

Ministry of Education and Science of Ukraine

Kharkiv Petro Vasylenko National Technical University of Agriculture

Department accounting and audit

Methodical recommendations  
for practical classes on Statistics (in English) for the students of the ERL  
of Business and Management

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Методичні рекомендації для практичних занять з дисципліни «Статистика» на англійській мові підготовлені згідно з програмою дисципліни “Статистика”. У методичних рекомендаціях висвітлюються питання організації і методів статистики, методики розрахунку статистичних показників, їх аналізу та складання висновків.

Методичні вказівки допоможуть оволодіти методикою розрахунку статистичних показників, навчитися будувати статистичні таблиці, набути вміння робити аналітичні висновки та прогнози.

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## Preface

The purpose of Statistics is to give students, primarily those in the fields of accounting and economics, a conceptual introduction to the fields of statistics and its many applications. Statistical methodology is an integral part of the organization, presentation and analysis of any research. Using of each technique and statistical results is given for solutions to problem.

In today's global business and economic environment, vast amounts of statistical information are available. The most successful managers and decision makers are the ones who can understand the information and use it effectively. In this course of lectures on Statistics (in English), we considers the main topics of the course that illustrate the stages of statistical research, the basis of statistical methodology and the skills of independent work with arrays of statistical information for providing of statistical research.

### Accounting

Accounting firms use statistical sampling procedures when conducting audits for their clients. For instance, suppose an accounting firm wants to determine whether the amount of accounts receivable shown on a client's balance sheet fairly represents the actual amount of accounts receivable. Usually the number of individual accounts receivable is so large that reviewing and validating every account would be too time-consuming and expensive. The common practice in such situations is for the audit staff to select a subset of the accounts called a sample. After reviewing the accuracy of the sampled accounts, the auditors draw a conclusion as to whether the accounts receivable amount shown on the client's balance sheet is acceptable.

### Finance

Financial advisors use a variety of statistical information to guide their investment recommendations. In the case of stocks, the advisors review a variety of financial data including price/earnings ratios and dividend yields. By comparing the information for an individual stock with information about the stock market averages, a financial advisor can begin to draw a conclusion as to whether an individual stock is over- or undervalued. This and other information would help the ad-visor make buy, sell, or hold recommendations for the stock.

## Marketing

Electronic scanners at retail checkout counters are being used to collect data for a variety of marketing research applications. For example, data suppliers purchase point-of-sale scanner data, process the data, and then sell statistical summaries of the data to manufacturers. Manufacturers also purchase data and statistical summaries on promotional activities such as special pricing and the use of in-store displays. Product brand managers can review the scanner statistics and the promotional activity statistics to gain a better understanding of the relationship between promotional activities and sales. Such analyses are helpful in establishing future marketing strategies for the various products.

## Economics

Economists are frequently asked to provide forecasts about the future of the economy or some aspect of it. They use a variety of statistical information in making such forecasts. For instance, in forecasting inflation rates, economists use statistical information on such indicators as the Producer Price Index, the unemployment rate, and manufacturing capacity utilization. Often these statistical indicators are entered into computerized forecasting models that predict inflation rates.

## Theme 1. Subject and theoretical aspects of Statistics

**The purpose of the lesson:** formation of students' knowledge about the content of statistics as a science, its basic concepts, categories and methodological foundations.

### Task 1.

Using the data on the permanent population of Ukraine, determine the original statistical concepts: **statistical population, population unit, feature and its types**. Draw conclusions about the dynamics of the population of Ukraine.

Table 1

The permanent population of Ukraine in 1979-2020.

Years	All permanent population, million people	including		to the total population	
		Men, million people	Women, million people	% men	% women
1	2	3	4	$5=(3:2)*100$	$6=(4:2)*100$
1979	49,8	22,8	27,0	46	54
1989	51,7	24,0	27,7	?	?
1999	49,9	22,9	26,9	?	?
2009	46,1	21,2	24,8	?	?
2020	41,9	19,2	22,6	?	?

### Task 2.

Using conditional data on the success of the group 21-MN to determine:

1. Initial statistical concepts: population, population unit, feature and its types, variant (Xi) and frequency (Fi).
2. Calculate the average score of the group for the winter and summer sessions.
3. Draw conclusions.

Table 2

Points (scores), Xi	Number of students who passed the exam in the discipline "Mathematics"	
	winter (F1)	summer (F2)

2	6	9
3	14	11
4	4	3
5	1	2
Total	?	?

