MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

SIMON KUZNETS KHARKIV NATIONAL UNIVERSITY OF ECONOMICS

Tasks for self-instruction
on the academic discipline
"STATISTICS"
for students of training directions
6.030601 "Management" of specialization "Business Administration",
6.140103 "Tourism" of all forms of study

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Tasks are provided to help students consolidate the gained knowledge and skills in the use of statistical methods for the processing of social and economic information. Attention is focused on the analysis of statistical data and application of mathematical methods to economic research.

Recommended for students of training directions 6.030601 "Management" and 6.140103 "Tourism".

Подано задачі, які допоможуть студентам закріпити отримані знання й навички щодо використання статистичних методів для обробки соціально-економічної інформації. Великої уваги надано проблемі аналізу статистичних даних й використанню математичних методів у економічних дослідженнях.

Рекомендовано для студентів напрямів підготовки 6.030601 "Менеджмент" та 6.140103 "Туризм".

Introduction

The implementation of practical exercises aims to develop students' skills in using statistical methods of analysis of distribution series. Solving problems plays an important role in the mastering of statistical methods for the analysis of social and economic phenomena and processes, since it requires from the students the theoretical knowledge and ability to apply it to practice for processing and the economic interpretation of specific data. Personal study allows the teacher to have an idea about the abilities of a student, his professionalism, the ability to analyze information, synthesize information and draw conclusions.

The tasks for the academic discipline "Statistics" are designed for home assignments but they can also be used in the classroom practice. Each topic is developed on the principle "from simple to complex." Each task provides for the correct numerical answer, as well as the reasoning for the method of solving problems: the computation of specific statistical indicators measuring the statistical regularities of distribution and dynamics, assessment of the impact of individual factors.

The purpose of the academic discipline is the formation of practical skills in solving and analyzing economic problems.

The following main tasks are set to achieve the goal:

to study the main categories of statistics;

to master the basics of statistical methodology;

to identify the main statistical study of phenomena and processes that occur in society.

The subject of the academic discipline is to study the quantitative aspect of mass social and economic phenomena which are studied in close connection with the qualitative aspect.

Qualification requirements for the students in the area of Statistics. Knowledge background necessary for studying the academic discipline

In order to properly understand the educational material of the academic discipline, students must first acquire knowledge and skills in the field of the General Theory of Statistics, Economic and Mathematical Modeling. On the other hand, the knowledge of Statistics provides their successful performing in other disciplines. While studying Statistics students should acquire the following skills (Table 1).

Table 1

Competences to be formed while performing self-instruction on the academic discipline "Statistics"

The name of the competence	The content of the competence	The ability of a student in regard to the competence
1. Accounting and statistics	1.1. The ability to conduct statistical calculations	1.1.1. Carrying out the calculation of indicators for checking statistical hypotheses. 1.1.2. Carrying out the calculation of time series indicators
2. Analytical	2.1. The ability to conduct a statistical analysis	2.1.1. Identifying the factors that influence the change indicators. 2.1.2. Forecasting the run of the processes analyzing and evaluating possible consequences of changeable conditions
3. Organizational and methodological	3.1. The ability to apply the statistical methodology	3.1.1. Developing their own methods of forecasting. 3.1.2. Developing their own research methods of the types of economic and social phenomena. 3.1.3. Developing their own methods of assessing the general trend of a phenomenon. 3.1.4. Developing their own methods of assessing the stochastic phenomena. 3.1.5. Developing their own methods of forecasting based on trend extrapolation models. 3.1.6. Developing their own methods of vibration and dynamic series consistency. 3.1.7. Developing their own methods of constructing the unvaried and multivariate regression models. 3.1.8. Developing their own methods of constructing the auto-correlation
4. Control	4.1. The ability to build single-factor and multi-factor models and check them for compliance	4.1.1. Preparing the information for choosing the type of models, carrying out the calculations of their parameters and checking them for compliance. 4.1.2. Using the appropriate criteria for analysis of the level of the authenticity of forecasting the estimates
5. Information	5.1. The ability to use the modern means of information processing for the solution of economic problems	5.1.1. Using a variety of features of the Excel application package for visualization systems analysis of economic processes or phenomena in order to enhance the quality of management decisions

Module 1. Methods of descriptive statistics

Topic 1. Methodological principles of statistics

The purpose is to consolidate the theoretical material on the theme "Methodological principles of statistics".

The task is to determine the essence of statistics as a science, features of the statistical methodology, the basic concepts and categories of statistics.

