

Міністерство освіти і науки України
Національний університет водного господарства та
природокористування
Навчально-науковий інститут автоматичної, кібернетики та
обчислювальної техніки
Кафедра комп'ютерних технологій та
економічної кібернетики

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Methodological guidelines
for the execution of laboratory work in the discipline
«Basics of Digital Technologies»
for undergraduate students of all NUWEE degree programmes of
full-time and part-time forms of education.
Module 1

Методичні вказівки
до виконання лабораторних робіт з навчальної дисципліни
«Основи цифрових технологій» для здобувачів вищої освіти
першого (бакалаврського) ступеня усіх освітньо-професійних
програм спеціальностей НУВГП усіх форм навчання.
Модуль 1

Схвалено
науково-методичною
радою НУВГП
Протокол № 10 від 25.10.2023 р.

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Методичні вказівки до виконання лабораторних робіт з навчальної дисципліни «Основи цифрових технологій» для здобувачів вищої освіти першого (бакалаврського) ступеня усіх освітньо-професійних програм спеціальностей НУВГП усіх форм навчання. Модуль 1. [Електронне видання] / Василів В. Б., Джоші О. І. – Рівне : НУВГП, 2023. – 43 с.

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Introduction

Digital competence is a key competence of the fourth industrial revolution. Confident mastery and use of digital technologies for education, employment, work, leisure and participation in public life is critically important for every citizen of Ukraine.

The aim of the course is to develop skills and abilities in such areas as: information and media literacy, communication and collaboration, creating digital content, protecting information in the digital environment, solving problems and lifelong learning.

The course is based on the European conceptual framework of digital competences for EU citizens (DigComp 2.1.).

The course "Basics of digital technologies" is divided into two content modules:

1. Digital technologies for working with text and data;
2. Creation and use of digital content.

Mastering of each module is checked using test tasks in the Moodle environment.

To successfully pass the course, the student must complete 15 laboratory works and pass two modules. Each laboratory work is evaluated in the range of 0-4 points. Each module - 0-20 points. To successfully pass the discipline, a student must score at least 60 points. The form of final control is an exam.

Вступ

Цифрова компетентність є ключовою компетенцією четвертої промислової революції. Впевнене володіння і використання цифрових технологій для навчання, працевлаштування, роботи, дозвілля та участі в суспільному житті є критично важливою для кожного громадянина України.

Завданням курсу є формування вмій і навичок в таких сферах як: інформаційна грамотність та медіа грамотність, комунікація та співпраця, створення цифрового контенту, захист інформації у цифровому середовищі, розв'язання проблем і навчання впродовж життя.

За основу курсу взято концепцію розвитку цифрових компетентностей для громадян ЄС (DigComp 2.1.).

Вивчення курсу «Основи цифрових технологій» поділено на два змістових модуля:

1. Цифрові технології роботи з текстом і даними;
2. Створення та використання цифрового контенту.

Засвоєння кожного модулю перевіряється за допомогою тестових завдань у середовищі Moodle.

Для успішного проходження курсу студенту необхідно виконати 15 лабораторних робіт та здати два модуля. Кожна лабораторна робота оцінюється в діапазоні 0-4 бали. Кожен модуль – 0-20 балів. Для успішного складання дисципліни студент має набрати не менше 60 балів. Форма підсумкового контролю – екзамен.

Module 1

Laboratory work № 1

DIGITAL TECHNOLOGIES OF THE NUWM AND DIGITAL COMPETENCES

Goal: To acquire skills in working with the services and the website of the NUWM. Digital competences testing.

Task 1: Familiarize yourself with the structure of the NUWM website. <https://nuwm.edu.ua/>.

1. On the website, you can find information about the institute where you study, the graduation department, the brand book of the university, the plan of the educational building where classes are held.
2. Corporate mail. Students need to check their corporate mail and send a letter with completed laboratory work tasks to the teacher.
3. Electronic journal.
4. Electronic class schedule
5. LMS Moodle. <https://exam.nuwm.edu.ua/>. Students need to log in to the Moodle educational platform and familiarize themselves with its structure and purpose.
6. Repository. <http://ep3.nuwm.edu.ua/> Students need to find an electronic guide for studying subjects.
7. Wikisytet. Students familiarize themselves with the university website

Task 2: Organization of work on course study

- Students get acquainted with the syllabus of the discipline, the evaluation system.
- Students need to find educational videos on YouTube by course topics. It is suggested to review the courses by Dmytro Kivganov, about Word , Excel .
<https://www.youtube.com/c/DmitriyKivganov>

Task 3: Assessment of own digital competence

Students need to familiarize themselves with the structure of the framework of digital competences for citizens of Ukraine. https://osvita.diia.gov.ua/uploads/0/1364-1_compressed.pdf

To test digital literacy skills, students must pass the Digigrams test from the Ministry of Digital Transformation of Ukraine. <https://osvita.diiia.gov.ua/>

If desired, the student can choose one of the courses offered by the Diia portal.

Due to the large amount of time spending for testing (30-40 minutes), students solve tasks independently.

Report on laboratory work #1.

The results of the Digigram test in the form of a certificate must be uploaded to the Moodle platform.

Laboratory work № 2

TEXT FORMATTING USING WORD STYLES

Goal: Create a document using WORD styles. Get skills in text formatting using styles.

Task execution procedure:

1. Create a new document.

2. In the created document, form its structure:

Page 1 – *Title page*;

Page 2- *Contents*;

Pages 3–5 – *Chapters 1–3*;

Page 6 – *Conclusions*;

Page 7 – *List of literary sources*.

Each element of the text structure (title page, contents, chapters, conclusions, list of literary sources) must be started from a new page. To do this, at the end of each element, set the command *Page break*. To display the mode *show all symbols*, use the *Ctrl + Shift + ** key combination or by clicking the icon ¶ in the *Home → Paragraph* menu.

In *show all symbols* mode breaks are set between sheets using the command *Layout → Page Setup → Insert page and section breaks → Section breaks, Next Page*.

3. On the site <http://pidruchniki.c o m/>, (or similar) copy according to the variant the structure for the essay in the following structure (Fig. 1). (student chooses the text independently).

Розділ 1. ПОНЯТТЯ ТА ЗМІСТ ФРАНЧАЙЗИНГУ	Розділ 1.
1.1. Основні поняття категорійного апарату франчайзингових відносин	1.1.
1.2. Види франчайзингу	1.2.
1.3. Економічні та організаційні аспекти формування та розвитку франчайзингових відносин	1.3.
Розділ 2. ВИДИ ТА ОСОБЛИВОСТІ ФОРМУВАННЯ ФРАНЧАЙЗИНГОВИХ СИСТЕМ ПІДПРИЄМСТВ	Розділ 2.
2.1. Види франчайзингових систем та особливості їх організування	2.1.
2.2. Зміст процесу формування франчайзингової системи з позиції диттєвого шклу франчайзингу	2.2.
2.3. Модель формування франчайзингової системи	2.3.
Розділ 3. ФРАНЧАЙЗИНГОВА ВІНАГОРОДА ЯК ЕЛЕМЕНТ ФРАНЧАЙЗИНГОВИХ ВІДНОСИН	Розділ 3.
3.1. Економічний зміст і види франчайзингових платежів	3.1.
3.2. Визначення розміру франчайзингової винагороди	3.2.
3.3. Оптимізація структури франчайзингової винагороди	3.3.

Fig. 1. Structure of the essay

4. **Necessarily** clear the formatting, for this you need to select the entire text *Ctrl+A* and use the *Clear Formatting* command (Fig. 2). The *Clear Formatting* command is also recommended to be used before working with a document that is made up of fragments of other documents. This command formats all selected text in *Normal style*, all other effects will be removed.

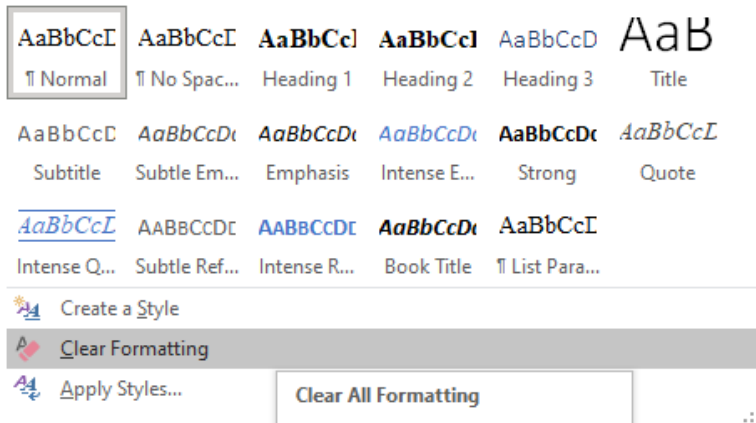


Fig. 2. Styles menu

5 . The *Clear formatting* command does not remove hyperlinks, therefore it is additionally necessary:

- select all text " Ctrl + A "
- press the key combination "Ctrl+Shift+F9"

6. Select the entire document and apply the *Normal* style to it by following the *command* sequence *Home* → *Styles* → *Normal*, with the following characteristics (Fig. 3).