**Critical questions:**

1. Explain the origin of the term "statistics".
2. Define the modern concept of "statistics".
3. Define the subject and object of statistics.
4. Describe the stages of statistical research.
5. List the methods that are inherent in statistical research.
6. Describe the original statistical concepts.
7. How is the organization of statistics in the country?

**Theme 2. Statistical observation**

**The purpose of the lesson:** students gain skills in organizing and conducting statistical observation, as a scientifically organized collection of mass data about the studied objects.

Task 1.

Define the object of observation, the unit of observation, the unit of population in special statistical surveys:

Table 1

Name of the Observation	Object of Observation	Observation Unit	Population Unit
1.Census of the population of Ukraine	<i>the whole population</i>	<i>family</i>	<i>one person</i>
2.Inventory of technical means of education in the city's universities as of January 1, 20XX			
3.Accounting for			

fruit trees in the backyards of the residents of the district on June 1, 20XX.			
4. One-time accounting of the agricultural tractor fleet enterprises of the region as of 01.09.20XX.			
5. Census of obsolete equipment at the enterprises of the branch as of October 1, 20XX			

Task 2.

Identify the form and types of observations in the following statistical surveys:

Table 2

Name of the Observation	Form of the Observation	Types of Time Observation	Types by Coverage of Population Units
1. Census of the population of Ukraine	<i>specialy organized</i>	<i>periodic</i>	<i>continuous</i>
2. Monthly reporting of the enterprise on execution of the plan on production			
3. Accounting			

for the natural movement of the population (births and deaths) by rags and village councils			
4. Inspection of living conditions of dormitory students by the student committee			
5. Daily registration of the rate of purchase and sale of currency			
6. To study the time budget, every 10th student of the university kept a record of time spent on a special form for a month			

Task 3.

With the help of logical control to detect errors in the correctness of the census form and make corrections:

Table 5

Questions	Answers
1. Last name, first name and patronymic	Ivanov Ivan Ivanovich
2. Gender	Female



3. Age	15
4. Is he married at this time?	yes
5. Nationality	Ukraine
6. Native language	Ukrainian
7. Education	Higher
8. Source of livelihood	Work at the enterprise
9. Place of work	JSC "House"
10. Position at the place of work	Director

Task 4.

Using conditional data carry out arithmetic control of the availability of fixed assets at the end of the year, taking into account the sequence and logic of actions. Please correct errors:

Table 3

Availability of Fixed Assets at the Beginning of the Year	Put into Operation New Fixed Assets	Received during the Year from other Industries	Dropped out during the year due to Depreciation of Fixed Assets	Transferred during the year to other Industries	Availability of Fixed Assets at the end of the Year
1	2	3	4	5	6
57000	5500	1700	1200	2500	75000

**Critical questions:**

1. Define the concept of statistical observation.
2. What is the object and unit of statistical observation?
3. Describe the forms of statistical observation. Define the concept of each of them.
4. Give the classification of types of statistical observation: by the degree of coverage of population units, by time.
5. Define the concepts of "continuous observation" and "carrying continuous" observation.
6. Describe the methods of statistical observation.
7. Name the program-methodological and organizational issues of observation.
8. Describe the types of control over the materials of statistical observation.

### Theme 3. Summary and ranking data

**The purpose of the lesson:** formation of students' knowledge about the essence of compilation and grouping as an important stage of statistical research, methodology of construction of statistical groupings Task1.

Table 1

№	Work experience (years)	Monthly output per 1 worker, UAH	№	Work experience (years)	Monthly output per 1 worker, UAH
1	8,0	262	16	4,5	222
2	7,0	252	17	12,0	279
3	7,5	253	18	11,0	295
4	5,3	252	19	14,0	320
5	5,0	244	20	13,2	284
6	2,5	240	21	16,0	310
7	5,5	245	22	2,7	223
8	10,1	262	23	2,5	230
9	6,0	256	24	6,9	280
10	5,0	241	25	4,4	250
11	6,5	252	26	9,2	298
12	9,0	264	27	6,5	290
13	9,0	270	28	3,0	205
14	1,0	234	29	1,0	202
15	10,5	276	30	1,0	200

**Using the above conditional data:**

1. Build a series of distribution of workers by length of service, creating five groups at different intervals.
2. To study the relationship between experience and productivity, make:
  - 1) grouping workers by length of service, creating five groups at regular intervals. Describe each group by the number of workers, average length of service; monthly output - together and on average for 1 worker;
  - 2) combination grouping on two grounds: work experience (5 gr.) And monthly output per 1 worker (3 gr.). Describe each group according to the same indicators.

