

МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ  
ХАРКІВСЬКИЙ НАЦІОНАЛЬНИЙ ЕКОНОМІЧНИЙ УНІВЕРСИТЕТ  
ІМЕНІ СЕМЕНА КУЗНЕЦЯ

**ЗАТВЕРДЖЕНО**

на засіданні кафедри  
статистики і економічного прогнозування  
Протокол № 7 від 03.01.2024 р.

**ПОГОДЖЕНО**

Проректор з навчально-методичної роботи



Каріна НЕМАШКАЛО

**СТАТИСТИКА**

**робоча програма навчальної дисципліни (РПНД)**

Галузь знань **07 "Управління та адміністрування"**  
Спеціальність **073 "Менеджмент"**  
Освітній рівень **перший (бакалаврський)**  
Освітня програма **"Бізнес-адміністрування"**

Статус дисципліни **обов'язкова**  
Мова викладання, навчання та оцінювання **англійська**

Розробники:  
д.е.н., професор

підписано КЕП

Олена РАЄВНЄВА

к.е.н., доцент



Ірина СЕРОВА

к.е.н., ст.дослідник

підписано КЕП

Вікторія ШЛИКОВА

Завідувач кафедри  
статистики і економічного  
прогнозування

підписано КЕП

Олена РАЄВНЄВА

Гарант програми



Ольга МИРОНОВА

Харків  
2024

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE  
SIMON KUZNETS KHARKIV NATIONAL UNIVERSITY OF ECONOMICS

**APPROVED**

at the meeting of the Department of  
Statistics and Economic Forecasting  
Protocol No. 7 dated January 3, 2024

**AGREED**

Vice-rector for Educational and Methodical  
Work



Karina NEMASHKALO

**STATISTICS**  
Program of the course

Field of knowledge **07 "Management and administration"**  
Specialty **073 "Management"**  
Study cycle **First (bachelor)**  
Study programme **"Business Administration"**

Course status **mandatory**  
Language **English**

Developers:  
Doctor in Economics  
Professor

\_\_\_\_\_ Digitally signed Olena RAYEVNYEVA

PhD (Economics)  
Associate Professor

\_\_\_\_\_ *2 Серев* Iryna SIEROVA

PhD (Economics)  
Senior Research  
Fellow

\_\_\_\_\_ Digitally signed Viktoriia SHLYKOVA

Head of Department of  
the Statistics and economic  
forecasting

\_\_\_\_\_ Digitally signed Olena RAYEVNYEVA

Head of Study Programme

\_\_\_\_\_ *[Signature]* Olga MYRONOVA

Kharkiv  
2024

## INTRODUCTION

In the system of economic sciences, statistics is considered one of the fundamentals that form the competence of a modern specialist in any field of knowledge. Statistical methods and indicators are used for drawing up plans and forecasts, evaluating the results of the activities of business structures, analysing the dynamic and proportional development of the country, and evaluating socio-economic processes taking place in the regions.

The growing interest in statistics in modern conditions is caused by the development of the economy and integration processes. It is the statistical data that reflect the course of processes occurring at the macro, meso, and micro levels and serve, at the same time, as an information base for making management decisions.

Thanks to this, important tasks have been set before statistics regarding the further improvement of the system of statistical indicators, techniques and methods of collecting, processing and analysing mass data, providing all levels of management with comprehensive, reliable and accurate information.

The study of the academic discipline "Statistics" belongs to the cycle of professional training of mandatory educational components of the "bachelor" degree and is aimed at the formation of basic competencies in the acquirers regarding the ability to objectively evaluate phenomena and processes, establish the dependence of the performance indicator on a set of factors, and identify trends of change studied phenomena and predict their development, etc.

The purpose of the course is the formation of theoretical knowledge, applied skills and abilities in the organization of statistical observations, the use of methods of statistical analysis and forecasting of socio-economic phenomena and processes.

The object of the course is the most diverse phenomena and processes of social life.

The subject of the course is the dimensions and quantitative ratios of mass social phenomena in an inextricable connection with their qualitative side, the quantitative expression of the laws of social development in specific conditions of place and time.

The objectives of the course are to study the essence of statistics as a tool for analytical processing of information, to master statistical methods of observation, grouping, analysis of distribution series and series of dynamics, assessment of development trends and fluctuations, study of relationships between factors, construction of index models, etc.

The learning outcomes and competencies formed by the course are defined in table 1.