Questions

1. Supply examples of social life sectors which statistics studies.

2. Formulate a definition of statistics as a science and give it an appropriate justification.

3. Describe the main features of the statistics object.

4. Say which types (quantitative or qualitative, discrete or continuous) include the following features:

a) the number of employees,

b) the relationships of family members,

c) the gender and age of a person,

d) the social position of depositors of commercial banks,

e) the number of floors of houses,

f) the number of children in a family,

g) the retail turnover of shops.

5. Determine populations which can be identified at University for the statistical study.

6. What quantitative and attribute (qualitative) characteristics can describe a population of high school students, a population of banks?

7. What are the main features which determine the variation of a student's achievement?

8. Provide a list of indicators which can characterize: a) population; b) a consumer market; c) an industry; d) a firm.

9. What are varying and not varying features inherent in a person, a firm?

10. Name the main categories of statistics and explain their meaning.

11. Explain the distribution statistics for specific industries and why the study of statistics begins with the general theory of statistics.

12. Describe the main stages in the development of statistics and explain the cause of the shift from accounting to statistics as a science.

13. Name the specific techniques (methods) of statistical research.

14. Describe the basic tasks of statistics in modern terms.

15. The organization of statistics in Ukraine and other countries.

16. The international statistical organizations.

Topic 2. Statistical observation

The purpose is to consolidate the theoretical and practical material on the topic "Statistical observation".

The task is to determine the forms, types and ways of statistical observation; to make a program of observation; to define mistakes of statistical observation; to apply the arithmetic and logic control of statistical data.

Exercises for self-instruction

1. Define the object and an observation unit for carrying out a population census; a census of the working industrial equipment; an estimation of the quality of student's preparation in the state and private educational institutions.

2. Define an observation unit and a unit of population for carrying out a census of the industrial equipment, the inspection of workers or employees budgets; the account of availability of cash registers in commercial shops of a city.

3. Make a list of questions for an observation program:

a) interrogation of listeners of a business school concerning orientation of the educational process to practical activities;

b) selective observation of marketing campaign participants;

c) the account of currency transactions of commercial banks.

4. Specify the forms and types of statistical observation of the material assets inventory, the register of physical persons, the account of an operating time of the equipment by the method "The moment observation".

5. Define the type of statistical observation on the coverage of population units which are considered and on the time of data recording:

a) the account of the number of the registered crimes;

b) data recording of the tenders at universal stock exchanges;

c) registration of a price level on the agricultural products which are sold in the markets of large cities;

d) inspections of budgets of not protected layers of the population;

e) the account of the number of newborns;

f)   interrogation of young families of a region concerning the planning of a family.

6. Define the organizational form and the way of:

a) property inventory in public catering establishments;

b) the list of all the registered economic structures with the indication of their requisites (the name, the address, the phone, the fax), the kind and the field of activity;

c) inspections of responses of the clients of service stations;

d) the monthly account of the volume of manufacture and realization of products of enterprises;

e) accounting balances of enterprises of separate branches of a national economy;

f) marketing research of the saturation of the audio, video equipment market.

7. By means of the logic control, find mistakes and ways to correct them in the following sheet. Specify, which of the answers are not consistent with each other.

Name and surname: Kirichenko Ivan.

The relation to the head of the family: the head.

Sex: female.

Age: 3.

The marital status: divorced.

Nationality: Ukrainian.

The native language: Russian.

Education: special.

Source of means of existence: work in an institution.

8. Establish the form, the type and the way of each observation (Table 2).

Table 2

The forms, the types and the ways of statistical observation

Statistical observation	Form of observation			Types and methods of observation							
	The statistical reporting	Specially organized observation	The register	according to the data registration time		coverage of population units		ways of obtaining information		
				Current	Discontinuous	Running	Non-running	Direct	Documentary	Interrogation
1	2	3	4	5	6	7	8	9	10	11
1. Population census of the country in 2015										
2. Sample inspection of the population of the country in January, 2014										

Table 2 (the end)

1	2	3	4	5	6	7	8	9	10	11
3. The report of an industry enterprise on the performance of the plan of product realization										
4. Census of the industrial equipment in the industry as of 01.10 each year										
5. Registration of acts of civil position										
6. The account of the presence and absence of workers at work										
7. The quarterly account of the rest of the goods in trading networks										