Task 2.

We have the following conditional data on the work of 30 enterprises:

Table 2

№/п	Average list number of employees, men	Production output for the year, UAH million	№/п	Average list number of employees, men	Production output for the year, UAH million
1	160	2,4	16	305	3,9
2	207	2,2	17	306	3,9
3	350	3,6	18	450	8,2
4	328	3,7	19	311	3,6
5	292	2,8	20	406	4,6
6	448	5,1	21	235	2,5
7	300	2,2	22	411	9,1
8	182	1,9	23	312	3,4
9	299	4,2	24	253	1,3
10	252	2,3	25	395	6,4
11	435	5,5	26	460	4,3
12	262	2,2	27	268	3,2
13	223	1,9	28	227	1,5
14	390	6,1	29	381	8,6
15	236	4,5	30	360	3,2

To study the dependence of output and productivity on the number of employees, build a series of distributions at regular intervals on the average number of employees per year. Create the number of groups in your opinion. For each group, calculate:

- 1) the number of enterprises;
- 2) the number of employees;
- 3) production output: in total, on average for 1 enterprise, for 1 employee. Give the results in the form of a group table, draw conclusions.

Task 3.

The following data on the work of 20 enterprises are known:

Table 3

№	Average annual cost of fixed assets, UAH million	The average number of workers, men	Commodity products,		№	Average annual cost of fixed assets, UAH million	The average number of workers, men	Commodity products,	
			million, UAH	in% to the plan				million, UAH	in% to the plan
1	3,0	360	3,2	103,1	11	2,7	310	2,8	108,5
2	7,0	380	9,6	120,1	12	3,3	200	2,3	102,1
3	2,0	220	1,5	109,5	13	3,0	250	1,3	111,7
4	3,9	460	4,2	104,4	14	3,1	310	1,4	92,0
5	3,3	395	6,4	104,8	15	3,1	410	3,0	108,0
6	2,8	280	2,8	94,3	16	3,5	600	2,5	111,1
7	6,5	580	9,4	108,1	17	3,1	400	7,9	96,9
8	6,6	200	11,9	125,0	18	5,6	450	3,6	114,1
9	2,0	270	2,5	101,4	19	3,5	300	8,0	108,1
10	4,7	340	3,5	102,4	20	4,0	350	2,5	107,1

To summarize the results of these data, build a series of distribution of enterprises by value of fixed assets, identified five groups at regular intervals. Calculate the share of enterprises in each group. Specify the most characteristic value of fixed assets. Make a logical and arithmetic control of the compound grouping, determine its purpose and write the name of the table and conclusions.

Task 4.

Production of agricultural products in Ukraine (all categories of farms), thousand tons is characterized by the following data in the base year: potatoes - 18453.0; vegetables - 6538.2; fruits and berries-1696.7; meat (live weight) -2629.4; milk -13661.4; eggs - 11477.1 (million pieces); wool - 3353.

In the reporting year, these farms produced: potatoes - 18719.0; vegetables - 5927.0; fruits and berries - 1270.0; meat (live weight) - 1250.3; milk - 13543.0; eggs - 11775.0; wool - 3231.0.

Using conditional data of the problem, display the data in tabular and graphical form, determining the type of table, its subject and predicate.

**Critical questions :**

1. What do you mean by "summary"? Determine the purpose of the construction and describe its elements.
  2. What is called a "distribution series", name its elements.
  3. Describe the types of distribution series.
  4. Statistical grouping, grouping feature and their types.
- What do you mean by "grouping"? Describe its types.
5. Define the concept of statistical table.
  6. What is the subject and predicate of the table?
  7. Describe the types of statistical tables and give the rules of their construction.
  8. What is called the layout of the statistical table?

**Theme 4. Statistical indexes**

**The purpose of the lesson:** the formation of students' knowledge of the technique of calculating absolute and relative values and their economic interpretation

Task 1.

Agricultural birds were fed at the poultry farm during the year: oats - 25 centners, corn grains - total amount of feed that was fed to poultry in terms of conventional feed units by the following coefficients: oats - 1.00, corn grain - 1.34, barley - 1.21, millet - 0.96.

Task 2.

The cannery for processing vegetables and fruits produced products in banks of different capacity:

Table 1.