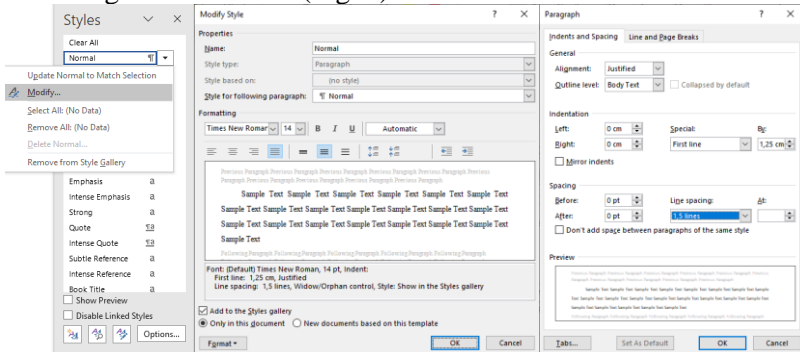


Fig. 3. *Normal* style properties

7. Apply the *Heading 1* style for section names. To do this, you need to select the title of the 1st section, and then execute the sequence of commands: *Home* → *Styles* → *Heading 1*. Then set the characteristics for the *Heading 1* style (Fig. 4).

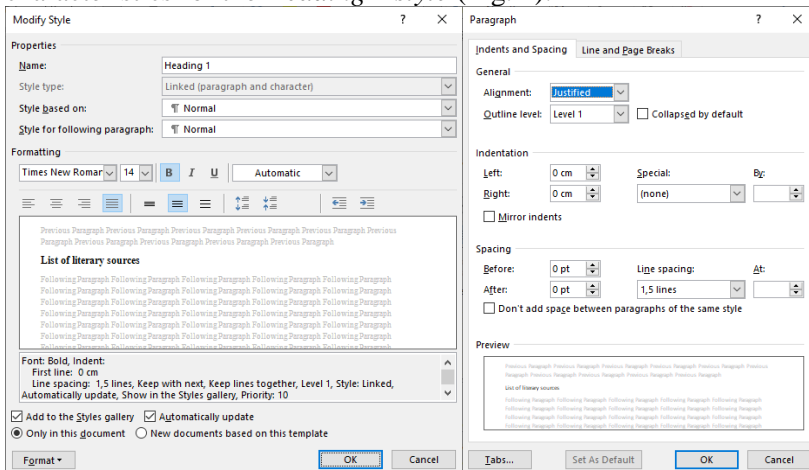


Fig. 4. Style properties *Heading 1*

Similarly, apply *the Heading 1 style* for other section names. To do this, select the appropriate names of the sections and execute the sequence of commands: *Home* → *Styles* → *Heading 1*.

8. Apply the *Heading 2 style* to the names of the subdivisions. To do this, select the name of subsection 1.1, and then execute the sequence of commands: *Home* → *Styles* → *Heading 2*. Then set the characteristics for *the Heading 2 style* (Fig. 5).

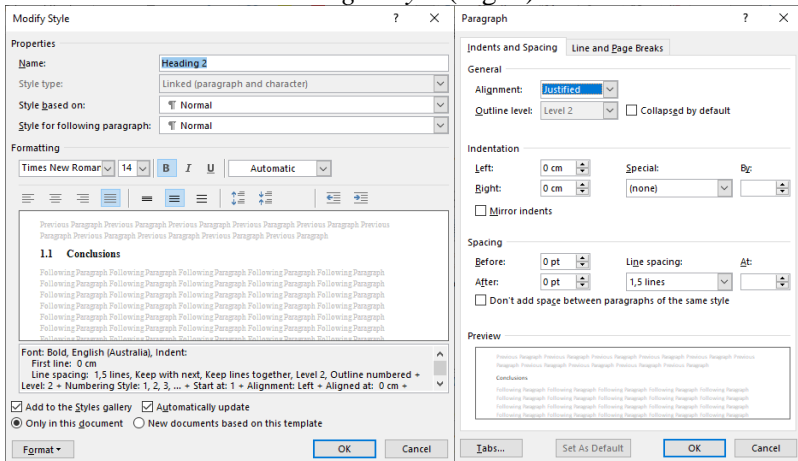


Fig. 5. Style properties *Heading 2*

Similarly, apply *the Heading 2 style* for other section names. To do this, select the appropriate names of the subdivisions and execute the sequence of commands: *Home* → *Styles* → *Heading 2*.

9. Create the content of the document. To do this, you need to go to page #2 of the document and write *CONTENTS* in the first line (all capital letters, font size 14 pt, bold font, alignment in the middle). Then go to the second line of this page and execute the sequence of commands: *References* → *Table of contents* → *Contents...*

10. Draw up the title page (Fig. 6). Format the title page as follows:

- 1–3 lines aligned in the center, normal font, font size 14 pt, single line spacing;
- 4 line alignment in the center, bold font, font size 14 pt; single line spacing, paragraph→space→before→150pt;
- 5–9 lines of width alignment, normal font, font size 14 pt, single line spacing; paragraph→indent→left→10cm;

- 5th line (additional formatting) paragraph → space → before → 150pt;
- 10 line center alignment, font normal, font size 14 pt, line spacing single, paragraph → space → before → 150pt

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Навчально науковий інститут економіки та менеджменту

ЗВІТ
з лабораторної роботи №2
дисципліна:
«Основи цифрових технологій»

Виконав:

Студент спеціальності 051 Економіка

Антохов М.В.

Перевірив:

Доц. к.т.н. Василів В.Б.

Рівне - 2021

Fig. 6. Title page

11. Number the pages. For this, a sequence of commands is executed:
Insert → *Header&Footer* → *Page number* → *Top of page* → *Right*
(*Plain number 3*).

Remark! The title page and the 2nd page (Table of Contents) are not numbered. Numbering starts from the 3rd page.

Report on laboratory work #2.

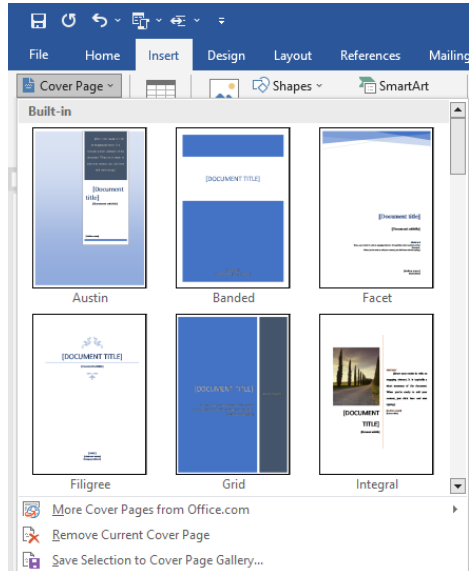
The report consists of a title page, table of contents, 3-4 chapters, in each chapter 2-3 subsections, conclusions, a list of used sources. The report must be submitted on the Moodle platform.

Laboratory work № 3

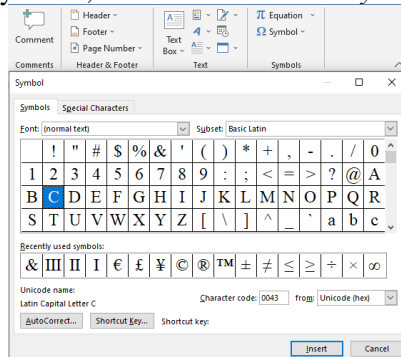
FORMATTING TABLES, FIGURES, FORMULAS USING WORD STYLES

Goal: To acquire the skills of formatting title pages, tables, figures, formulas.

Task 1. Create the cover page of the essay using the *Insert* tab → *Pages* → *Cover page*, when formatting, use your own surname, name of specialty, name of subject, year of admission.



Task 2. Creation of formulas and symbols in the text
To insert symbols, use the tab *Insert* → *Symbol*.



To insert an equation, use the tab *Insert* → *Equation* → *Insert new equation*.

Type the equations according to your own number in the list in the group log.