Table 1

## Learning outcomes and competences formed by the course

Learning outcomes	Competencies
LO 6	GC 8
LO 8	SC 2
LO12	GC 8, SC 2, SC 13

where, LO6. Skills of searching, collecting and analysing information, calculating indicators to substantiate managerial decisions.

LO8. Apply management methods to ensure the effectiveness of the organisation.

LO12. Assess the legal, social and economic consequences of the organisation's functioning.

GC8. Ability to use information and communication technologies.

SC2. Ability to analyse the results of organisation's activities, to compare them with the factors of the external and internal environment influence.

SC13. Understand the principles of law and use them in professional activities.

## COURSE CONTENT

### Content module 1. Introduction to statistics.

#### Topic 1. Methodological principles of statistics.

##### 1.1. The concept of statistics as a social science, its origin and development.

The history of the development of statistics as a science. Characteristics of directions of development of statistics: school of "political arithmeticians", state management, statistical and mathematical direction. Development of domestic statistical science. Modern understanding of statistics.

##### 1.2. The subject and methodological foundations of statistics.

The subject of statistics, its fundamental features. Analysis of relationships between quantitative and qualitative aspects of the expression of economic laws in scientific research. Theoretical basis of statistics. Connection of economic theory and statistics. Methodological basis of statistics.

##### 1.3. Stages of statistical research and specific methods of statistical analysis.

Peculiarities of statistical methodology. Characteristics of the stages of statistical research. Methods of statistics. Constituent elements of statistical methods as a set of specific research methods.

##### 1.4. Concepts and categories in statistics.

Basic concepts and categories: statistical regularity - concepts and types; statistical population - concepts, properties, elements, signs and their gradation. A unit

of a statistical population. Sign – forms of external expression, types of scales for measuring signs. Variation. Statistical indicator. Indicator system.

### **1.5. Organization and tasks of statistics in modern conditions.**

Organization of statistical work in Ukraine and abroad. The essence of state statistics development programs. Modern trends in the development of statistics.

## **Topic 2. Statistical observation.**

### **2.1. The essence and task of statistical observation.**

Concept of statistical observation as the first stage of statistical research. Requirements for statistical information and its properties. Requirements for statistical observation. Primary and secondary observation. Stages of statistical observation.

### **2.2. Forms, types and methods of statistical observation.**

Organizational forms of observation: reporting (properties; types depending on the level of approval and purpose) and specially organized observation. Registers.

Classification of types of statistical observation: according to the degree of coverage of studied population units; by the time of registration of statistical data.

Methods of statistical observation: direct accounting, documentary accounting, surveys.

### **2.3. Plan of statistical observation.**

Monitoring plan: programmatic, methodological and organizational issues of the plan. Determination of the purpose of observation, the object of examination. Censors. The aggregate unit as a constituent part of the survey object. The source of information is the unit of observation. Observation program: essence and requirements for its construction. Bodies and personnel, place of examination, material and technical support, system of control and trial examinations, time and period of examination.

### **2.4. Statistical observation errors and assurance of data reliability.**

Monitoring data control. Types of control: logical, arithmetic. Grouping of observation errors depending on the cause of occurrence. Characteristics of registration errors.

## **Topic 3. Presentation of statistical data: tables, graphs, maps.**

### **3.1. The role and significance of the graphic method.**

Concept of statistical graph. The value of graphs in statistical analysis. A specific feature of graphs.

### **3.2. The main elements of the schedule. Rules for constructing statistical graphs.**

The main elements of the graph: the field of the graph, geometric signs, spatial landmarks, scale, explication of the graph. Scale and its elements. Graphic interval, numeric interval. Types of scales. Requirements related to the construction of graphs.

### **3.3. Types of statistical graphs and tables and methods of their construction.**

Types of graphs depending on the geometric signs, from the point of view of the problems being solved. Types of graphs depending on the method of construction: diagrams and statistical maps. Types of diagrams: linear, bar, strip, square, sector,

radial, triangular, figure, etc. Diagrams of comparison, structure and dynamics. Types of statistical maps: cartograms and cartograms. Types of cartograms: background, point.

Statistical tables and their structure. Conjugation tables as a type of statistical tables.

#### **Topic 4. Statistical data summarization and grouping.**

##### **4.1. The essence of statistical summary and its types.**

Statistical compilation is the second stage of the study of mass social phenomena. Types of summaries according to the depth of material processing, according to the form of information processing, according to the technique of execution. The essence of classifications.