Capacity, cm <sup>3</sup>	100	250	400	500	1000	3000
Cans that are issued, thousand pieces	1000	1200	1450	840	410	120

Determine the total production of canned food in thousands of conventional cans, if the conditional jar is a jar with a capacity of 400 cm<sup>3</sup>.

Task 3.

Using the conditional data on the output of the research enterprise "X" and the relationship between the relative magnitude of the plan, fill in the table with the missing data. Draw conclusions.

Table 2

№	Plan, thousand UAH	Actually, thousand UAH	% Execution of the plan
1.	720	810	?
2.	930	?	106
3.	?	130	94
Total	?	?	?

Task 4.

According to the following data, calculate the share of sown areas of Ukraine in 20XX. If the total sown area is 21.65 million km<sup>2</sup>, including grain crops - 12.72, technical - 1.47, others - 7.46.

Task 5.

Production of gross domestic product by type of economic activity is characterized by the following data (in actual prices, billion UAH).

Table 2

Industry branches	2010	2011	2012	2013	2014	2015
GDP (total in basic prices)	2594,8	3147,9	3347,6	3375,8	3558,2	4488,3
including by industries: mining and quarrying	119,9	157,4	153,1	155,8	156,2	186,2
processing industry	810,8	970,1	974,9	904,0	975,6	1206,0
agriculture, forestry and	1953,90	261,3	269,9	315,5	381,2	558,8

fisheries						
construction	137,1	164,9	184,7	174,2	162,5	188,6
transport, warehousing, postal and courier activities	169,5	215,7	222,4	231,0	217,3	295,6
wholesale and retail trade; repair of motor vehicles and motorcycles	295,2	362,3	399,3	409,4	442,9	549,2
other	?	?	?	?	?	?

Based on these data, calculate the relative size of the structure (share of industries) of production by year. Analyze the results and draw conclusions.

Task 6.

Using conditional data on the production of industrial products of Ukraine in 2xxx.

Calculate the relative magnitude of the structure and the comparison.

Table 3

Industries	Actually produced for the year, billion UAH
Electricity	22197
Fuel	11728
Building materials industry	9476
Forest, woodworking, pulp and paper	8741
Chemical and petrochemical	6548
Fuel and lubricants industry	4782
Light	1275
Nutritional	985
Total	?

Task 7.

Calculate the relative values of the dynamics of basic and chain, using data on the number of higher education institutions of III-IV levels of accreditation in Ukraine.

Table 4

Number of higher educational institutions of III-IV levels of accreditation in Ukraine in 2013-2019.

Years	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019
Number of universities in Ukraine (at the beginning of the year)	370	349	325	277	288	282

**Critical questions and tasks:**

1. Statistical indicator, its concept.
2. What are absolute values and how are they classified?
3. How to construct relative quantities, name their elements.
4. Identify the main types of relative values and show the method of their calculation.

**Theme 5. Average magnitudes**

**The purpose of the lesson:** formation of knowledge on the technique of calculating generalized statistical indicators (average values) and their economic interpretation

Task1.

Determine the average yield of cereals on the basis of conditional data in table.



Table 1

Average grain yield  
(all categories of farms in Ukraine), reporting year

Cultures	winter and wheat	winter and rye	winter and spring barley	corn on the cob	millet	oat	buckwheat	legumes
Yield, c \ ha	14,7	15,8	14,9	34,6	13,2	17,3	9,6	11,9

Task 2.

Using the conditional data of the table, determine the average score of one student in the discipline "Statistics" in the winter and spring semesters.

Table 2

The following conditional data on the outcome of the session are known:

Points (score),X	Number of students who passed the exam in the discipline "Statistics", pers., (F)	
	Winter semester	Spring semester
1	2	3
1	-	-
2	2	1
3	6	2
4	7	9
5	10	13
Разом	25	25

Task 3.

Calculate the average amount of capital investment of one enterprise using the conditional data of table and an interval series.

Table 3

The initial data for the calculation of the arithmetic mean weighted in the interval series

Volume of capital investments, UAH million	the middle of the interval	Number of enterprises
--	----------------------------	-----------------------

до 20,0		14
20,0-30,0		10
30,0-40,0		6
more than 40,0		3

Task 4.

Using the conditional data of the table, calculate the average time spent by one worker on the manufacture of parts (average harmonic simple).

Table 4

The cost of processing 1st part

№ /employee	Time spent on processing 1 detail, min.
1	0,3
2	0,4
3	0,6
4	0,6
5	0,7

Task 5.

Using the conditional data of the table. Calculate the average yield of cereals in the reporting year (harmonic weighted).