1	$\left\{ \begin{array}{l} N_0 \lambda_v \frac{\partial T_v(x_v, Fo)}{\partial x_v} \Big _{x_v=R_v} = \frac{N_1}{R_{v,v+1}} \times \\ \times [T_{v+1}(x_{v+1}, Fo) _{x_{v+1}=0} - T_v(x_v, Fo) _{x_v=R_v}] \\ \lambda_v \frac{\partial T_v(x_v, Fo)}{\partial x_v} \Big _{x_v=R_v} - \lambda_{v-1} \frac{\partial T_{v+1}(x_{v+1}, Fo)}{\partial x_{v+1}} \Big _{x_{v+1}=0_{v+1}} = f_2(Fo) \end{array} \right.$
2	$\ell_v = \ell_{v-1} [ch\sqrt{p/\beta_{v-1}} + 1/R_{v-1,v}^* \cdot \sqrt{p/\beta_{v-1}} sh\sqrt{p/\beta_{v-1}}] + \chi_{v-2,v-1} \ell_{v-1}^* [sh\sqrt{p/\beta_{v-1}} + 1/R_{v-1,v}^* \cdot \sqrt{p/\beta_{v-1}} ch\sqrt{p/\beta_{v-1}}]$
3	$T_v(x, Fo) = \sum_{\ell=1}^m \left[\sum_{n=0}^{\infty} \Omega_n(\mu_{n,\ell}^v(x), \phi_n) \cdot H_{\ell}^{(n)}(Fo) + \sum_{k=1}^{\infty} \frac{\bar{H}_{\ell}(p_k)}{\psi'(\phi_n, p_k)} Q(p_k, \mu_{n,\ell}^v(x)) \cdot exp(\gamma^2 Fo) \right] + z_v^*(x, Fo).$
4	$\bar{F}_{v-1,v}(p) = \bar{F}_{v-2,v-1}(p) [ch\sqrt{p/\beta_{v-1}} + 1/R_{v-1,v}^* \cdot \sqrt{p/\beta_{v-1}} sh\sqrt{p/\beta_{v-1}}] + \bar{F}_{v-2,v-1}^*(p) [sh\sqrt{p/\beta_{v-1}} + 1/R_{v-1,v}^* \cdot \sqrt{p/\beta_{v-1}} ch\sqrt{p/\beta_{v-1}}]$
5	$\bar{H}_0(p) = -h_0 Bi_0 \bar{f}_0(p) + h_0 Bi_0 M_0 \bar{z}_1^*(0, p) - \alpha_0 \bar{z}_1^*(1, p);$ $\bar{H}_1(p) = h_1 Bi_1 \bar{f}_1(p) - \alpha_1 \sqrt{p/\beta_m} \bar{F}_{m,m+1}^*(p) + h_1 Bi_1 M_1 F_{m,m+1}(p)$
6	$z_v^*(x, Fo) = \sum_{n=0}^{\infty} \beta_v^n \frac{Fo^n}{n!} \phi_v^{(2n)}(x) + \beta_v^* \sum_{n=0}^{\infty} \frac{\beta_v^n}{n!} \int_0^{Fo} (Fo - \theta)^n \frac{\partial^{2n}}{\partial x^{2n}} W_v(x, \theta) d\theta$
7	$\Omega_{v,2k+1}(Fo) = \frac{1}{(2k+1)!} \sum_{j=k}^{[m-1/2]} \frac{(2j+1)!}{(j-k)!} a_{v,2j+1} \beta_v^{j-k} Fo^{j-k}$ $\phi_v(x) = \sum_{k=0}^m a_{v,k} x^k$
8	$w_v(x, Fo) = \sum_{j=0}^m a_{v,j}^* Fo^j x^j$ $\Omega_{v,2k}(Fo) = \frac{\beta_v^*}{(2k)!} \sum_{j=k}^{[m/2]} \frac{(2j)!(2j)!}{(3j-k+1)!} a_{v,2j}^* \beta_v^{j-k} Fo^{3j-k+1}$
9	$\mu_{n,1}^v(x) = \left[\sum_{j=0}^n a_{n-j,v}(x) \eta_{v,j} + \chi_{v-1,v} 1/\sqrt{\beta_{v-1}\beta_v} \sum_{j=0}^{n-1} a_{n-j-1,v}^*(x) \eta_{v,j}^* \right] - \left[\sqrt{\beta_v/\beta_{v-1}} \sum_{j=0}^n a_{n-j,v}(x) \xi_{v,j} + \chi_{v-1,v} \sum_{j=0}^n a_{n-j,v}^*(x) \xi_{v,j}^* \right],$
10	$Z_1(\tau) = f'(\tau), Z_2(\tau) = f''(\tau), \dots, Z_n(\tau) = f^{(N)}(\tau)$

	$f_{(\tau)} - f_{(\tau)} = \int_0^{\tau} Z_1(\eta) d\eta, f_{(\tau)}^{(k)} - \sum_{v=0}^{k-1} f_{(0)}^{(k)} \frac{\tau^v}{v!} = \int_0^{\tau} \frac{(\tau-\eta)^{k-1}}{(k-1)!} Z_k(\eta) d\eta$
11	$\phi'(p_k) = \frac{1}{2\gamma_k \sqrt{\beta_2}} \left[(1 + \chi_{1,2}) \left(\sqrt{\frac{\beta_2}{\beta_1}} + 1 \right) \sin \gamma_k \left(\sqrt{\frac{\beta_2}{\beta_1}} + 1 \right) + (1 - \chi_{1,2}) \left(\sqrt{\frac{\beta_2}{\beta_1}} - 1 \right) \sin \gamma_k \left(\sqrt{\frac{\beta_2}{\beta_1}} - 1 \right) \right], \mu_{1,n}(x) = \frac{1}{(2n)!} \frac{x^{2n}}{\beta_1^n},$
12	$\phi_i = \frac{1}{(2y)!} \frac{1}{\beta_2^i} \left[(1 + \chi_{1,2}) \left(\sqrt{\frac{\beta_2}{\beta_1}} + 1 \right)^{2i} + (1 - \chi_{1,2}) \left(\sqrt{\frac{\beta_2}{\beta_2}} - 1 \right)^{2i} \right],$ $\chi_{1,2} = \frac{\lambda_1}{\lambda_2} \sqrt{\frac{a_1}{a_2}},$
13	$T_3(x, \tau) = f_{2,3}(\tau) + \frac{x^2}{2!} Z_1(\tau) + \frac{x^4}{4!} Z_2(\tau) + \dots + \frac{x^{2N}}{(2N)!} Z_N(\tau) +$ $\frac{x^2}{\lambda_3} g_2(\tau) + \frac{x^4}{3! \lambda_3} Z_1^*(\tau) + \frac{x^6}{5! \lambda_3} Z_2^*(\tau) + \dots + \frac{x^{2N+2}}{(2N+1)! \lambda_3} Z_N^*(\tau),$
14	$\int_0^{t^*} \int_{-\infty}^{+\infty} \int_{-\infty}^{+\infty} \phi_1^* \left(n \frac{\partial \phi_1}{\partial t} + \frac{\partial u \phi_1}{\partial x} + \frac{\partial v \phi_1}{\partial y} + \sigma \phi_1 - \operatorname{div}(\mu \Delta \phi_1) \right) dx dy dt =$ $= \int_0^{t^*} \int_{-\infty}^{+\infty} \int_{-\infty}^{+\infty} \sum_{i=1}^N Q_i \delta(x - x_i) \delta(y - y_i) \delta(t - t_0) \phi_1^* dx dy dt.$
15	$\varepsilon_x^{(k)} = \sum_{m=0}^3 P_m u_{m,x}^{(k)}, \varepsilon_z^{(k)} = \sum_{m=1}^2 P'_m w_{m+1}^{(k)},$ $\gamma_{xy}^{(k)} = \sum_{m=0}^3 P_m (u_{m,y}^{(k)} + v_{m,x}^{(k)}) \gamma_{xz}^{(k)} = \sum_{m=0}^3 (P_m w_{m+1,x}^{(k)} + P'_m u_m^{(k)})$
16	$\sigma_2(t, x) = E_2(t - \tau * (x)) \varepsilon_2(t, x) -$ $\int_{\tau^*(x)}^t \varepsilon_2(\tau, x) R(t - \tau * (x), \tau - \tau * (x)) d\tau;$ $\rho_1 c_1 \frac{\partial \theta_1(t, x)}{\partial t} = \frac{\partial}{\partial x} \left(\lambda_1 \frac{\partial \theta_1(t, x)}{\partial x} \right),$

Task 3. Formatting tables

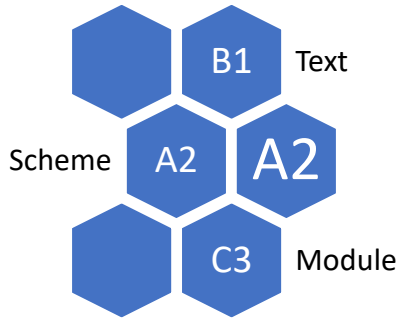
Create the following table:

Use table styles and the *Table design* and *Layout* tabs of the *Table tools* menu.

Indicator name	Field of knowledge, training direction	Characteristics of the academic discipline
The number of credits – 3	Field of knowledge 0305 "Economics and entrepreneurship"	full-time education Selective
Modules - 1	6.030503 training direction "International Economy"	Year of training:
Content modules - 1		3rd
The total number of hours – 108		Semester the 6th
Weekly hours for full-time education: classrooms – 2		Lectures 20 hours Practical, seminar - - Laboratory 20 hours Independent work Individual tasks
	Educational qualification level: bachelor	Type of control: settlement

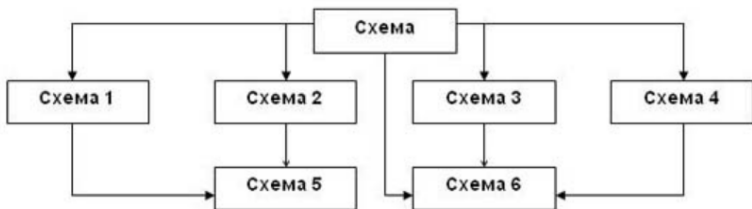
Task 4. Work with drawings

Insert a picture into the document using the *Insert* menu, item *SmartArt* . Change color and styles using the *SmartArt Tools* tab.



Make a caption of the figure 14 pt, Times New Roman alignment in the center: " **Fig.1. Figure Microsoft Word** ".

Create the following figure using standard elements from the *Shapes* menu:



The student can make his own design of figures and tables

Report on laboratory work №3.

The report file contains the title page, table of contents, completed tasks are numbered and placed on separate sheets.

Laboratory work № 4

WORD TOOLS FOR WORKING WITH ELECTRONIC DOCUMENTS

Goal: To acquire the skills of creating documents with automatic updating of references, numbering of tables and figures and the list of used literature, to create multi-level lists, cross-references, subject references, bookmarks, footnotes, hyperlinks.

Task 1. Automatic numbering of tables and figures

To perform the tasks of laboratory work №4, you can use the formatted text from laboratory work №2. If unformatted text is used, the following actions must first be performed:

- To clear the formatting, you need to select all the text "Ctrl+A" and apply the *Clear Formatting command* .
- Select the entire document and apply the *Normal style* to it by following the command sequence *Home* → *Styles* → *Normal*.
- Apply 1st-level style to section titles. To do this, select the appropriate names of the sections and execute the sequence of commands: *Home* → *Styles* → *Heading 1*.
- Use the 2nd level style for subsection names. To do this, highlight the appropriate names of the subsection and execute the sequence of commands: *Home* → *Styles* → *Heading 2*.
- Create document content. To do this, you need to follow the sequence of commands: *References* → *Table of contents* → *Contents..* or click on the table of contents and select **Update Entirely**.

