practical work / A. I. Povoroznyuk, O. A. Povoroznyuk - Kharkov: Kursor, 2021. – 95 p.

4. СТЗВО-ХПІ-3.01-2018. Текстові документи у сфері навчального процесу. Загальні вимоги до виконання. – Чинний від 28.09.2018.

5. ДСТУ 3008:2015. Інформація та документація. Звіти у сфері науки і техніки. Структура та правила оформлювання. – Чинний від 2017-07-01 – Київ: ДП "УкрНДНЦ", 2016. – 26 с.

6. ДСТУ ГОСТ 7.1-2006. Система стандартів з інформації, бібліотечної та видавничої справи. Бібліографічний запис. Бібліографічний опис. Загальні вимоги та правила складання. ГОСТ 7.1–2003, IDT – Чинний з 2008-04-01. – Київ: Держспоживстандарт України, 2007. – III, III, 47 с.

7. ДСТУ 3966-2009. Термінологічна робота. Засади і правила розроблення стандартів на терміни та визначення понять. – Чинний від 01.07.2010.

8. СТЗВО-ХПІ-2.01-2018. Дипломні проекти та дипломні роботи. Загальні вимоги до виконання. – Чинний від 28.09.2018.

9. Далека В. Д. Дипломне проектування в комп'ютерній інженерії: навч.-метод. посібник / В. Д. Далека, А. І. Поворознюк., А. О. Подорожняк – Харків: НТУ «ХПІ», 2020. – 56 с.

Addendum A
Example of design and sequence of following the structural elements of the course project

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

NATIONAL TECHNICAL UNIVERSITY
"KHARKIV POLYTECHNICAL INSTITUTE"

Institute Computer Sciences and Information Technologies

Department Computer Engineering and Programming

Speciality 123 Computer Engineering

Educational program Modern programming, mobile devices and computer games

COURSE PROJECT

of the educational discipline: "Computer Architecture"

Developers:

Manager:

Ph.D., Ass.
_____/ Povoroznyuk O. A. /

Executor *:*
student of the group KH-921X
_____/ Ivanov I. I. /

Kharkiv
2022

Name of the product, object or topic	Name of document	Format	Num. of pages	Notes
	General documents			
Course project of the educational	Technical task	A4	1	
discipline: "Computer Architecture"	Explanatory note	A4	15	
	Graphical documents			
	Presentation	A4	15	

				KH-921X 015 LD		
	Last name	Signature	Date			
Develop.	Ivanov I. I.			Course project of the educational discipline:“Computer Architecture”	Page	Pages
Checked	Povoroznyuk O. A.				1	1
				List of documents	NTU «KhPI» Department CEP	
Varify	Povoroznyuk O. A.					
Approv.	Zakovorotny O.Yu.					

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

NATIONAL TECHNICAL UNIVERSITY
"KHARKIV POLYTECHNICAL INSTITUTE"

Institute Computer Sciences and Information Technologies

Department Computer Engineering and Programming

Speciality 123 Computer Engineering

Educational program Modern programming, mobile devices and computer games

APPROVED
Head of Department Zakovorotny O.Yu.

«____» _____ 2022 year

TASK
for COURSE PROJECT

Ivanov Ivan Ivanovych
(прізвище, ім'я, по батькові)

1 The topic of the work According to the individual task
work manager Povoroznyuk O. A., Ph.D., Ass.
2 Deadline for submission of work by the student 09.06.2021

3 Initial data for work individual task

4 List of questions to be developed in the explanatory note

Answer the following questions:

1. Purpose and principle of operation of memory cache.
2. Interrupt controller programming, OCW and ICW assignments.
3. File reading algorithm using ROOT and FAT.
4. Modification of the Brezenheim algorithm for the representation of thick lines.

5. Develop a program that fills the 2nd video page from the file, and when pressing the keys 1, 2, 3, 4 makes the corresponding quarter of the screen invisible (use programming of palette registers).

5 List of graphic material (with exact indication of mandatory drawings) Presentation – 10 slides A4

6 Consultants of sections of work (for diploma project)

Section	Surname, initials and position of consultant	Signature, date	
		issued the task	accepted the task
Technical and economic justification of implementation SRWS			
SRWS			
Labor and environmental protection			
Plagiarism check and submission to the repository			

7 Issue date of the task 10 September 2022 year

CALENDAR PLAN

Stage number	The name of the stages of the work	Term of implementation of work stages	Note
1	Selection and justification of the topic, setting of problems and tasks	30.09.2022	
2	Analytical review of sources, choice of research methodology	20.10.2022	
3	Software development	30.10.2022	
4	Testing and debugging the program	10.11.2022	
5	Preparation of the explanatory note	15.11.2022	
6	Protection of course project	30.11.2022	

Student _____ Ivanov I. I.
(signature) (surname, initials)

Work manager _____ Povoroznyuk O. A.
(signature) (surname, initials)

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

NATIONAL TECHNICAL UNIVERSITY
"KHARKIV POLYTECHNICAL INSTITUTE"

Institute Computer Sciences and Information Technologies

Department Computer Engineering and Programming

Speciality 123 Computer Engineering

Educational program Modern programming, mobile devices and computer games

EXPLANATORY NOTE

to the course project
of the educational discipline: "Computer Architecture"

Performed by student of the 2nd year, group KH-921X

_____ / Ivanov I. I. /

(signature, surname and initials)

Manager
Ph.D., Ass.
_____ / Povoroznyuk O. A. /
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Kharkiv 2022

ABSTRACT

Report on the execution of the CP: 15 pages, 2 figures, 3 tables, 5 sources, 1 addendum.

Keywords: CACHE MEMORY, INTERRUPT CONTROLLER, FILE READING ALGORITHM, BRESENHEIM ALGORITHM, MODIFICATION, PROGRAM, PALETTE REGISTERS

Purposes, principles of operation and management capabilities of cache memory are described. Programming capabilities of the interrupt controller, assignment of OCW and ICW; file reading algorithm using ROOT and FAT are represented. Modification of the Bresenheim algorithm for the representation of thick lines is performed.

An algorithm and a program were developed that fills the 2nd video page from the file, and when pressing the keys 1, 2, 3, 4, makes the corresponding quarter of the screen invisible (use programming of palette registers).

CONTENT

Educational edition

POVOROZNYUK Anatoly Ivanovich
POVOROZNYUK Oksana Anatolyivna
FILATOVA Anna Yevgenivna

COMPUTER ARCHITECTURE

Methodical instructions
to the execution and design of the course project
for full-time and part-time students by speciality
123 "Computer engineering"

The work was recommended to the publication by prof. M. Y. Zapolovskyi

In the author's edition

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