##### **4.2. Statistical groupings and their types.**

The essence of grouping, its functions. Types of groupings by the number of grouping features: simple and combined. Characteristics of structural, typological and analytical groupings. Grouping construction: tasks solved using the grouping method; the choice of a grouping feature - attributive or quantitative. Determining the number of groups – based on the optimal number of groups according to the Sturges formula and grouping intervals. Secondary grouping.

##### **4.3. Distribution series in statistics.**

Distribution series: construction and elements of the series. Types of distribution series: depending on the characteristic underlying the construction of the series and depending on the nature of the variation. Graphical representation of distribution series.

##### **4.4. Statistical tables, their types and construction rules.**

Definition of statistical tables by the main representatives of academic statistics. Table elements: subject and predicate. Types of tables depending on the subject. Rules for the technical design of tables. Mandatory attributes of statistical tables: general and internal headings, summary line, numerical data.

### **Content module 2. Statistical indicators and distribution series.**

#### **Topic 5. Statistical indicators.**

##### **5.1. The essence, types and meaning of absolute indicators.**

Statistical indicator: its qualitative and quantitative content. Types of indicators according to the method of calculation, according to the sign of time. The essence of absolute statistical values, their means of obtaining and units of measurement. Types of absolute values.

##### **5.2. The essence, types and forms of expression of relative indicators.**

The essence and meaning of relative quantities. Types of relative values, methods of their calculation and forms of expression. Base of relative values and its selection. The problem of matching when constructing relative quantities.

##### **5.3. The essence, types and methods of calculating average indicators.**

The essence of average values. The main types and forms of averages: arithmetic average – simple and weighted; average harmonic – simple and weighted;

geometric mean – simple and weighted; chronological average, quadratic average. Mathematical properties of the average arithmetic value. Terms of use of average values. The rule of majority of averages. System of statistical indicators: integral complex evaluations, multivariate average.

## **Topic 6. Analysis of distribution series.**

### **6.1. Distribution regularity and its frequency characteristics.**

Characterization of regularity of distribution using frequency characteristics, characteristics of the center of distribution, characteristics of variation, characteristics of distribution unevenness, concentration, asymmetry.

### **6.2. Characteristics of the center distribution.**

Average values, structural averages (mode, median), their calculation in discrete and interval series.

### **6.3. Indicators of variation.**

Absolute and relative characteristics of variation. Formulas and methods of calculating variation indicators. Advantages and disadvantages of variation indicators. General dispersion and its mathematical properties. The variance of an alternative trait. Group, group average, intergroup variance. The rule of adding variances. Empirical correlation relation and its use for evaluating the closeness and strength of the connection between factor and outcome features.

## **Topic 7. Sampling and sampling distributions.**

### **7.1. General concept of sampling observation. Types and methods of selecting units from the general population.**

Sampling observation - essence, advantages, practice of use. Principles of selective observation. The main generalizing characteristics of the general and sample populations.

Characteristics of the methods of selecting units from the general population into the sample: random, mechanical, typical, serial, combined. Sampling with means replacement and sampling without the means replacement

### **7.2. Errors of sampling observation for different sampling schemes.**

Classification of sampling errors: by causes of occurrence, by calculation methods: average (standard), marginal. Sample estimates of average and proportion. Types of estimates of parameters of the general population - point estimation, interval estimation. Limits of the confidence interval - for the average, for the proportion. Calculation of sampling errors for different methods and methods of selection.

### **7.3. Features of a small sample and determination of the required sample size.**

Determining the required sample size for various selection methods. Relative sampling error: its purpose and calculation.

The essence of a small sample. Calculation of average and marginal errors based on the data of small samples.

Methods of distribution of sample observation data.

## **Topic 8. Analysis of concentration, differentiation and similarity of distributions.**

### **8.1. Ordinal distribution characteristics.**

Ordinal characteristics: quartiles and deciles. Quartile coefficient of variation, coefficient of decile differentiation. Asymmetry of distribution.

### **8.2. Characteristics of distribution unevenness.**

Characteristics of the shape of the distribution: single-peaked curves, symmetric distributions, asymmetric distributions, multi-peaked curves. Asymmetry coefficient.

### **8.3. Statistical indicators of concentration and centralization.**

Evaluation of the concentration of characteristic values: concentration coefficient, localization coefficients. Summarizing indicator of centralization. A graphic representation of the concentration of the trait.