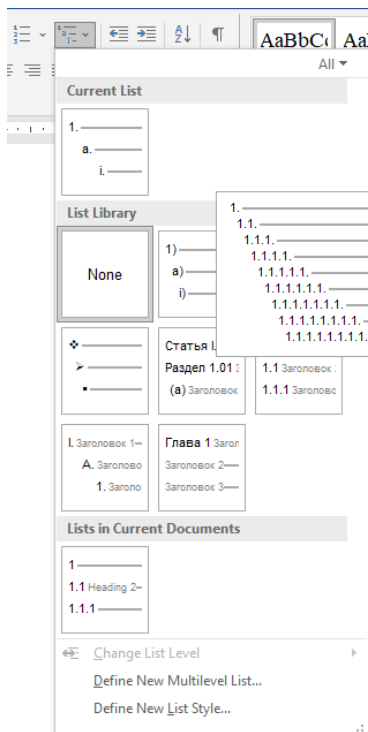
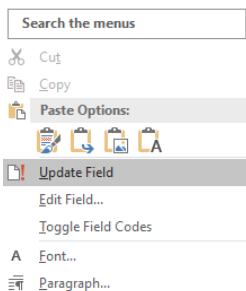
Task 2. Multilevel lists

For automatic numbering of sections and subsections in the document, you need to go to the *Home tab "Multilevel list"* and select from the library of ready-made lists a style that provides for the numbering of sections of the type 1,2,3... and subsections 1.1;1.2;...

If the document is formatted correctly, the numbering of all sections and subsections will be automatically updated. For more complex formatting of section numbering (for example, to automatically add words to the title of the section), use the command *Define new multilevel list*.

To quickly navigate through a formatted document, you can execute the sequence of commands *View →*

Navigation Pane.



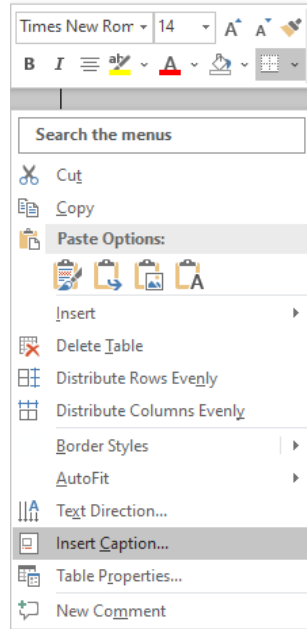
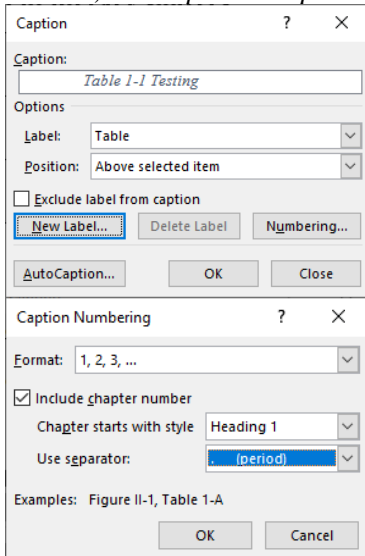
For the appearance of numbering in the table of contents, it must be updated using the command sequence *Update field → Update entire table*.

Task 3. Automatic numbering of tables

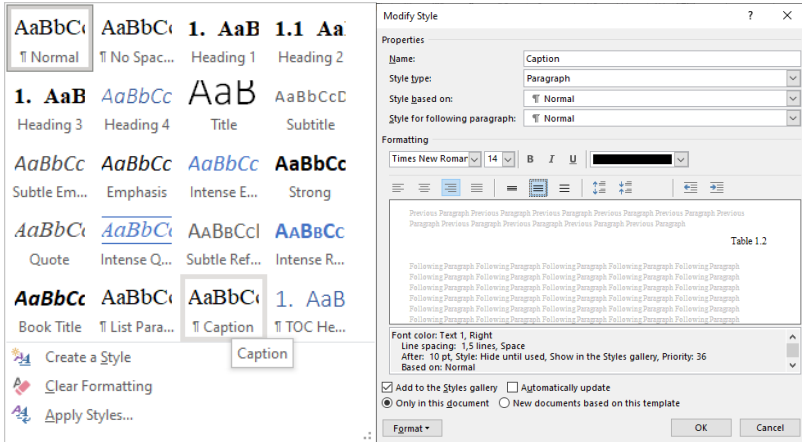
Automatic numbering of objects (tables, figures) in Word will be carried out correctly, if the text is formatted with styles and the style

of multi-level lists is defined (the previous paragraph of laboratory work).

Add a table to the formatted text using the *Insert Table* menu. Select the table and execute the *Insert caption* command, setting the following options *Label - Table; Position - above selected item; Numbering - Include chapter number, Use separator - period.*



As a result, we will get an automatic table number. If the format of the number (location, font, font size, line spacing) does not comply with the norms (14 pt non-bold font, alignment on the right edge), it is necessary to correct the *Object name* style parameters.



For verification, it is necessary to insert another table and automatically number it. To do this, you only need to select the *Insert caption* item and click OK. All other settings (number, font, alignment) will be made automatically.

Students need to set the automatic numbering of all tables in the text.

Task 4. Automatic numbering of figures

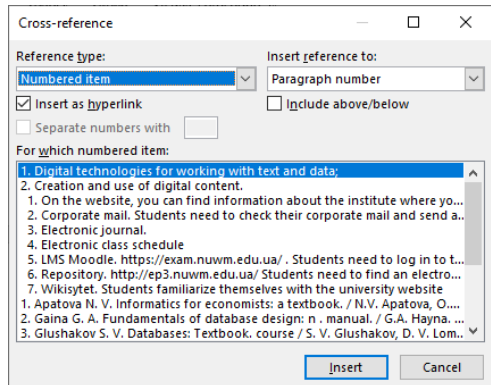
For automatic numbering of figures, it is necessary to insert a figure and perform actions similar to the numbering of tables, taking into account that the name of the figure is located under the object, aligned in the center and has the form

Fig. 1.1 Name of the drawing

Task 5. Cross-references

For automatic tracking of changes in references, Word 2019 offers the *Cross References* tool.

To add a cross-reference to the document, select the command *Insert* → *Links* → *Cross-reference*.



The type of cross-link is specified in the *Reference type* list, and the object to which this link will point is specified in the *Insert Reference to* list. For each type of link, a list of objects is offered in the *Insert Reference to* list. For example, if the link is of the *Heading type*, then in the *Insert Reference to* list, you can set the *Heading text* so that the title text is inserted directly into the link text, and you can select *Page number* so that only the page number on which it is located is inserted into the link text given title. The heading itself can be selected in the *For which heading* list at the bottom of the window. In addition to the title text and page number, the link can contain the title number, as well as simply indicate whether the referenced text is located above or below (above/below).

To create links in the text to the number of the table or figure, you need to go to the menu *Insert* → *Links* → *Cross-reference*. In the *Reference type* list, specify the type of cross-reference *Table* or *Fig.* and a specific table or figure is selected.

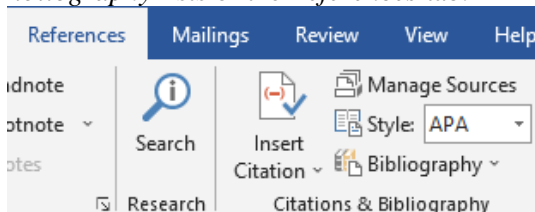
The student must cross-reference one section and all tables and figures in the text.

Task 6. Creating a list of used literature

Another type of list that can be automatically created in Word 2019 is a bibliography. In the bibliography, you can place a list of literature and other sources of information that were used in the creation of the document.

The principle of creating a bibliography is the same as for a table of contents or a list of figures: first you need to tell Word 2019 what to list, and then create it. First, note the citations in the text and indicate the source for each. Then a list of created sources is inserted on the selected page.

All commands for creating a list of used sources are in the *Citations&Bibliography* lists of the *References* tab.



First of all, it is necessary to decide on the design style of citations in the text and in the list itself. Depending on the chosen style, both references to sources in the middle of the text and the list itself on the bibliography page will be formatted differently. You can set the appropriate standard (we use the IEEE 2006 standard) in the *Style list*.

After the bibliographic data design standard has been selected, you need to go to the place in the document to which the external source corresponds and place the cursor where the name of the source in brackets will be located. This is usually the end of a paragraph or quote. By clicking on the *Insert link button* choose one of the available menu items *Add new source*, the *Create Source* dialog will appear.

The screenshot shows the 'Create Source' dialog box. At the top, there is a title bar with a question mark and a close button. Below the title bar, there are two dropdown menus: 'Type of Source' set to 'Book' and 'Language' set to 'Default'. Underneath, the section 'Bibliography Fields for APA' contains several input fields: 'Author', 'Title', 'Year', 'City', and 'Publisher'. There is also a checkbox for 'Corporate Author' and an 'Edit' button. At the bottom of the dialog, there is a checkbox for 'Show All Bibliography Fields', a 'Tag name' field with a placeholder 'Placeholder1', and 'OK' and 'Cancel' buttons.

In the *Type of Source* drop-down list, select the type of source: book, book section, journal article, article in a periodical, conference proceedings, report.

After the work on the document is completed, and all the included sources are formatted, you can add a bibliography with a list of them. To do this, place the cursor in the place where the bibliography will be inserted, and press the *Bibliography command*. In the drop-down list, choose one of the three bibliography templates.