9. Conduct the arithmetic control of the data of the joint-stock companies' report (Table 3).

Table 3

Data of the joint-stock companies' report

Indicators	Type of joint-stock companies		
	Opened	Closed	All
The joint-stock company value	150	100	250
The size of the authorised capital, UAH m	1 400	600	2 000
The sum of joint-stock payments, UAH m	1 200	–	1 500
The number of shareholders	16 800	5 200	22 000
The average size of a payment of one shareholder, UAH ths	74.1	57.7	68.2
The share of the authorised capital, %	72	28	100
The share of the sum of joint-stock payments, %	81	20	100
The number of shareholders counting upon a joint-stock company	112	50	88

Topic 3. Summarization and grouping of statistical data

The purpose is to consolidate the theoretical and practical material on the reporting and grouping of statistical data, acquiring skills in the reporting and grouping of data.

The task is to group statistical data by means of analytical, combinational groupings.

Tasks for self-instruction

1. We have data about the distribution of 20 workers by the skill level:

5	6	4	2	3
3	2	6	5	4
4	5	3	4	3
4	5	4	5	1

Construct a discrete line of distribution of workers by the skill level (categories), show it graphically. Draw conclusions.

2. We have the following data about the experience of work of employees of a credit department:

7 8 2 18 4 5 0 6 8 7 10 12 1 2 4 3 11 3 1 2 3
4 7 4 1 3 15 12 13 19 12 3 0 3 5 1 14 1 8 9 25 12
8 21 2 2 16 8 4 20 5 7 18 13 14 5 4 11 23 9

Construct an interval variation line of distribution. Specify the elements.
Show the distribution of workers on a histogram. Draw conclusions.

3. We have some data about the cost of the fixed capital and commodity output of industrial enterprises for a year (Table 4).

Table 4

Distribution of enterprises according to the output and cost of the fixed capital

The number of the enterprise	The cost of the fixed capital, € ths	The commodity output, € ths	
		Under the plan	Fact
1	2	3	4
1	480	560	590
2	690	1 435	1 470
3	1 750	3 535	3 742
4	3 420	7 150	8 210
5	1 146	1 124	1 217
6	1 205	1 784	1 955
7	1 308	2 966	2 994
8	364	408	409
9	2 120	3 151	3 276
10	1 332	2 150	2 166
11	1 000	2 100	2 300
12	4 073	10 967	12 099
13	1 014	2 976	2 138

Table 4 (the end)

1	2	3	4
14	586	978	992
15	905	1 296	1 404
16	1 746	4 010	4 157
17	3 140	6 572	6 206
18	529	1 088	1 057
19	2 861	6 068	6 412
20	407	618	724
21	1 990	3 912	4 075

Make a grouping of the enterprises according to the cost of the fixed capital, having selected the groups: up to € 500 ths, from € 501 ths up to € 1 000 ths, from €1 001 ths up to €1 500 ths, from €1 501 ths up to € 2 500 ths, from above € 2 500 ths. In each group count the number of the enterprises, the cost of the fixed capital, the commodity output under the plan and the actual one, the percent of the plan performance, the fund feedback under the plan and the actual one. Calculate the relative density of each group in the general actual output.

Tabulate the results of the calculation. Draw an analytical conclusion.

4. We have some data about the sum of the capital and profit on 26 commercial banks (Table 5).

Table 5

**Distribution of banks according to the amount
of the capital and profit**

The number of the bank	The capital, UAH m	The profit, UAH m
1	2	3
1	6.3	4.7
2	11.8	8.6
3	7.6	5.3
4	10.5	8.8
5	8.1	6.2
6	8.3	4.1
7	12.0	8.2
8	5.1	3.6
9	7.8	4.1
10	5.4	3.3
11	6.3	5.1
12	8.3	5.8
13	5.4	3.5

Table 5 (the end)

1	2	3
14	6.3	4.8
15	8.4	7.1
16	5.4	4.0
17	7.0	5.8
18	9.6	7.8
19	8.1	6.9
20	5.2	4.3
21	7.3	6.0
22	8.2	6.4
23	5.4	4.1
24	3.2	2.8
25	4.4	3.0
26	3.0	1.2

Construct:

1) the combinational distribution of banks to these attributes, form three groups with equal intervals and draw a conclusion;

2) the analytical grouping which reflects the dependence of profit on the capital. Draw results of the grouping in a tabulated form.

5. We have some data about the percent of the privatized property and the level of expenses profitability in 20 companies (Table 6).