### **8.4. Statistical evaluation of structural changes in time and space.**

The coefficient of similarity of structures of two populations, indicators of structure and intensity of structural shifts.

## **Content module 3. Methods of analysing the interconnections of phenomena and processes.**

### **Topic 9. Statistical methods of measuring interconnections.**

#### **9.1. Concepts and types of connections in statistics.**

Factorial and resultant features. Functional and stochastic relations. Correlation connection as a subtype of stochastic connection. Distinctive features of correlation relations. Direct and inverse correlations. Straight and curved correlation dependences. Statistical methods used in the analysis of the relationship between phenomena: the method of adding parallel series, the method of analytical groupings, the balance method.

#### **9.2. Model of analytical grouping.**

Regression equation as a form of analytical expression of statistical relationship. The effects of the influence of the factor characteristic on the resultant. Estimation of connection density using the correlation ratio. Checking the materiality of the connection.

#### **9.3. Regression equation and determination of its parameters.**

Stages of building a correlation equation. Pairwise (simple) linear correlation. Curvilinear correlation: calculation of parameters of linear one-factor regression equation, hyperbola equation, parabola and other mathematical functions. The essence of the regression coefficient. The coefficient of elasticity of the change in the outcome measure.

#### **9.4. Indicators of closeness and significance of correlation.**

Linear correlation coefficient. Coefficient of determination. Statistical evaluation of selective indicators of communication. Checking the significance of the regression coefficient using the Student's t-test. Verification of the significance of correlation and reliability of the model.

#### **9.5. Construction of multiple correlation-regression models.**

The essence of multiple correlation. Pure and complete regression coefficients. Elasticity coefficients, beta coefficients. Coefficient of multiple correlation and

coefficient of multiple determination. Construction and evaluation of a multivariate correlation model.

### **9.6. Methods of studying social phenomena relations.**

Quantitative assessment of the connection between social phenomena. Coefficients of association and contingency. Pearson-Chuprov coefficient of conjugation and its modifications. Four-cell conjugation tables - odds ratio calculation. Biserial correlation coefficient.

### **9.7. Non-parametric indicators of relations. Rank correlation coefficients.**

The essence of ranking. Spearman's rank correlation coefficient, Kendall's rank correlation coefficient, Fechner's coefficient, multiple rank correlation coefficient (concordance coefficient). Terms of application of the above coefficients.

## **Topic 10. Analysis of the dynamics intensity.**

### **10.1. The concept of series of dynamics and their types.**

Dynamic series: essence and types depending on the statistical nature of the indicators and on the sign of time. The concept of the level of a series of dynamics. Scientific conditions for construction of dynamics series.

### **10.2. Analytical indicators of series of dynamics.**

Basic and chain method of calculating absolute growth rates, growth rates, growth rates. Forms of expression of the above indicators of the intensity of dynamics. Absolute value of one percent increase. Methods of calculating average levels of dynamic series depending on the statistical structure of the indicator: simple and weighted arithmetic average, simple and weighted chronological average. Average absolute growth, average rate of growth and growth.

Acceleration and deceleration of dynamics: absolute and relative.

## **Topic 11. Analysis of development trends and fluctuations.**

### **11.1. Techniques for identifying the main trend of development in a series of dynamics.**

The general tendency of the development of socio-economic phenomena: the essence and methods of statistical description. The method of increasing intervals, calculation of the average by increased intervals, the method of moving average. The method of closing dynamic series.

### **11.2. Interpolation and extrapolation.**

Calculation of the missing levels of the series, which are inside and outside the series. Analytical alignment: essence and form of expression. Alignment by a straight line, by a parabola of the second order, by the equation of an exponential curve, by a hyperbola. Prediction of social phenomena.

### **11.3. Factor analysis of series of dynamics.**

Characteristics of the main methods of factor analysis of dynamic series: reduction of dynamic series to one basis, comparison of several parallel series of effective and factor indicators, dissection of the studied population into qualitatively homogeneous groups and subgroups, dispersion analysis.

### **11.4. Analysis of seasonal fluctuations.**

Concept of seasonal irregularity and its characteristics. Methods of calculating

seasonality indices depending on the nature of the general trend of a series of dynamics.