References and *Works Cited* templates place lists of sources on separate pages. A container field is added, inside which there are separate fields for each source. If not all sources have been fully formatted, but empty container fields remain, they will not be included in the list.

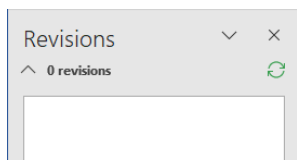
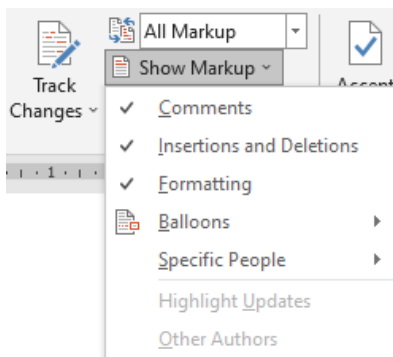
To update the table of contents, bookmarks, links, list of sources, numbering of tables and figures, indexes, it is necessary to

select the entire text or a certain list and press the *F9* button on the keyboard or *Update ...* in the drop-down list.

Students need to create a list of used literature from at least 5 sources.

Task 7. Document review

To review a document, click the *Show markup* button in the *Tracking* group on the *Review* tab. Here you can specify the changes of which elements should be tracked in the text, the ability to observe all corrections in the document at the current moment, as well as the total number of corrections and the number of



corrections of each type. These summaries can be seen by bringing up the *Reviewing pane* window.

When viewing corrections and notes, you can accept or reject any of them. Until all corrections and notes made to a document are accepted or rejected, even hidden changes will appear in displayed or sent documents. Actions for accepting or rejecting changes are combined in the *Changes* group on the *Review* tab. The changes is indicated by the full name of its author, the date and time of creation.

The student needs to make several corrections to the text.

Report on laboratory work №4.

The report file contains the title page, table of contents, tasks 1-8 are performed in the text. The results of task 9 are copied and added to the report file and included in the content of the report.

Module 2

Laboratory work № 5

CREATING TABLES AND GRAPHS IN THE EXCEL ENVIRONMENT. USE OF FORMULAS

Goal: To acquire the skills of creating tables and graphics in the MS Excel environment.

Task 1. It is necessary to calculate the wages of employees using formulas with relative and absolute references.

Progress:

1. Create a table of initial data according to the template presented in the figure of columns A, B, C, D.
2. Perform calculations using the formulas in columns E-H.

	A	B	C	D	E	F	G	H
1		Output data						
2		variant number		1				
3		Income tax rate %		18				
4		Military levy rate %		1,5				
5								
6								
7		Hourly wage calculation statement						
8								
9	№	employee's last name	hourly wage rate	worked hours	total accrued wages	income tax	military fee	all wages to be paid
10	1		100	20	2000	360	30	1610
11	2		120	10	1200	216	18	966
12	3		80	8	640	115,2	9,6	515,2
13	4		60	2	120	21,6	1,8	96,6
14	5		75	7	525	94,5	7,875	422,625
15	6		100	30	3000	540	45	2415
16	7		120	17	2040	367,2	30,6	1642,2
17		Sum		94,00	9525,00	1714,50	142,88	7667,63
18		Average	93,57	13,43	1360,71	244,93	20,41	1095,38

9	№	employee's last name	hourly wage rate	worked hours	total accrued wages	income tax	military fee	all wages to be paid	
10	1		100	20	=C10*D10	=E10*\$D\$3/100	=E10*\$D\$4/100	=F10-F10-G10	
11	2		120	10	=C11*D11	=E11*\$D\$3/100	=E11*\$D\$4/100	=F11-F11-G11	
12	3		80	8	=C12*D12	=E12*\$D\$3/100	=E12*\$D\$4/100	=F12-F12-G12	
13	4		60	2	=C13*D13	=E13*\$D\$3/100	=E13*\$D\$4/100	=F13-F13-G13	
14	5		75	7	=C14*D14	=E14*\$D\$3/100	=E14*\$D\$4/100	=F14-F14-G14	
15	6		100	30	=C15*D15	=E15*\$D\$3/100	=E15*\$D\$4/100	=F15-F15-G15	
16	7		120	17	=C16*D16	=E16*\$D\$3/100	=E16*\$D\$4/100	=F16-F16-G16	
17		Sum		=SUM(D10:D16)	=SUM(E10:E16)	=SUM(F10:F16)	=SUM(G10:G16)	=SUM(H10:H16)	
18		Average		=AVERAGE(C10:C16)	=AVERAGE(D10:D16)	=AVERAGE(E10:E16)	=AVERAGE(F10:F16)	=AVERAGE(G10:G16)	=AVERAGE(H10:H16)

Fig. 1. Calculations

Task 2. Creating diagrams

Based on the data on the quantitative composition of students of the educational and scientific institute of economics and management, create and design a diagram. For better visual perception, similar data are displayed in pie charts.

Progress:

1. create the table shown in Fig. 2.
2. select the range of cells A3:B10 (Fig. 1);
3. on the *Insert* tab, in the *Charts* group, select the type of chart *Pie*→*3-D Pie*
4. using the *Chart design* tab → *Charts Layouts* → *Add Chart Element* → *Chart title*, place the name of the diagram *above chart*.
5. using the tab *Chart design* tab → *Charts Layouts* → *Add Chart Element* → *Data labels*→ *More data levels options* check the points *Category Name*, *Percentage*, *Show Leader Lines*.

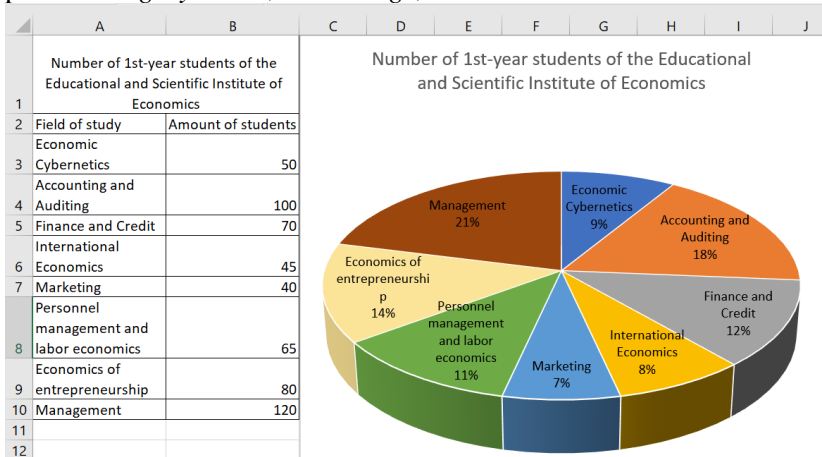


Fig. 2. Creating a pie chart

Task 3. Creation of histograms.

Based on tabular data about population in the Rivne region from 2003 to 2022, create and design a diagram. It is convenient to present similar data in histograms.

Progress:

1. form the table shown in Fig. 3.
2. select the range of cells A3:B22 containing the original data (Fig. 3);

3. on the tab *Insert*, in the *Charts* group, select the type of chart *Column*;
4. using the tab *Chart design* tab → *Charts Layouts* → *Add Chart Element* → *Chart title*, place the name of the diagram *above chart*;
5. for chart axis labels you need to choose *Add chart element* → *Axis title* → *Primary Horizontal* and *Primary Vertical*.

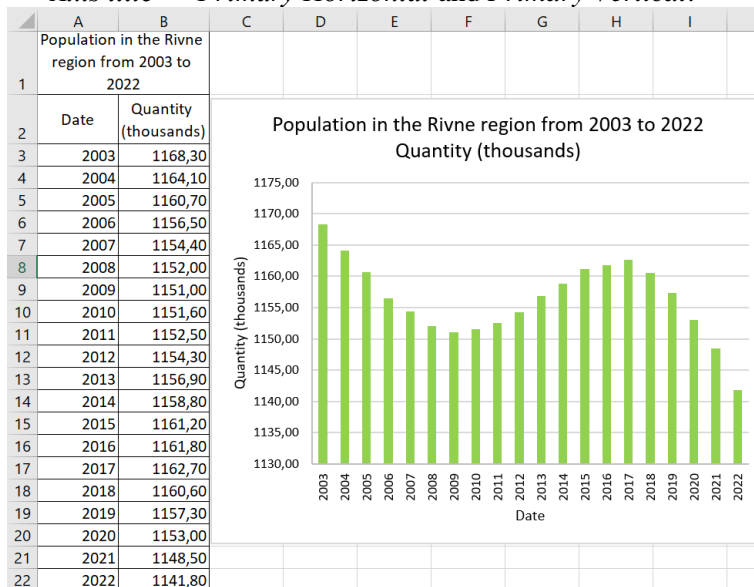


Fig. 3. Construction of a histogram based on tabular data

Task 4. Calculation of the function value

Calculate the value of the function

$$y = \frac{(3x + 2)^2}{\sin x + 3}$$

provided that

$$4,8 \leq x \leq 7,6,$$

$$dx = 0,4,$$

and graph the function.

Progress:

To fill the table with function values, you must first place the output data: step $dx=0,4$ placed in cell D5. In the header of the table we will place the designations of the variables x and y .

The next step is to fill column x with the values of the corresponding argument. To do this, enter the initial value in cell A6 x (4,8), and in cell A7 – the formula for calculating the remaining x values: =A6+D5. Since the value dx is constant, it will not change during the calculation and needs an absolute address. To do this, you need to press the function key near the address D5 in the formula bar <F4> – \$D\$5.

Move the mouse cursor to the lower right corner of cell A7, which already contains the formula, so that it takes the form of a solid cross, press the left mouse button and "pull" down until the value in some cell of column A becomes 7.6.