Table 6

Distribution of companies according to the profitability and percent of the privatized property

The number of the enterprise	% of the privatized property	Profitability of expenses, %
1	2	3
1	95	31
2	81	22
3	68	24
4	66	15
5	79	28
6	81	29
7	90	30
8	100	37
9	56	20

Table 6 (the end)

1	2	3
10	75	27
11	86	29
12	55	18
13	81	30
14	58	21
15	94	27
16	77	23
17	48	19
18	78	25
19	100	36
20	70	29

Make a grouping of companies according to the percent of the privatized property by groups with equal intervals.

Construct the combinational distribution and the analytical grouping.

6. Design breadboard models of statistical tables: a) simple; b) group; c) combinational.

Topic 4. Generalizing statistical indicators

The purpose is to consolidate the theoretical and practical material on the theme "Generalizing statistical indicators", acquiring skills in the calculation of absolute, relative and average parameters.

The task is to calculate relative and average parameters.

Exercises for self-instruction

1. We have data about the population of a region which has secondary and higher education, thousand people (Table 7).

Table 7

Distribution of the population of a region according to the educational level

	Years				
	1995	2000	2005	2010	2015
People having secondary and higher education, total including:	58.7	95.0	139.1	164.3	177.3
higher complete	3.8	8.3	14.8	20.8	28.4
higher incomplete	1.7	2.6	3.2	3.5	7.5
special secondary	7.9	13.4	23.5	30.9	30.4
secondary	9.9	23.4	45.1	65.4	66.3
incomplete secondary	35.4	47.3	52.5	43.7	44.7

Determine:

the structure of the population by education;

the number of people with higher education relative to 100 people with incomplete secondary education;

the dynamics of the population by the received education (the base is the year 1995).

Specify the kind of the calculated relative indicators. Present the data in the form of a statistical table.

2. The scheduled gain of the output of a branch for the current year should make 4.6 %. The actual growth of the output has made 106.5 % in this year. Determine the percent of the plan performance of the output.

3. We have some data about the realization of products by some industrial enterprises, UAH ths (Table 8).

Table 8

**Distribution of the enterprises according
to the level of products realization**

The number of the enterprise	Actual for the 1st quarter	2 quarter	
		Under the plan	Actual
1	8 500	8 650	8 720
2	7 540	7 650	7 700
3	9 900	10 400	10 670
4	5 900	6 000	5 950

Calculate the indicators which describe the planned target, the performance of the plan and the dynamics of products realization at each enterprise and in the association as a whole. Explain how you did the calculations and draw a conclusion.

4. We have some data about the structure of foreign trade in services (Table 9).

Table 9

The geographical structure of foreign trade in services, $ ths

Countries	Export		Import	
	2014	2015	2014	2015
Total	35 476.64	34 271.78	14 265.89	14 828.72
The CIS countries	13 971.39	15 089.10	3 198.12	3 617.07
Other countries of the world, including:	21 505.25	19 182.68	11 067.77	11 211.65
Europe	10 114.77	5 451.86	4 839.15	6 881.27
Asia	6 396.27	8 404.70	1 613.40	3 226.88

Calculate all the possible kinds of relative parameters, explain their substance.

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5. We have some data about the labour input into some production in factories (Table 10). Determine the average time consumption for a unit of produce.

Time consumption for output in factories

The number of a factory	Time consumption for production of a unit of produce, hours	Time consumption for all the produce, hours
1	45.0	2 250.0
2	52.0	3 200.0
3	60.0	1 800.0
4	58.0	6 380.0

6. Determine an average share of credits in the total sum of creditor debts of banks (Table 11). Explain the choice of the average.

Distribution of branches of commercial banks

Branches of commercial banks	The total sum of creditor debts, UAH m	The share of credits on the security of property in the total sum of creditor debts, %
Central	256	25
Branch	109	47

7. We have some data about the level of profitability of some enterprises of the food-processing industry (Table 12).

Distribution of the enterprises according to the level of profitability

Profitability of production, %	The number of enterprises of the food processing industry
Less than 5	12
5 – 10	24
10 – 15	8
15 – 20	4
20 and more	2

Determine an average level of profitability for the enterprises of the food-processing industry. Explain how you did the calculations and draw a conclusion.

8. We have some data about the cost of the fixed capital of some enterprises (Table 13).

Table 13

**Distribution of the enterprises according to the cost
of the fixed capital**

The cost of the fixed capital, UAH m	up to 1.5	1.5 – 2.5	2.5 – 3.5	3.5 – 4.5	4.5 and more
The number of enterprises, unit	178	66	32	18	6

Determine an average level of an attribute which is studied by two ways. Explain how you did the calculations.