**Topic 12. Index method.**

**12.1. Concept of indices and their role in statistical and economic analysis.**

Concept of statistical index. Indexed quantities and weights. A system of conditional designations of indicators for the construction of indices. Concept of basic, reporting (current) periods. Classification of indices according to the degree of coverage of elements of the population, according to the method of construction, according to the basis of comparison, according to the calculation period and other features.

**12.2. Aggregate index as the main form of general index. Average weighted indices.**

Aggregate indexes of quantitative and qualitative indicators: essence and construction rules. Construction of indices of the system of commodity circulation.

The rule for constructing average weighted indexes: arithmetic mean and harmonic mean. Interrelationship between indices. Equal index systems: base-weighted (Laspeyres) and current-weighted (Paasche).

**12.3. Indexes with variable and constant weights.**

Variants of building a system of indices: base and chain. A system of individual and general base and chain indices and the relationship between them.

**12.4. Indices of average values.**

The rule for constructing indices of variable, permanent composition and structural shifts. Indices of average price, average cost price, average salary, average labor productivity. The economic value of these indices.

**12.5. Territorial indexes.**

A system of indices for characterizing the dynamics of a complex phenomenon in space. Peculiarities of calculating territorial indices. Indexed value for territorial indices. Method of standard weights.

**12.6. Index factor method of analysis.**

Systems of codependent indices. Index systems of turnover, production costs, wage fund, etc. Methods of decomposition of the general index into factors. Multivariate index models.

The essence of multiplicative and additive models.

The list of laboratory studies in the course is given in table 2.

Table 2

**List of laboratory studies**

Name of the topic and / or task	Content
Topic 1. Task 1.	The theoretical basis of the discipline: the evolution of the achievements of famous statisticians.
Topic 2. Task 2.	An overview of Excel capabilities. Mastering the skills of working with the MS Excel table processor.

Topic 3. Task 3.	Visualization of socio-economic information: construction and analysis of various types of diagrams.
Topic 4. Task 4.	Mastering the skills of data grouping in MS Excel.
Topic 5. Task 5.	Acquiring skills for calculating relative and average indicators.
Topic 6. Task 6.	Acquisition of skills in the analysis of distribution series.
Topic 7. Task 7.	Acquiring the skills of selective observation using MS Excel.
Topic 8. Task 8.	Mastering the methods of analysis of concentration, differentiation and similarity of statistical distributions.
Topic 9. Task 9.	Mastering the skills of conducting correlation, regression and dispersion data analysis in MS Excel.
Topic 10. Task 10.	Acquiring the skills of calculating dynamics indicators.
Topic 11. Task 11.	Acquiring skills in using extrapolation and interpolation in time series using MS Excel.
Topic 12. Task 12.	Acquisition of statistical data analysis skills using the index method.

The list of self-studies in the course is given in table 3.

Table 3

### List of self-studies

Name of the topic and / or task	Content
Topic 1.	Preparation of a presentation on questions, preparation for a game discussion.
Topic 2.	Preparation for the implementation of a situational task
Topic 1-12.	Performance of laboratory tasks
Topic 4-7.	Completion of homework 1 in the form of a case study on topics 4-7
Topic 1–12.	Preparation for laboratory classes and test control
Topic 10-12.	Completion of homework 2 in the form of a case study on topics 10-12
Topic 1–12.	Preparation for the exam

The number of hours of lectures, laboratory studies, and hours of self-studies is given in the work plan (technological map) for the academic discipline.

## TEACHING METHODS

In the process of teaching an educational discipline, to acquire certain learning outcomes, to activate the educational process, it is envisaged to use such learning methods as:

Verbal (lecture (Topic 4-8, 11-12), problem lecture (Topic 1, 2, 9), mini-lecture (Topic 3, 10)).

In person (demonstration (Topic 1-12)).

Practical (laboratory work (Topic 1-12), essay in the form of a presentation (Topic 1), case method (Topic 2, 4-7, 10-12), test control (topic 1-12)).

## FORMS AND METHODS OF ASSESSMENT

The University uses a 100-point cumulative system for assessing the learning outcomes of students.

**Current control** is carried out during lectures and laboratory classes and is aimed at checking the level of preparedness of the student of higher education to perform specific work and is evaluated by the sum of points scored:

– for disciplines with a form of semester control examination (exam): the maximum amount is 60 points; the minimum amount that allows a student of higher education to pass an exam is 35 points.