Let's go to the column with the function values. Enter the formula for calculation y in cell B6

$$=(3*A6+2)^2/(SIN(A6)+3).$$

To autofill this column, you should repeat the steps for copying the formulas. In fig.4 the result of performing operations in formula mode is given.

To construct a graph of a function, the following steps should be performed: *Insert* → *Charts group* → *Scatter* → *Scatter with smooth lines and markers*. The appearance of the resulting diagram can be improved as follows:

- select the chart on the tab *Chart design* → *Charts Layouts* → *Add Chart Element* → *Chart title*, place the name of the diagram *above chart* and sign the names of the axes (Axis titles);

- press the right mouse button on the OX axis, select the item in the context menu *Format axis* → *Axis Options* → *Bonds* → *Minimum* and appoint 4.

	A	B	C	D	E
1					
2					
3					
4					
5	x	y	dx=	0,4	
6	4,8				
7	=A6+\$D\$5				
8					
9					

	A	B	C	D	E
1					
2					
3					
4					
5	x	y	dx=	0,4	
6	4,8				
7	5,2				
8	5,6				
9	6				
10	6,4				
11	6,8				
12	7,2				
13	7,6				

	A	B	C	D	E
1					
2					
3					
4					
5	x	y	dx=	0,4	
6	4,8	134,2226			
7	5,2	146,3517			
8	5,6	149,2105			
9	6	147,0272			
10	6,4	144,2108			
11	6,8	143,6015			
12	7,2	146,8131			
13	7,6	155,0031			

	A	B	C	D
1				
2				
3				
4				
5	x	y	dx=	0,4
6	4,8	= (3*A6+2)^2/(SIN(A6)+3)		
7	=A6+\$D\$5	= (3*A7+2)^2/(SIN(A7)+3)		
8	=A7+\$D\$5	= (3*A8+2)^2/(SIN(A8)+3)		
9	=A8+\$D\$5	= (3*A9+2)^2/(SIN(A9)+3)		
10	=A9+\$D\$5	= (3*A10+2)^2/(SIN(A10)+3)		
11	=A10+\$D\$5	= (3*A11+2)^2/(SIN(A11)+3)		
12	=A11+\$D\$5	= (3*A12+2)^2/(SIN(A12)+3)		
13	=A12+\$D\$5	= (3*A13+2)^2/(SIN(A13)+3)		

Fig. 4 Step-by-step calculation of function values

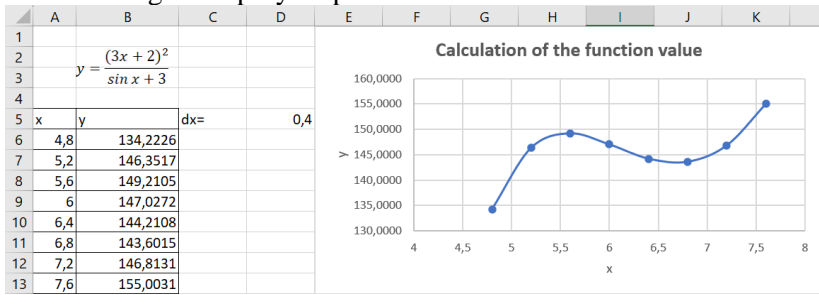


Fig. 5 Construction of a scatter based on tabular data

Task 5 Logical functions

Theoretical information

Logical functions are an integral component of many formulas. If it is necessary to implement certain actions depending on the fulfillment of some conditions, you should use logical functions. Logical functions are included in the category *Logical* of the window *Formulas*. Logical functions include::

- **IF** (*logical_test*, *value_if_true*, [*value_if_false*]) is used to select one of the alternatives depending on the given condition. For example, the formula "**=IF**(A6<20;5;10)" returns the number 5 if the value in cell A6 is less than 20, and in the opposite case – 10. **LOG_expression** is any logical condition that acquires a value **TRUTH** or **FALSE**;

- **AND**(*logical_test1*; *logical_test2*;...) used to combine two or more conditions;

- **OR**(*logical_test1*; *logical_test2*;...) checks input values and returns values **TRUTH**, if at least one of the arguments is valid **TRUTH**;

- **NOT**(*logical_test*) reverses the value of its argument.

It is necessary to calculate the wages of employees taking into account changes in tax legislation. Income tax in the amount of 18% is charged only to those employees whose accrued wages do not exceed UAH 2,000. Who has an accrued salary of more than UAH 2,000, the income tax is 20%.

Progress:

1. Copy the table from task 1 onto a new sheet;
2. Clear the data from the column *Income tax*
3. Using the function **IF** of Logical categories from the menu *Formulas* in cell F10 describe the new tax calculation mechanism.
4. Copy the contents of cell F10 to all other employees.

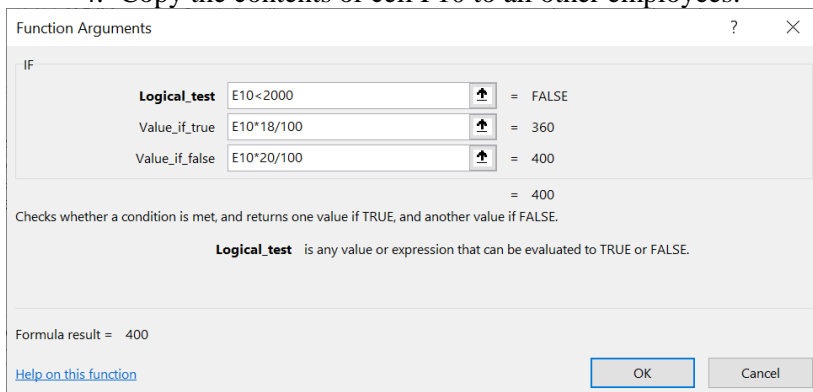


Fig. 6 Defining function argument

Task 6. Statistical functions.

The following functions from the *Statistical* category are often used to process statistical data.

Using the array X and Y from the previous task to find

1. Correlation coefficient between arrays X and Y. (*CORREL* (array 1; array 2).
2. F-statistics (*F.INV.RT* (probability – 0,05; deg_freedom 1 – 1; deg_freedom 2 – 8) – finds the F-probability distribution for two sets of data.
3. *STDEV* (number 1; number 2;) – finds the standard deviation based on the sample.

Task 7. Mathematical functions.

1. Enter the current year and day of the month in separate cells and convert them in the adjacent cells to the format of Roman numerals (function *Roman*).
2. Find the root of any number using the function *SQRT*.
3. Calculate 10^3 using the function *POWER*.
4. Find the cosine of the number 4 using the function *COS*.
5. Find the factorial of the variant number using the function *FACT*.

Task 8. Date and time functions.

1. Insert the current date into the cell. (function *TODAY* or *NOW*)
2. Insert the date of birth in the cell in the format *Date*.
3. Find the number of days lived. (subtract the birthday from the current date).
4. Find the weekday on which you were born (function *WEEKDAY()* function arguments select birthday references and *Type* - 2).

Task 9. Lookup and reference functions.

To convert the X:Y array from vertical to horizontal, you need to select a range of empty cells with a dimension of 11×3 , select the function *TRANSPOSE* from the category *Lookup and reference*, select the range with the output array and press the keys $\langle \text{Ctrl} \rangle + \langle \text{Shift} \rangle + \langle \text{Enter} \rangle$.

Task 10. Financial functions

Theoretical information

An important area of MS Excel tools is related to the implementation of financial calculations. The main financial functions are as follows:

- **FV(rate, nper, pmt, [pv], [type])** one of the financial functions, calculates the future value of an investment based on a constant interest rate. You can use FV with either periodic, constant payments, or a single lump sum payment. The FV function syntax has the following arguments:

- **Rate (nper, pmt, pv, [fv], [type], [guess])** – Required. The interest rate per period.

- **Nper (rate,pmt,pv,[fv],[type])** – Required. The total number of payment periods in an annuity.

- **Pmt (rate, nper, pv, [fv], [type])** – Required. The payment made each period; it cannot change over the life of the annuity. Typically, pmt contains principal and interest but no other fees or taxes. If pmt is omitted, you must include the pv argument.

- **Pv (rate, nper, pmt, [fv], [type])** – Optional. The present value, or the lump-sum amount that a series of future payments is worth right now. If pv is omitted, it is assumed to be 0 (zero), and you must include the pmt argument.

Remark. All arguments representing money to be paid are represented by negative numbers; funds to be received - in positive numbers.

Financial function of FV

The client put 1,000 hryvnias on deposit in the bank at a rate of 10% per year. Calculate the future value of his deposit in 5 years using the compound interest rule.

Accrual by the method of compound interest means that at the end of the first year interest is accrued on the deposit in the amount of $1,000 \times 0.10 = \text{UAH } 100$. This amount is added to the initial deposit amount. At the end of the second year, interest is accrued in the amount of UAH 1,100, i.e. $\text{UAH } 1,100 \times 0.10 = \text{UAH } 110$. and so on.

Progress:

1. Enter the notation $PV = 1000$; $n = 5$; $r = 10\%$ (fig. 7). FV – the value of the deposit after 5 years, and enter this data into the MS Excel table (cells B1:B3).

	A	B		A	B
1	PV	1000	1	PV	1000
2	n	5	2	n	5
3	r	0,1	3	r	0,1
4	FV	1 610,51 €	4	FV	=FV(B3;B2;;-B1)

Рис. 7. Results of the FV function

2. In the *Financial Functions* menu, we find the FV function, which allows you to calculate the future amount, taking into account interest charges. As arguments in the window of the function that appeared, we enter links to the corresponding cells: RATE = 0.1; NPER = 5; PV = -1000. Standard notation of arguments is used here: NPER – number of periods (years), PV – initial deposit amount. In computer calculations, the value of the deposit rate is always entered in fractions of a unit.