9. The discipline of businessmen of different kinds of activity, concerning the payment of taxes is characterized by the following data (Table 14).

Table 14

Distribution of enterprises concerning the payment of taxes

Kind of activity	The number of businessmen who pay taxes		The sum of the tax which is paid by one businessman, UAH m
	Total, thousand people	In % to all the registered businessmen	
Industrial	8	60	1.7
Trading	19	70	1.2
Intermediary	37	53	4.3

Determine the average share of the enterprises which pay taxes and the average size of the tax paid by one businessman.

10. We have some data about the payment of workers of small enterprises (Table 15).

Determine the average wage of 1 worker of an enterprise, using the parameters:

columns 1 and 2;

columns 2 and 3;

columns 1 and 3;

columns 3 and 4.

Explain the choice of the kind of averages.

Table 15

Data about the payment

The number of the enterprise	The wage fund, UAH	The number of workers, people	The monthly average wage, UAH	The relative share of workers, %
	Column 1	Column 2	Column 3	Column 4
1	270 000	300	900	60
2	240 000	200	1200	40

Topic 5. Analysis of distribution series

The purpose is to consolidate the theoretical and practical material on the topic "The analysis of distribution series".

The task is to carry out the analysis of statistical distribution series, to give economic interpretation of the calculated parameters.

Exercises for self-instruction

1. We have some data about the distribution of the sums of the given loans according to the credit rates.

<div align="right">Table 16</div>

Distribution of loans according to the credit rate size

The credit rate, %	The sums of the given loans, million UAH	
	1 quarter	2 quarter
Up to 30	1	5
30 – 40	4	11
40 – 50	9	8
50 and more	6	6
Total	20	30

Determine the mean credit rate in the usual way and in the way of "moments", the mode and the median. Compare the obtained data. Determine the variance and a standard deviation in two ways, the coefficient of the variation. Estimate the uniformity of the set on quarters. Draw an analytical conclusion by the results of the calculations.

2. We have some data about the term of the non-material assets use (Table 17).

<div align="right">Table 17</div>

Distribution of non-material assets according to the term of use

The term of use, years	1	2	3	4	5	6	In total
% of the total sum of the non-material assets	18.5	6.3	28.5	25.7	9.2	11.8	100

Determine the number of cumulative frequencies, the mode and the median of the term of non-material assets use, variance, and estimate the uniformity of the set. Draw a conclusion.

3. There is some information on the distribution of city dwellers according to the size of the income per capita (Table 18).

Table 18

Distribution of city dwellers according to the size of the income per capita

The average income per capita, US thousand	Up to 0.5	0.5 − 0.6	0.6 − 0.7	0.7 − 0.8	0.8 − 0.9	0.9 − 1.0	1.0 − 1.1	More than 1.1
The number of inhabitants	463	380	406	613	823	420	283	242

Determine the parameters of the centre value of distribution and structural characteristics of the set, parameters of the size and intensity of the variation. Draw conclusions.

4. Charges on the demonstration of commercials on different channels are characterized by the following data (Table 19).

Table 19

Distribution of channels according to the cost of commercials

Channels	The number of commercials per day	Expenses for demonstration of one commercial, UAH ths					
State	4	1.18	0.97	1.15	1.20		
Commercial	6	0.29	0.31	0.26	0.34	0.30	0.25

Determine the intergroup, the average of the group variance, the intergroup variance and the total variances of the expenses on the demonstration of commercials, and the share of the intergroup variance in the total variance. Draw conclusions.

5. Labour productivity at the enterprises of the coal industry is characterized by the following data (Table 20).

Table 20

Distribution of the enterprises of the coal industry according to the labour productivity level

The enterprise	The relative share of workers, %	The monthly average coal mining per worker, thousand t	The dispersion of the coal mining
Mines	75	40	3 400
Coal cuts	25	200	2 600
On the set as a whole	100	80	−

Determine the intergroup, average of the group variance and the total variance of the coal mining per worker. Explain the sense of each variance.

6. Consumption of natural gas in the residential sector per year is characterized by the following data (Table 21).

Table 21

**Distribution of categories of habitation according
to the level of natural gas consumption**

The category of habitation	The number of consumers, thousand	Mid-annual consumption of gas per consumer, m^3
An apartment with a gas cooker	40	250
An apartment with a gas cooker and a water heater	10	400
Total	50	–

Determine the intergroup and average of the group variance of the consumption of gas if it is known that the total variance is equal to 4 800.