**The final control** includes the semester control and an exam.

**Semester control** is conducted in the form of a semester exam. The semester exam is taken during the exam session.

The maximum number of points that a student of higher education can receive during the examination is 40. The minimum amount for which the exam is considered passed is 25 points.

**The final grade for academic discipline** is determined by:

– for disciplines with a form of semester control exam - summing up the points from current and final control.

During the teaching of the academic discipline, the following control measures are used:

Current control: Laboratory work (15 points), essay in the form of a presentation (3 points), homework in the form of a case study (6 points), test control (24 points), written control works (12 points).

Semester control: Grading including Exam (40 points)

More detailed information on the assessment system is provided in technological card of the course.

An example of an exam card and assessment criteria.

### EXAMPLE OF EXAMINATION

Simon Kuznets Kharkiv National University of Economics  
First (bachelor's) level of higher education  
"Management" specialty  
Study programme " Business Administration ".  
Semester III  
Course "Statistics"

#### EXAMINATION TICKET No. 1

***Stereotype task (tests). (20 points)***

1	The subject of statistics is: a) dimensions of phenomena and processes and their relationship; b) sizes and quantitative relations between mass social phenomena, regularities of their formation, development, interconnection;
---	--

	c) the most diverse phenomena and processes of social life.
2	The population census refers to the observation of: a) selective; b) monographic; c) continuous; d) main massif.
3	Marketing research on the adaptation of a new product brand on the market refers to the observation of: a) current; b) simultaneous; c) periodic.
4	The seasonality index is: a) the percentage ratio of individual levels to the average level of a given series of dynamics; b) the ratio of individual levels to the total sum of levels of the dynamics series; c) moving average of individual levels of the series.
5	The criterion of homogeneity of the population is considered to be: a) decile coefficient of differentiation; b) quartile coefficient of variation; c) root mean square coefficient of variation.
6	The possible deviation of the indicators of the sample population from the indicators of the general population is measured by: a) sampling error; b) dispersion; c) mean square deviation.
7	The statistical population is: a) phenomena and processes of social life; b) a set of indicators studied by statistics; c) a set of phenomena that are homogeneous in at least one characteristic.
8	During the survey of the population, residents of every fourth apartment were interviewed about the total income of families. Every fourth apartment had four rooms. As a result, the results of the family survey were incorrect. What type of error occurred during this examination? a) random error of representativeness; b) systematic registration error; c) random error of representativeness; d) systematic registration error.
9	Equipment inventory refers to monitoring: a) documentary observation; b) direct; c) survey; d) expert assessments.
10	The study of product quality at the enterprise refers to the observation of: a) selective; b) monographic; c) continuous; d) main massif.
11	Specify the relative value of the intensity: a) 510 crimes were registered per 100,000 residents over the age of 14; b) among convicts, one in three is under the age of 30; c) 897 men per 1000 women.
12	Specify the relative value of dynamics:

	<p>a) investments in the oil production industry increased by 40% over the year;</p> <p>b) oil production compared to gas production increased by 210 million tons;</p> <p>c) the share of own funds is 70%.</p>
13	<p>The examination was carried out:</p> <p>1) every 10th agricultural enterprise out of 150 that irrigates land at the expense of its own funds in order to study the efficiency of the use of irrigated areas;</p> <p>2) agricultural firm "Koblevo" in order to study the reserves of increasing the efficiency of irrigation in this farm.</p> <p>Which of the examinations are selective?</p> <p>a) the first;</p> <p>b) the second;</p> <p>c) both the first and the second;</p> <p>d) does not have a correct answer.</p>
14	<p>How will a 4-fold increase in variance affect the sampling error?</p> <p>a) the sampling error will increase by 4 times;</p> <p>b) the sampling error will decrease by a factor of 2;</p> <p>c) the sampling error will not change;</p> <p>d) the sampling error will increase by 2 times.</p>
15	<p>Statistical observation is</p> <p>a) planned scientifically organized collection of data on mass social processes and phenomena with the help of registration of their essential features;</p> <p>b) registration of social phenomena and processes in special forms of statistical observation;</p> <p>c) collection of observation materials and their registration.</p>
16	<p>Specify the relative size of the structure:</p> <p>a) budget expenditures on health care are 10%;</p> <p>b) the export of products of the joint-stock company to European countries increased by 15%;</p> <p>c) for 100 hryvnias. fixed assets account for UAH 120. of gross production.</p>
17	<p>Which of the following composite index formulas is an index of the physical volume of product exports:</p> <p><math>\frac{\sum q_1 p_0}{\sum q_0 p_0}</math>, <math>\frac{\sum q_1 p_1}{\sum q_1 p_0}</math>, <math>\frac{\sum q_1 p_1}{\sum q_0 p_0}</math>, <math>\frac{\sum q_0 p_0}{\sum q_1 p_0}</math>.</p> <p>a) <math>\frac{\sum q_1 p_0}{\sum q_0 p_0}</math> B <math>\frac{\sum q_1 p_1}{\sum q_1 p_0}</math> C <math>\frac{\sum q_1 p_1}{\sum q_0 p_0}</math> D) <math>\frac{\sum q_0 p_0}{\sum q_1 p_0}</math>.</p>
18	<p>Setting the start and end date of data collection is</p> <p>a) objective observation time;</p> <p>b) subjective observation time;</p> <p>c) critical moment of observation.</p>
19	<p>The median in the distribution series is:</p> <p>a) the highest frequency (or value of the characteristic);</p> <p>b) the value of the sign that occurs most often;</p> <p>c) the value of the sign, mentally divides the distribution series into two equal parts.</p>
20	<p>The general price index is equal to <math>p = 0.92</math>. How has the cost of sales changed due to prices?</p> <p>Answers: 1) increased by 8%; 2) decreased by 8%; 3) changed by 0.92%.</p> <p>a) increased by 8%;</p> <p>b) decreased by 8%;</p> <p>c) changed by 0.92%.</p>