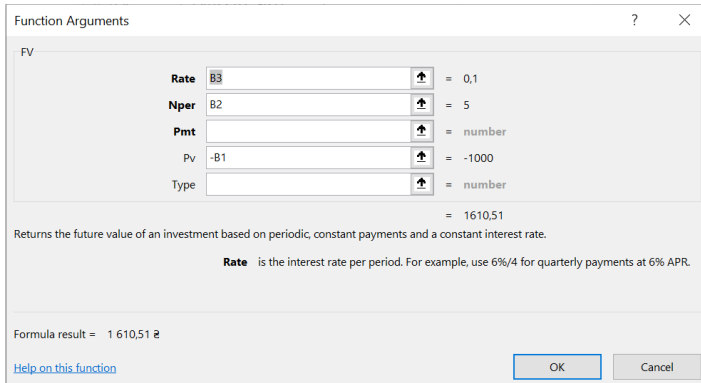


Fig. 7 Use of financial functions FV

3. After pressing the OK key, the result of performing the FV function is displayed in cell B4 – the value is 1610,51.

Report on laboratory work № 5.

Reports for laboratory works 5-7 are drawn up in the form of Excel files. Each task is performed on a separate sheet of the file.

Laboratory work № 6

OPERATIONS ON MATRICES. ANALYSIS AND FORECASTING USING EXCEL

Goal: Get the skills to perform operations on matrices, as well as get the skills to perform economic analysis and build predictive models using MS Excel.

Theoretical information

Functions for working with matrices

A significant number of economic and mathematical models of various objects and processes are recorded in array form. In MS Excel, matrices are presented in the form of arrays (blocks of adjacent cells). When performing operations with matrices or vectors, solving systems of equations, etc., you can use the following MS Excel functions:

- *Minverse* (array)– finding the inverse array;
- *Mdeterm* (array) – finding the determinant of the array;
- *Mmult* (array 1 ; array 2) – product of two matrices;
- *Transpose* (array) – transposition of matrices.

Actions with elements of the array (array) should be performed in a certain sequence:

- before entering the necessary function to perform certain operations on arrays, you need to select a range of free cells in which the result will be displayed.
 - enter the necessary formula.
 - select ranges of initial array values.
 - press the key combination $\langle Ctrl \rangle + \langle Shift \rangle + \langle Enter \rangle$.

When entering an array formula, MS Excel automatically encloses the formula in curly brackets.

An individual cell of the calculated array cannot be changed. You can change only the entire array at once, for this it must first be selected.

Multiplying a array by a number. First, you need to enter the elements of the array, for example, in the range of cells A2:C4. To multiply the entered array by the number 5, a range of free cells is selected according to the size corresponding to the given array (for example, D2:F4). Next, enter the formula $=A2:C4*5$ in the formula

line and press the keys $\langle Ctrl \rangle + \langle Shift \rangle + \langle Enter \rangle$. The values of the original data multiplied by 5 appear in the selected range of cells.

Transposition of array. To do this, use the function *TRANSPOSE*, which translates the vertical range of cells into horizontal, and backward. For example, it is necessary to create a transposed array from the elements of array A. Select a range of cells into which the new array will be entered (A7:C9), select a function *TRANSPOSE* and enter the corresponding values of the elements of array A: *TRANSPOSE* (A2:C4). Keys are pressed $\langle Ctrl \rangle + \langle Shift \rangle + \langle Enter \rangle$.

Calculation of the array determinant

Remark: you can calculate the determinant only for a square array.

To calculate the determinant of an array, call the function *MDETERM*. For example, you need to find the determinant of the array A. First, select the cell in which the value of the determinant (E7) will be placed, call the function *MDETERM*. Enter the corresponding values of the elements of array A and press the key $\langle Enter \rangle$.

Multiplying an array by an array

To perform this operation, use the function *MMULT* (array 1; array 2), where array 1, array 2 – are arrays that are multiplied. The number of columns in the array 1 argument must be equal to the number of rows in the array 2 argument. When multiplying an array by a vector, the calculated array is a column array, the dimension of which coincides with the dimension of the vector.

To multiply an array by an array, you must enter the array into a range that must have as many rows as there are columns in the array. Next, select a range of cells where a new array will be created, activate the button *Insert function*, select a function *MMULT* (category *Math and Trig*) and enter the links of the ranges of array A and vector B. After that, press the keys $\langle Ctrl \rangle + \langle Shift \rangle + \langle Enter \rangle$.

Calculation of inverse arrays

Remark: the inverse array is constructed only for a square non-degenerate array whose determinant is different from zero.

To calculate the inverse array, activate the function *MINVERSE*. For example, it is necessary to create an inverse array from the elements of array A. To do this, select a range of cells where a new array will be created, and activate the function *MINVERSE*.

Enter the corresponding values of the array elements and press the keys $\langle Ctrl \rangle + \langle Shift \rangle + \langle Enter \rangle$.

Task 1. Accordingly, the initial data of the array A, it is necessary:

- multiply the array A by the number 10;
- find the transposed array to the array A;
- calculate the determinant of array A.

	A	B	C
1	The initial data of matrix A		
2	5	1	4
3	4	2	2
4	3	3	1

Fig. 8 The initial data of matrix A

Task 2. Solve the system of linear algebraic equations by the array method:

$$\begin{cases} 1,9x_1 + 7,1x_2 + 3x_3 = 5,8, \\ 6,4x_1 + x_2 + 4,3x_3 = -7,5, \\ 2,7x_1 - 1,9x_2 + 6,2x_3 = -4,5. \end{cases}$$

To find the solutions of the system of equations, you need to use the formula

$$X = A^{-1} \times B.$$

Where A – array of coefficients with unknowns,

A^{-1} – inverse array,

B – vector of free members,

X – vector of wanted unknowns.

Task 3. Construction of trend lines.

Theoretical information

In the modern economy, in order to make various kinds of decisions, it is necessary to be able to forecast the development of the economic situation. For this, it is necessary to know the past well and its inherent patterns. If various economic indicators are recorded regularly over a long period of time, such data form a time series.

Thanks to statistical analysis, it is possible to identify and use the information contained in the time series for forecasting. For visual analysis of time series in MS Excel, charts are used and trend lines are built.

Trend line – it is a function of a given type, with the help of which it is possible to detect the development trend of a particular process and provide a forecast for a given period.

MS Excel provides several types of trend lines.

Table 1

Dependency type	Equation
Linear	$Y = a + bX$
Polynomial	$Y = a + a_1X + a_2X^2 + \dots + a_nX^n$
Logarithmic	$Y = a \ln X + b$
Exponential	$Y = ae^{bX}$
Power	$Y = ax^b$

Where Y and X – some economic variables between which the relationship is studied (Y is considered a dependent variable of X).

Task condition

Some company has observed the demand and price of its products. Observation data are summarized in a table. It is necessary to determine the quantitative dependence of demand on price and apply the obtained dependence for forecasting and analysis of demand for products. It is believed that the dependence has the form of paired linear regression

$$Y = b_0 + b_1X,$$

which can also be written as

$$Y = AX + B,$$

where

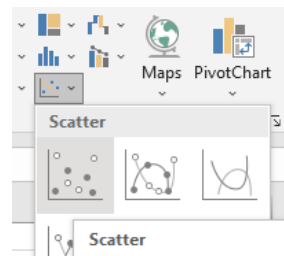
Y – demand;

X – price;

A, B or b_0, b_1 – model parameters.

Progress:

1. Create a table of output data according to the sample in the



following figure. To calculate the values of Y, add your option according to the group list to the demand values (formula =C4+\$C\$1 in cell F4, press F4 and copy to the entire column Y).

2. Construct a scatter plot.

3. Add a linear trend to the already constructed chart:

- Select all the points on the constructed diagram;
- add a trend line (*right mouse button* → *Add trendline*);
- *Trendline options* (select the type of trend line), set parameters *Display equation on chart*, *Display R-squared value on chart*.

The linear regression equation appears in the chart box, along with the confidence value of the approximation R^2 .

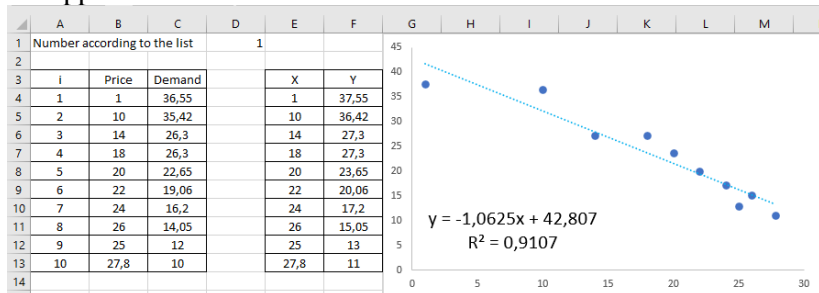
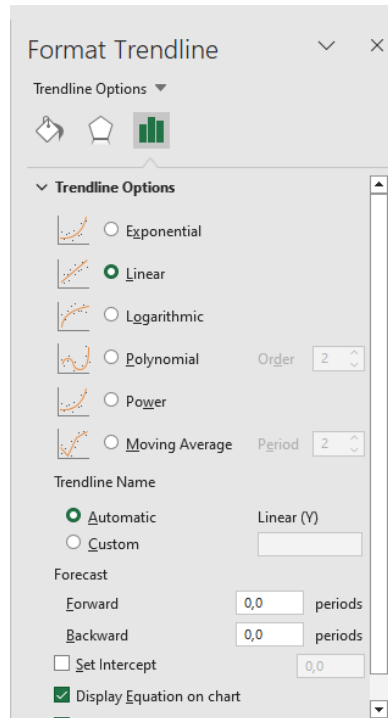


Fig. 9 Raw data and trend line with forecast demand values

Task 4. Building a forecast for N years using a trend line.