Table 5

Gross production and yield of grain crops (all categories of farms) in the reporting year

Civilization	Crop, th. t	yield, c/h
Winter and spring wheat	3600	24
Winter and spring wheat	624	29
Winter and spring barley	6800	25
Corn for grain	7800	35

Task 6.

Calculate the average annual population of Ukraine based on the data in table (chronological average).

Table 6

## Population of Ukraine (million people)

Indicator	On 1.01 2010	On 1.01 2011	On 1.01 2012	On 1.01 2013	On 1.01 2014	On 1.01 2015	On 1.01 2016	On 1.01 2017
Population, million people	51,1	50,0	49,2	48,5	45,4	44,5	43,5	42,0

Task 7.

Calculate the average size of the deposit using the method of conditional moments.

Table 7.

Auxiliary table for calculating the average value by way of conditional moments

Deposit amount, UAH (x)	Number of depositors, pers. (f)	The middle of the interval $\bar{x}$	$x_i - a$ (a=600)	$\frac{x_i - a}{k}$	$\frac{x_i - a}{k} \times f$
under 300	30				
300-500	100				
500-700	130				
700-900	100				
more than 900	40				
Altogether	400				

Task 8.

Calculate the mode and median using the conditional data of table about groups of farms by the size of the land area.

Table 8

Auxiliary table for calculating fashion and median

Groups of farms by land area, ha (X)	The middle of the interval	Number of farmers in 200_r. (F)	Accumulated frequencies (S)
under 4,0	$2 = (0+4) \div 2$	2	2

4,0 – 8,0	$6=(4+8)/2$	10	12
8,0 – 12,0	$10=(8+12)/2$	45	57
12,0 – 16,0	$14=(12+16)/2$	37	94
16,0 – 20,0	$18=(16+20)/2$	25	119
more than 20,0	$22=(20+24)/2$	17	136

**Critical questions:**

1. The essence and value of the average value.
2. Name the main types of averages.
3. What are the basic principles and rules of scientific use of averages?
4. Mathematical properties of the average value.
5. Arithmetic mean, conditions of its use and calculation technique.
6. Terms of use and methods of calculating the average harmonic.
7. Name the formulas and explain the economic meaning of the numerator and denominator in the calculation of simple and weighted average.
8. Structural means - fashion and median, technique of their calculation.

**Theme 6. Indexes of variation and the foundation of variance analysis**

**The purpose of the lesson:** the formation of students' knowledge on the calculation of indicators of variation and the basics of analysis of variance, their interpretation and characterization

Task 1

Using the conditional data of table 1:

Table 1

Initial data for calculation

1 <sup>st</sup> option		2 <sup>nd</sup> option	
№ / n contract	the profit received from 1 contract, UAH	number of contracts, units	the profit received from 1 contract, UAH
1	40	8	15
2	30	12	35
3	20	6	40
4	10	4	8

Choose the most profitable investment option. The selection criteria are:  
 1) the highest average profit;  
 2) the smallest fluctuation of profit.

Task 2.

Using conditional data to study the relationship between the value of fixed assets and gross output at 25 enterprises, calculate the intergroup, between group and total variance.

Table 2

Value of fixed assets and gross output (UAH million)

№	Cost of fixed assets, UAH million	Production output, UAH million, X	X <sup>2</sup>
1	1,2	1,5	2,25
2	2,9	4,9	24,01
3	2,7	3,6	12,96
4	2,8	3,6	12,96
5	2,1	2,9	8,4
6	1,1	1,3	1,69
7	1,6	2,3	5,29
8	1,2	1,4	1,96
9	2,4	5,0	25
10	2,8	6,2	38,44
11	6,7	9,0	81
12	5,6	9,7	94,09
13	1,8	2,1	4,41
14	1,8	2,5	6,25
15	4,3	4,6	21,16
16	5,7	8,6	73,96
17	1,4	1,8	3,24
18	3,9	4,8	23,04
19	1,8	2,6	6,76
20	1,4	1,9	3,61
21	3,1	3,5	12,25
22	4,6	4,9	24,01
23	5,9	6,8	46,24
24	1,1	1,2	1,44
25	5,5	6,1	37,21
Total		102,8	571,58

Table 3

Initial data for the calculation of intergroup variance of gross output

Groups of enterprises at cost of fixed assets, million UAH	Number of enterprises, F	Gross output, UAH million		$(\bar{X}_i - \bar{X})$	$(\bar{X}_i - \bar{X})^2$	$(\bar{X}_i - \bar{X})^2 F$
		total	on average per enterprise			
under 2,5						
2,5-3,9						
3,9-5,3						
more than 5,3						
total	25					

Task 3.