7. The relative share of honors students at the faculty makes 15 %. Determine the variance of the share of the honors students.

8. The share of high liquidity assets in the sum of current assets of commercial banks at the beginning of the year made 31 %. Determine the dispersion of the share of high liquidity assets.

9. According to the inspection of commercial banks of a city, 70 % of the general number of clients are legal persons with the average size of credit of 120 thousand UAH and the coefficient of variation of 25 %, and 20 % are physical persons with the average size of credit of 20 thousand UAH at the standard deviation of 6 thousand UAH. Using the rule of addition of dispersions, determine the degree of interdependence between the credit size and the type of client.

Module 2. Methods of inferential statistics

Topic 6. Sampling and sampling distributions

The purpose is to consolidate the theoretical and practical material on the theme, acquire skills in carrying out inspection and the estimation of selective inspection results.

The task is to carry out analysis of selective observation data by calculation of the necessary volume of a sample, a limiting mistake of the sample and a confidential interval.

Exercises for self-instruction

1. According to the sample of 64 enterprises of small business the average return of charges makes 27 % with an average standard deviation of

7.2 %. Determine the standard error of the sample and the confidence intervals in which there is an average level of the recoupment of charges with a probability of 0.997. Draw a conclusion.

2. According to the sample of 45 % of respondents consider that advertising is the basic source of the information on the commodity market. A standard error of the sample of this parameter is 2.6 %. With probability of 0.954 estimate the limits of confidence intervals for the whole population. Draw a conclusion.

3. The contract between the manufacturer and the customer stipulates, that the customer can refuse the contract and all the losses are to be covered by the manufacturer if the share of non-standard products exceeds 5 %. As a result of checking a production run from 300 units it is revealed, that 16 units are defective. Can the customer break off the contract?

4. A 2 % mechanical sampling was conducted in a region (Table 22).

Table 22

Distribution of the unemployed according to the duration of unemployment

Groups of the unemployed according to the duration of unemployment, months	Up to 5	5 − 10	10 − 15	15 − 20	20 − 25	25 − 30	30 and more
The number of the unemployed	47	81	150	193	107	99	23

Determine:

the confidence intervals in which there is an average duration of unemployment in the general population with a probability of 0.954;

with a probability 0.997 determine the confidence intervals for the share of the unemployed with duration of unemployment over 20 months.

Draw a conclusion.

5. As a result of the observation of each fifth small enterprise the following data have been obtained:

Table 23

Distribution of the operating ratio of the equipment

The operating ratio of the equipment, %	Up to 80	80 − 85	85 − 90	90 and more
The number of small enterprises	26	16	8	11

Determine the confidence intervals with a probability of 0.954:

the average operating ratio of the equipment;

the relative share of small enterprises with the operating ratio of the equipment of up to 85 %. Draw conclusions.

6. 100 banks out of 200 commercial banks of the region (casual sampling without recurrences) were distributed by percent actives of highly liquid assets.

Table 24

Distribution of the percent of highly liquid assets

The percent of highly liquid assets	Up to 10	10 − 15	15 − 20	20 − 25	More than 25
The number of banks	5	12	44	26	13

With a probability of 0.997 determine the confidence intervals of the average percent of highly liquid assets among 200 banks of the region;

with a probability of 0.954 determine the confidence intervals for the share of banks in which the percent of highly liquid assets is over 15 %.

Draw conclusions.

7. A 10 % sample was taken with the purpose of studying the time budget use in an institute. 200 people were surveyed for the sample. By the results of the observation the working hours consumption was distributed as shown in Table 25.

Table 25

Distribution of working hours consumption

Working hours	Average time consumption	Standard deviation
Time for the auditory work	4.5	0.270
Independent preparation for lessons	3.4	0.374

15 % of the surveyed students are honours people.

With a probability of 0.954 find an error in the time consumption of each point;

with a probability of 0.997 determine the error in the share of honours students.

Analyze the received results and draw conclusions.

8. 100 people out of 1 000 enterprise workers were surveyed by casual sampling. They were distributed according the level of replaceable products manufacture (Table 26).

Table 26

Distribution of workers

Replaceable products, UAH	518 – 624	624 – 730	730 – 836	836 – 942	In total
The number of workers	10	30	40	20	100

Determine:

the average daily production per worker;

the average and standard error of the sample with a probability 0.954;

the probability that the average daily production of the working enterprise will deviate no more than by 6 UAH;

the share of workers of the enterprise with the daily production higher than 730 UAH with a probability 0.954.