To change the trend line, you need to select it from the context menu *Format trendline*.

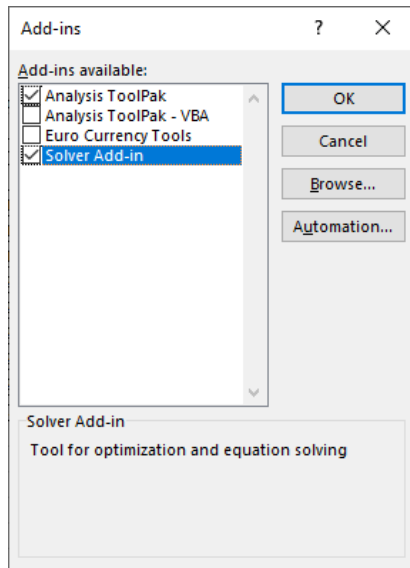
Using the trend line, it is possible to predict the dynamics of the development of one or another economic process for the following

periods. To do this, you need to fill in the window with the number of periods in the Format trend line context menu in the Forecast group. As a result of the above actions, we will get a trend line and a forecast for three years.

Task 5. Finding and analyzing a regression equation using the *Data Analysis* add-in.

To obtain comprehensive information, which is necessary for a detailed study of the model for the purpose of its further use for forecasting and economic-mathematical analysis, it is necessary to use the tool *Regression Data Analysis add-in*.

If the add-in is not installed, it is required in the menu *File* to choose *Options, Add-ins* and add *Analysis toolpack* and *Solver add-in*. Add-ons will appear in the menu *Data*.



Progress:

1. Copy the X, Y data table to a separate sheet (think about how to save the connections between the sheets ☺).
2. Select the tab *Regression Data Analysis* add-in from the menu *Data*.
3. Give *Input range* for **Y** and **X** (if the column names are included in the intervals, put them *Labels*), *Output range* (one cell on the active sheet). As a result, we get model parameters
Y – intersection - B or b0.
X – A, or b1.
4. Find the predicted demand value **Y** for the predicted price value **X=32**. With the help of the function *FORECAST* or from the equation.

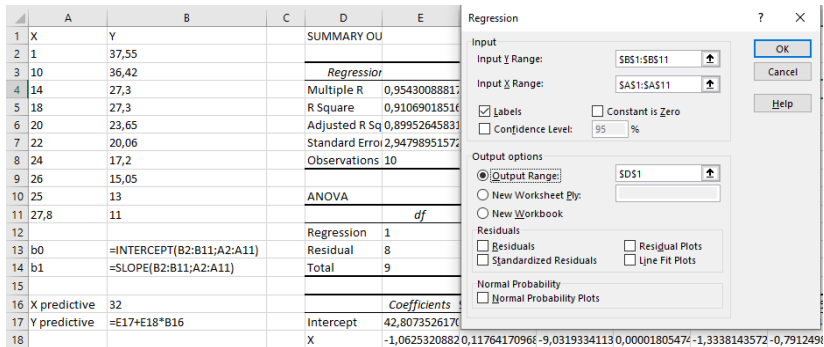


Fig. 10 Regression results

Task 6. Finding the parameters of the regression equation using a function.

The parameters of the regression equation can also be found using functions.

To find the parameter b_0 function must be applied *Intercept*, b_1 – *Slope* (Statistical functions).

As a result, it is necessary to compare the parameters of the regression equation obtained by different methods:

- Graphically using a trend line;
- tabs *Regression* data analysis package;
- functions *Intercept* and *Slope*.

Laboratory work № 7 OPERATIONS ON LARGE DATA ARRAYS. CONDITIONAL FORMATTING, SMART TABLES

Goal: Get the skills to perform operations on large data arrays and format them.

Theoretical information

Conditional formatting is a way to make working with Excel spreadsheets as easy as possible. This method of processing information allows you to save a lot of time and facilitate all calculations. You can make the program automatically perform many tasks that used to be done manually, wasting a lot of time.

In addition, for your convenience, you can configure Excel so that it immediately selects the necessary or important information in the documents. In addition, such formatting will help to display information more clearly, quickly and efficiently create reports without using complex graphic models, such as charts or graphs.

"Smart" table is a special type of formatting, after applying which to the specified range of data, the array acquires certain properties. First of all, after that, the program begins to treat it not as a range of cells, but as a complete element. If you make an entry in any cell that is located directly near its borders, then the row or column is automatically included in this tabular range.

The use of this technology allows you not to recalculate formulas after adding rows, if the data from it is pulled into another range by a certain function. In addition, among the advantages should be selected the fixing of the cap at the top of the sheet, as well as the presence of filter buttons in the headers.

In a "smart" table, by default, when it is created, useful tools are automatically connected, which provide sorting and filtering of data.

As you can see, there are already icons in the form of triangles in the cap near the names of the columns in each cell. It is through them that we get access to the filtering function. We click on the icon near the name of the column we are going to manipulate. After that, a list of possible actions opens.

Pivot tables are one of the most powerful MS Excel tools for analyzing databases placed in tables or lists. The summary table not only groups and summarizes the data, but also provides an opportunity to conduct an in-depth analysis of the available information. When creating a pivot table, the user specifies the names of the fields placed in its rows and columns. It is also allowed to specify a page field, which allows you to work with a summary table as with a set of sheets. Pivot tables are convenient for data analysis for several reasons:

- allow you to create summarizing tables that provide the possibility of grouping the same type of data, summarizing, and static characteristics of records;
- easily transformed;
- allow automatic selection of information;
- on the basis of the summary tables, diagrams are built, which are dynamically rebuilt along with the change of the summary table.

Task 1. Conditional formatting.

It is necessary to Select in color the prices of phones in the range of 80-160 \$.

Progress:

1. Create a table according to the sample.
2. Select the data in the price column.
3. Choose from the menu *Home* the tab *Conditional formatting, Highlight cells rules; Between.*
4. Set formatting borders and color.
5. Select the data in the Quantity column.
6. Choose from the menu *Home* the tab *Conditional formatting, Data bars* and select the fill type.

	A	B	C	D	E	F	G	H	I	J	K	L
1	№	Phone brand	Price, \$	Amount								
2	1	S1	100	20								
3	2	S2	150	2								
4	3	S3	200	80								
5	4	F1	40	14								
6	5	F2	80	56								
7	6	P1	89	57								
8	7	H2	67	15								
9	8	D	50	7								

Fig. 11 Conditional formatting results...

7. Copy the Quantity column to the adjacent column and select it.
8. Select in the tab *Conditional formatting, Color scales* or *Icon sets* and select the fill type.

Task 2. Smart table.

Create a smart table, add data to it and summarize.

Progress:

1. We copy the table from the previous task to a new sheet, remove conditional formatting and add a column.
2. Select the table.
3. Choose any table style from the tab *Format as table* from the menu *Home*

4. Add a new *Sales Volume* column to the table and enter the formula: $Price * Amount$.

5. In the menu *Table design* which is activated when you click on any element of the smart table activate the item *Total row*.

6. For the **Price** column, we define the average price.

7. Check out other Smart Table Builder features.

	A	B	C	D	E
	№	Phone bran	Price	Amount	Sales volum
2	4	F1	40	14	560
3	9	W	40	8	320
4	8	D	50	7	350
5	7	H2	67	15	1005
6	5	F2	80	56	4480
7	6	P1	89	57	5073
8	1	S1	100	20	2000
9	2	S2	150	2	300
10	3	S3	200	80	16000
11	Total			259	30088

Task 3. Sorting and filtering.

Sort and filter data in a smart table and using a tab *Sort and filter*.

Progress:

1. Sort the table by phone price from minimum to maximum.

2. Copy smart table data to a separate sheet and convert it into a regular data range (command *Convert to range* from the menu *Table design*). You can also type a new table.

3. Sort a regular table using a tab *Sort and filter* from the menu *Home*.

4. Add a note to cell A1 of any content using *Review* → *Notes* → *New note*.

	A	B	C	D	E	F
	№	Phone bran	Price	Amount		
2	4	F1	40	14		
3	9	W	40	8		
4	8	D	50	7		
5	7	H2	67	15		
6	5	F2	80	56		
7	6	P1	89	57		
8	1	S1	100	20		
9	2	S2	150	2		
10	3	S3	200	80		
11	Total			259		

	A	B	C	D	E
	№	Phone bran	Price	Amount	Sales volum
2	4	F1	40	14	560
3	9	W	40	8	320
4	8	D	50	7	350
5	7	H2	67	15	1005
6	5	F2	80	56	4480
7	6	P1	89	57	5073
8	1	S1	100	20	2000
9	2	S2	150	2	300
10	3	S3	200	80	16000
11	Total			259	30088

	A	B	C	D	E
	№	Phone bran	Price	Amount	Sales volum
2	4	F1	40	14	560
3	9	W	40	8	320
4	8	D	50	7	350
5	7	H2	67	15	1005
6	5	F2	80	56	4480
7	6	P1	89	57	5073
8	1	S1	100	20	2000
9	2	S2	150	2	300
10	3	S3	200	80	16000
11	Total			259	30088