**Diagnostic task 1 (calculation test). (3 points)**

The share of highly liquid assets in the sum of current assets is 18%. Find the dispersion of the share of highly liquid assets. Explain the calculations.

### **Diagnostic task 2 (essay). (7 points)**

Conclude the localization and concentration of employees at enterprises according to the specified types of economic activity: the coefficient of localization at industrial enterprises is 3.4; at agricultural enterprises - 5.7; at trade enterprises – 7.8. The concentration factor is 85%. Explain the answer.

### **Heuristic task (calculation). (10 points)**

We have data on the volume of merchandise turnover in the region, million hryvnias:

2017 year	2018 year	2019 year	2020 is the year	2021 year	2022 year	2023 year
135	120	110	130	145	156	167

Analyze this dynamic series using base and chain methods. Submit the obtained indicators in tabular form. Calculate the average annual absolute growth, average annual growth rates and average annual growth rates of turnover for 2017-2023. Explain the calculation and results. Draw conclusions based on the obtained indicators.

Approved at the meeting of the Department of Statistics and Economic Forecasting protocol No. \_\_\_\_\_ dated "\_\_\_" \_\_\_\_\_ 20\_\_ year.

Examiner

Candidate of Economy Sciences,  
Senior Research Fellow, Shlykova V.O.

Head of Department

Doctor in Economics, Prof. Raevneva O. V.

### **Evaluation criteria**

**The final grade for the exam** consists of the sum of the points for the completion of all tasks, rounded to a whole number according to the rules of mathematics.

The algorithm for solving each task includes separate stages that differ in complexity, time-consumingness, and importance for solving the task. Therefore, individual tasks and stages of their solution are evaluated separately from each other as follows:

**stereotyped task in the form of closed tests** - 20 tests, maximum score per test - 1 point (maximum number of points - 20);

**diagnostic task 1 (calculation test)** – maximum score 3 points:

1 point – selection of the calculation formula;

1 point – implementation of calculation actions;

1 point – formulation of the answer to the question.

**diagnostic task 2 (essay)** - maximum score 7 points:

1 point – understanding the essence of the task;

2 points – selection of calculation formulas or algorithm for task performance;

2 points – making a calculation or formulating an algorithm of actions to perform the task;

2 points - the presence of reasoned conclusions based on the results of analytical work;

**heuristic task (calculation)** – maximum score 10 points:

2 points – understanding the essence of the task;

2 points – selection of calculation formulas that correspond to the essence of the questions;

2 points – calculation of indicators according to separate formulas related to the research topic;

2 points – calculation of indicators in full by the questions posed in the task;

2 points – providing reasoned conclusions based on the results of calculation work.