During the survey, 1000 units of 800 products were of high quality. Determine the variance and standard deviation of the share of high quality products.

Task 4.

Remuneration of workers is characterized by the following data:

Table 4

The amount of salary, UAH	Number of workers, pers.	
	Base year	Reporting year
under 300	8	5
300-400	10	12
400-500	25	30
500-600	7	13
> 600	6	3

Using these problems to determine the indicators of variation: the scope of variation; standard deviation; coefficient of variation.

Task 5.

Using conditional data on the distribution of household deposits in commercial banks of two districts, calculate: the average value of the deposit per depositor in the 1st district and in the 2nd district and

indicators of variation: variance, standard deviation and coefficient of variation. Draw conclusions.

Table 5

Deposit amount, USD	Number of depositors	
	1 <sup>st</sup> district	2 <sup>nd</sup> district
до 100	4	5
100-200	8	2
200-400	3	7
400-600	9	1
> 600	2	5
Total	?	?

Task 6.

Using conditional data on the distribution of equipment at the enterprise by service life to calculate the indicators of variation: variance, standard deviation and coefficient of variation; draw conclusions.

Table 6

Term of stay of the equipment in operation, years	до 3	3-5	5-7	7-9	9-11	> 11
Number of equipment	5	10	45	70	30	12

### Critical questions :

1. The concept of variation in the levels of socio-economic indicators, their causes.
2. Name the system of indicators of variation and their purpose.
3. Types and economic content of variances, their relationship.
4. The value and method of calculating the coefficient of variation.
5. Methods for determining variances.
6. What is the essence of analysis of variance?

## Theme 7. Statistical Studying of Dynamic Row

**The purpose of employment:** acquisition of skills of construction of time series, calculation and interpretation of their basic characteristics, an estimation of intensity of change of indicators

Task 1.

Using the conditional data of table. Calculate the absolute, relative and average values of a number of dynamics of the base and chain.

Table 2.

Analysis of indicators of a number of dynamics of grain production in Ukraine (million tons)

Table 1

Years	Cereal production, million tons	Absolute growth		Growth rate		Rate of increase	
		basic	chain	basic	chain	basic	chain
2015	37						
2016	36						
2017	35						
2018	31						
2019	29						
2020	27						

Task 3.

Calculate the straight-line trend according to the conditional data of the table.

Table 2

Materials for calculating trend parameters

Years	Agricultural products, million UAH	Elements for calculating parameters			
		$t$	$t^2$	$y^*t$	$Y_{(t)}$
2012	31,6	1			
2013	28,6	2			
2014	28,1	3			
2015	25,3	4			
2016	23,6	5			
Total	137,2	?			



Task 3.

Using conditional data on the dynamics of the harvest of agricultural products calculate the seasonality or seasonal wave.

Table 3

Conditional data on the intra-annual dynamics of procurement of agricultural products of the region by quarters for three years:

Quarters	Procured products, thousand UAH			Total
	1 pik	2 pik	3 pik	
I	162	159	158	
II	170	193	225	
III	177	178	187	
IV	151	168	172	
Altogether				
Average annual levels				
Seasonality indexes				

Task 4.

Using conditional data on the number of cattle in one of the districts (heads):

Table 4

Indicators	Years			
	2017	2018	2019	2020
In the old boundaries	16010	16400	-	-
In the new boundaries	-	16900	17130	17270

Bring a series of dynamics to a comparable form.

Task 5.

Using conditional data that characterize the dynamics of production of the enterprise for 2009-2018. align the speaker range with the moving average.

Table 5

Years	Production output, UAH million	Years	Production output, UAH million
2013	10	2014	11
2014	7	2015	10

2015	11	2018	12
2016	9	2019	10
2017	9	2020	11

Task 6.

We have data on the population of Ukraine for 2011-2019:

Table 6

Population of Ukraine

	2013	2014	2015	2016	2017	2018	2019
Population, million people	51,3	50,9	50,5	50,1	49,7	48,5	42,0
Urban	34,8	34,5	34,3	34,0	33,8	32,6	32,3
Rural	16,5	16,4	16,2	16,1	15,9	15,9	15,7

Calculate: 1) the average annual population of Ukraine;

2) basic and chain method absolute increase (decrease), growth rate (decrease); absolute value of 1% increase;

3) build a bar chart that characterizes the dynamics of the population in Ukraine.