9. Apply the technique of selective estimation of the average and shares according to the observation of 100 registered unemployed (5 % sample) out of whom 30 people have received a conversion training to master a new trade. By the results of the inspection an average duration of unemployment makes 3 months, and the dispersion is equal to 2.25.

10. To determine the percent of the defective products it is supposed to conduct a selective supervision of a set of products which consists of 20 000 products. What should the number of samples be so that with a probability of 0.683 (0.954) it would be possible to prove that the error does not exceed 2 %?

Topic 7. Times series analysis

The purpose is to consolidate the theoretical and practical material on the theme "The analysis of dynamics'; acquire skills in the calculation of mean indices of dynamics.

The task is to carry out the analysis of dynamics series, to give economic interpretation of the calculated parameters.

Exercises for self-instruction

1. The profit of a commercial bank is characterized by the following data, UAH thousand (Table 27).

Table 27

The dynamics of the commercial bank profit

Year	Profit, UAH ths
2009	253
2011	273
2012	303
2013	314
2014	294
2015	344

For the analysis of the profit dynamics calculate:

the years 2011 – 2015: the absolute increases, the rates of growth and the rates of increase (by years and comparing to the basic 2011 year); the absolute values of one percent of an increase. Present the received parameters in the form of a table. Check up interrelation between the chain and basic rates of growth;

the average annual growth rates and the rates of the increase of profit for the years: 2009 – 2011; 2011 – 2015; 2009 – 2015;

the average level of profit for the years 2011 – 2015 and an average absolute increase of profit for this period.

Draw an analytical conclusion by the results of the calculations.

2. What should the average growth rate be for three years if production of the industrial output has increased from 18 up to 20 million UAH?

3. Using the interrelation of characteristics of the dynamics, determine the volumes of production of goods, the absolute and relative rate of the volumes of reduction (Table 28).

Table 28

Data for the characteristic of dynamics

Year	Production of goods	Basic characteristics of dynamics		
		absolute increase, UAH ths	rates of growth, %	rates of increase, %
1	600	–	–	–
2	–	–	–	-2
3	–	-28	–	–
4	–	–	97	–
5	–	–	–	-6

4. The dynamics of production of goods of light industry in a region is characterized by the following data (Table 29).

Table 29

The dynamics of production of goods

Kind of goods	Production in 2013	Annual absolute change of production	
		2014	2015
Fabrics, one million m^2	240	28	20
Knitted products, million pieces	150	15	-2
Footwear, million pairs	80	12	8

For each kind of goods determine:

the absolute average increase of production for the years 2014 – 2016;

the level of production in 2015;

the growth rate of production in 2015 in comparison with 2013;

the average growth rate of a gain for the years 2013 – 2015.

5. The dynamics of consumer charges of the population are characterized by the following data (Table 30).

Table 30

The dynamics of consumer charges

Consumer charges	The volume of charges in 2013, UAH m	The rate of increase, % compared to the previous year	
		2014	2015
Goods	82.5	122	107.5
Services	17.2	125	116.0

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For each group of consumer charges determine:

the average growth rate of the volume of expenses in the years 2014 – 2015;

the volume of charges in 2015;

the average absolute increase.

Topic 8. The index method

The purpose is to consolidate the theoretical and practical material on the theme "The index method", acquire skills in the analysis of statistical data by the index method.

The task is to carry out the analysis of data by the index method, to give economic interpretation of the calculated parameters.

Exercises for self-instruction

1. We have some data about the sale of goods (Table 31). Calculate:

individual indices

1) for price and volume;

aggregative indices of

2) the general cost;

3) the general price;

4) the total index of the actual volume;

5) the absolute amount of savings or cost overruns on the price change;

the **average level dynamics indices;**

6) the index of variable composition;

7) the index of constant composition;

8) the index of proportions shift.

Draw conclusions.

Table 31

The data about the sale of goods

Product A	The basis period		The current period	
	The number of products, units	Price per unit, UAH	The number of products, units	Price per unit, UAH
Enterprise 1	200	120	185	150
Enterprise 2	150	80	120	100

2. The actual volume of production has increased by 3.6 %. The price of products has decreased by 1.5 %. How have charges on production changed?

3. The cost price of a unit of product and the general charges on the products of factories are characterized by the following data (Table 32).