## RECOMMENDED LITERATURE

### Main

1. Diez D. M., Barr C. D., Cetinkaya-Rundel M. OpenIntro Statistics – Fourth Edition. Openintro. 2019. Access mode: <https://open.umn.edu/opentextbooks/textbooks/60>
2. Rayevnyeva O. Statistics [Electronic resource]: textbook / O. Rayevnyeva, I. Aksonova, O. Brovko [et al.]; Simon Kuznets Kharkiv national university of economics. - E-text data (3,53 МБ). - Kharkiv: S. Kuznets KhNUE, 2020. - 376 p.: il. - The title screen. - Referenc.: p. 356-362. Access mode: <http://repository.hneu.edu.ua/handle/123456789/25678>
3. Статистика [Електронний ресурс]: навч. посіб. / О. В. Раєвнева, І. В. Аксьонова, О. І. Бровко [та ін.]; за заг. ред. О. В. Раєвневої; Харківський національний економічний університет ім. С. Кузнеця. - Електрон. текстові дан. (3,59 МБ). - Харків: ХНЕУ ім. С. Кузнеця, 2019. - 389 с.: іл. - Загол. з титул. екрану. - Бібліогр.: с. 368-375. Access mode: <http://repository.hneu.edu.ua/handle/123456789/24523>
4. Горкавий В. К. Статистика: Підручник. Третє вид., переробл. і доповн. Київ: Алерта, 2020. 644 с.
5. Краєвський В. М. Статистика: навч. посіб. / В. М. Краєвський, Я. О. Остапенко, Н.В. Параниця // Ун-т ДФС України. Ірпінь, 2019. 218 с.
6. Статистика: підручник / С. І. Пирожков, В. В. Рязанцева, Р. М. Моторин та ін. – Київ: Київ. нац. торг.-екон. ун-т, 2020. 328 с.

### Additional

7. Sierova I. International Indices: Measurement and Usage Issues // Проблеми економіки, 2020, №2. С.416-423. Access mode: <http://www.repository.hneu.edu.ua/handle/123456789/24710>
8. Sierova I. Information technologies in education: the formation of a content component / I. Sierova, E. Zhelezniakova, T. Silichova et al // ScienceRise. – 2021. – No. 2(73). – P. 72-78. Access mode: <http://www.repository.hneu.edu.ua/handle/123456789/25713>
9. Spiegelhalter D. The Art of Statistics: How to Learn from Data. First Edition. Basic Books, 2019. – 448 p.
10. Шабельник Т. В. Математичні методи інтелектуального аналізу даних: навч. посібник для здобувачів першого рівня вищої освіти спеціальності 124 Системний аналіз / Т. В. Шабельник, О. Ф. Дяченко. – Маріуполь: МДУ, 2021. – 163 с. Access mode: <http://repository.hneu.edu.ua/handle/123456789/28088>
11. Педченко Г. П., Завадських Г. М., Прус Ю. О. Статистика: курс лекцій. Мелітополь: Люкс. 2021. 223 с.
12. Статистика [Текст]: метод. рек. до вивч. дисц. / Лохман Н.В., Носовська С.Є. Донец. нац. ун-т економіки і торгівлі ім. М. Туган-Барановського, каф. економіки та бізнесу. Кривий Ріг: ДонНУЕТ, 2021. 96с.

13. Семенова К. Д., Тарасова К. І. Бізнес-статистика: Підручник / К. Д. Семенова, К. І. Тарасова. К: ФОП Гуляєва В.М. 2018. 210 с.
14. Чекотовський Е. В. Статистичні методи на основі Microsoft Excel 2016: навч. посібник. Київ: Знання, 2018. 408 с.
15. Крамарев Г. В. Аналіз динаміки та структури зовнішньоторговельної діяльності України / Г. В. Крамарев, В. О. Шликова, О. М. Леванда // Бізнес Інформ. – 2019. – №1. – С. 79–91. Access mode: <http://repository.hneu.edu.ua/handle/123456789/22812>

### **Information resources**

16. Official website of the Main Department of Statistics in the Kharkiv region [Electronic resource]. Access mode: <http://kh.ukrstat.gov.ua/>
17. Official website of the State Statistics Service of Ukraine [Electronic resource]. Access mode: <https://www.ukrstat.gov.ua/>
18. Statistical Office of the European community [Electronic resource]. Access mode: <https://ec.europa.eu/eurostat/web/main/data/database>
19. Official website of the Department of Statistics and economic forecasting. Simon Kuznets Kharkiv National University of Economics. [Electronic resource]. Access mode: <https://statistics.hneu.edu.ua/>