**Critical questions:**

1. What is called a series of dynamics and what are its constituent elements?
2. Name the types of time series and give examples.
3. Describe the system of indicators used to analyze the dynamics.
4. What is the essence of the basic and chain method?
5. What is the trend of a number of dynamics and its content.
6. For what purpose is the alignment of a number of dynamics?
7. The essence of the moving average method.
8. What is the extrapolation and interpolation of a series of dynamics?

**Theme 8. Organization of selective observation**

**The purpose of the lesson:** formation of theoretical knowledge and acquisition of practical skills in conducting sample observation, assessment of the characteristics of the general population, testing statistical hypotheses.

Task1.

Using conditional data, determine with a probability  $P = 0.997$  the marginal error of the sample mean. To estimate the average wheat yield, the company's sown area of 5,000 hectares was divided into 50 equal plots. From them, by the method of random non-repeated selection, five plots were selected, on which a continuous accounting of the actual harvest was carried out. As a result, the following data were obtained:

Table 1

Average wheat yield					
№ plots	1	2	3	4	5
Average wheat yield, c \ ha	26	27	28	29	30

Task 2.

The agricultural enterprise conducted a sample survey of the viability of 20 cows and found that the average expectation of them is 2700 kg. Determine the marginal error of milk yield from all cows (320 heads) with an accuracy of 95.4% and the standard deviation of milk yield of a sample of 201 kg.

Task 3.

The fat content in 15 batches of milk was as follows:

Table 2

Fat content, %	2,8	2,9	3,0	3,4
Number of parts	3	4	5	3

Based on the data calculate:

- 1) the average fat content in milk;
- 2) standard deviation and variance of fat content;
- 3) with a probability of 0.954 sampling marginal error and the interval in which the average fat content in milk.

Task 4.

To establish the loss of grain when harvesting winter wheat on an area of 900 hectares, it is necessary to determine the required number of samples on stubble (1 sq.m) with a marginal error of up to 6 kg per 1 ha, accuracy of 95.4% and standard deviation of 20 kg.

Task 5.

A sample survey of 0.5% of the batch of cheese found that 270 units of the surveyed 300 products are classified as standard products. The distribution of a sample of cheese by its weight gave the following results:

Table 3

Product weight, kg	до 3	3-5	5-7	большее 7
Number of products, pcs	1	2	8	9

Determine with a probability of 0.954 the possible limit of the average weight of the products in the whole batch of cheese.

Task 6.

Determine with a probability of 0.95 what is the marginal assessment of the average quality of land in agricultural enterprises of the region, which involved 16 farms, the average soil fertility is 60 points, the standard deviation - 8 points.

**Critical questions:**

1. What is the essence of sample observation and in which cases it is used?
2. Describe the repeated and non-repeated selection.
3. Name the methods of selecting units in the sample.
4. How to determine the average and marginal sampling error.

**Theme 9: Indexes**

**The purpose of the lesson:** formation of knowledge on the methodology of construction of statistical indices, acquisition of skills in calculating the main types of statistical indices and conducting index analysis

Task 1.

Using the conditional data of table. determine the general indices of physical volume and prices.

Table 1

## Product sales data

Type of product	Sales revenue, thousand UAH		Individual indexes	
	base period	reporting period	physical volume of production	prices
Potato	4,6	6,0	1,04	0,96
Growth of cattle	27,8	29,6	1,02	0,98
Pig growth	8,2	9,4	0,94	1,06

## Task 2.

The sown area and yield of grain crops at the enterprise are characterized by the following conditional data:

Table 2

## Yield and sown area of cereals

Civilizations	Base period		Reporting period	
	sown area, ha ( $n_0$ )	yield, c / ha ( $y_0$ )	sown area, ha ( $n_1$ )	yield, c / ha ( $y_1$ )
Winter wheat	890	26,9	1000	23,2
Corn for grain	320	25,3	380	25,3
Barley	280	22,1	300	23,0

Determine: the total index of gross collection; general index of grain yield; general index of change in sown areas.

## Task 3.

Using conditional data on production by two companies:

Table 3

## Materials for calculating the system of indices of average cost

№ of the enterprise	Base period		Reporting period	
	Production volume, thousand c	The cost of 1 c, UAH	Production volume, thousand c	The cost of 1 c, UAH
1	98,1	2,64	100,2	1,98
2	120,2	2,50	118,1	2,32

Calculate: the average cost of 1 quintal products in the base and reporting periods; indices: variable composition, constant composition and structural changes.