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Table 32

The data about the charges of production

Product	The cost price of a product unit, UAH		The general charges on production, UAH ths	
	The basic period	The current period	The basic period	The current period
A	8.0	7.0	6.4	9.1
B	12.0	10.0	6.0	6.2

Using the initial data, calculate:

the total index of the actual volume;

the general price index;

the general cost index.

Show the interrelation between the calculated indexes.

4. There are some data about the cost of the exported products and the change in prices of the given products in the current period in comparison with the basic period (Table 33).

Determine by the index analysis how

the export has changed in the relative and absolute values due to changes in prices if it is known, that the export of products has decreased by 15 %;

the export has changed due to changes in the actual volume of the exported products.

Interpret the received parameters.

Table 33

The dynamics of cost indexes by kinds of the exported products

Kind of products	Export of products in the current period, US dollar ths	Change in the price of a unit of the exported products in the current year in comparison with the basic year, %
A	450	-4.2
Б	487	-7.4
B	325	+3.1

5. We have some data about the sale of shares at a stock exchange (Table 34).

Determine the absolute increase of the shares cost due to the change in the number of shares and calculate the general cost index of the shares. Construct a multiplicative relation of the modular value indexes of the sold shares and explain its essence.

Table 34

The dynamics of the shares sale at a stock exchange

Shares	The cost of the sold shares, UAH m		Rates of change in the number of shares, %
	Basic year	Current year	
Simple	2.0	3.5	-4.52
Exclusive	5.0	6.1	+8.06

6. We have some data about the general charges on production and the price changes (Table 35).

Determine the change in the total turnover due to the change in prices and due to the change in the actual volume by all kinds of products.

Construct an additive model of charges on production and explain the received results.

Table 35

The dynamics of charges on production

Kind of production	The monetary outlay, UAH th		The individual index of the price
	In the basic period	In the current period	
A	32.0	34.4	0.98
B	67.9	75.0	1.25

7. We have some data about the sale of the good A in two city markets (Table 36).

Calculate by the indexes of average levels, how the price has changed as a whole in the two markets. Show the interrelation between the calculated indexes and give an economic interpretation.

Table 36

The dynamics of the sale of good in the city markets

The market	January		March	
	The amount of the sold goods, thousand kg	The price of 1 kg, UAH	The amount of the sold goods, thousand kg	The price of 1 kg, UAH
Alekseyevskiy	4.0	1.95	4.5	2.05
Konnyy	6.2	1.80	5.8	1.75

8. The dynamics of depositary interest rates for legal and physical persons is characterized by the following data (Table 37).

Table 37

The dynamics of depositary interest rates

Investors	The average depositary rate, %		The sum of the involved deposits, UAH ths	
	In the basic period	In the current period	In the basic period	In the current period
Legal persons	40	26	820	950
Physical persons	25	20	180	450

Calculate:

a) the average depositary rate in the basic and current periods and the index of the average depositary rate (variable composition);

b) the indexes of the average depositary rate of the constant composition and proportions shifts.

Explain their economic essence and show the interrelation.

9. We have the following data about the labour productivity of different trades (Table 38).

Determine by the averages of the index analysis how the labour productivity of each trade and the average labour productivity of all the trades has changed. Draw conclusions.

Distribution of workers according to the labour productivity level

The trade	The volume of the given services for the period, UAH ths		The general charges of time on the granting of services for the period, hours	
	In the basic period	In the current period	In the basic period	In the current period
1. A hairdresser	15.1	15.5	1 069	1 095
2. A repairman of home appliances	4.8	5.0	340	350
3. A repairman of footwear	11.7	12.1	670	710

10. We have some data about the production of milk in two regions (Table 39).

The data about the production of milk

The breed of cows	Region A		Region B	
	Total milk, thousand t	Fat content of milk, %	Total milk, thousand t	Fat content of milk, %
Lebedinskaya	72	3.5	45	3.2
Simmentalskaya	48	3.1	55	3.4

Calculate:

the territorial indexes of the average milk fat content of the variable and constant composition;

the index of proportions shifts, using the standard percent of the fat content of milk which makes 3.4 %.

Explain the economic essence of the indexes.

11. The general charges on the enterprise production have increased in the current period in comparison with the basic period by 8 %, the volume of production has increased by 11.5 %. Determine how the cost price of a product unit has changed in the current period in comparison with the basic period.

12. Determine, how the average productivity of one worker has changed if the number of workers has decreased by 10 %, the volume of output has increased by 6 %.

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