Task 3.

Determine why the price index is equal if the number of goods sold increased by 14.9% and turnover was 140.1%.

Task 4.

We have conditional data on the number of products and its cost at the enterprise:

Table 4

Production	Quantity of output, thousand pcs.		Unit cost of production, UAH	
	basic	reporting	basic	reporting
A	3,0	3,2	1,0	1,0
Б	4,0	5,0	2,0	1,8
B	5,0	6,0	0,8	0,6

Determine: individual indices of cost and quantity of products; general indices: physical volume of production; product costs; cost and calculate the economic effect of cost reduction.

Task 5.

The following data on the volume of gross output (thousand UAH) are known:

Table 5

№ of the enterprise	Turnover at current prices		Individual indexes of physical volume of sales
	Base period	Reporting period	
1	69	79	1,031
2	83	88	0,976

Calculate: the index of physical volume of gross output at comparable prices.

Task 6.

The sown area and yield of grain crops in the enterprise are characterized by the following conditional data:

Table 6

Civilizations	Base period		Reporting period	
	Sowing area, ha	Yield, c \ ha	Sowing area, ha	Yield, c \ ha
Barley	425	26,8	445	32,4
Oat	220	25,4	205	27,8
Millet	70	23,2	90	22,0

Determine: 1) the average yield of cereals; 2) individual grain yield indices; 3) general indices of gross harvest, yield of fixed (constant) and variable composition, structure and size of sown areas; 4) calculate the influence of individual factors on the change in the gross harvest of cereals in absolute and relative terms. Draw conclusions.

Task 7.

Production of main types of livestock products per 1 population, kg:

Table 7

Types of products	Years				
	2016	2017	2018	2019	2020
Meat (in carcass weight)	34,0	33,6	31,2	34,2	35,7
Milk	267,7	255,7	276,2	293,4	285,7
Eggs, pcs.	175,1	178,0	198,6	234,6	240,0

Determine: chain and base indices of physical volume of production; show the relationship between chain and base indices. Draw conclusions.

**Critical questions:**

1. The essence of economic indices and their significance.
2. How are individual indices determined?
3. Construction of general indices.
4. Relationship between basic and chain indices.
5. Describe the system of indices for the analysis of averages, give a method of calculating them.
6. Indices with constant (fixed) and variable weights.
7. The value of the relationship of indices in economic analysis.

## Theme10. Statistical Studying of the Interconnection of Phenomena

**The purpose of the lesson:** the formation of theoretical knowledge and the acquisition of practical skills to identify and quantify the relationship between socio-economic phenomena

Task1.

Using conditional table data:

Table 1

The relationship between performance and factor characteristics

Loss of grain from 1 ha, c (effective sign), $Y$	Harvest time, days (factor feature), $X$	Squares		Product $XY$
		$X^2$	$Y^2$	
1	2			
0,5	1			
0,7	3			
2,0	5			
4,0	7			
6,0	9			
8,0	11			
9,0	13			
10,0	15			
10,5	17			
11,0	20			
$\sum y =$	$\sum x =$	$\sum x^2 =$	$\sum y^2 =$	$\sum xy =$

Determine the dependence of winter wheat losses on the time of its harvest. Calculate the correlation coefficient and reliability.

Task 2.

Based on the data in the table, determine the dependence of winter wheat losses on the time of its harvest: calculate the regression equation, calculate the correlation coefficient and its reliability. Draw conclusions.



Table 2

Harvest time, days	Loss of grain from 1 ha, c	Harvest time, days	Loss of grain from 1 ha, c
1	0,5	11	8,0
3	0,7	13	9,0
5	2,0	15	10,0
7	4,0	17	10,5
9	6,0	20	11,0

## Task 3.

Determine the regression parameters of multiple correlation of the dependence of yield on soil quality and doses of fertilizers, multiple correlation index and its reliability. Draw conclusions.

Table 3

№	Mineral fertilizers were applied per 1 ha, c of active substance	Land quality, points	Grain yield, c \ ha
1	1,3	73	26
2	3,1	87	32
3	1,1	45	15
4	3,0	90	32
5	4,4	96	37
6	1,1	52	20
7	3,2	64	31
8	1,8	55	26
9	4,1	94	43
10	1,8	48	19

## Task 4.

Using conditional data on milk yields and feed costs in agriculture enterprises. Determine the parameters of one-factor equations of dependencies, setting the smallest sum of linear deviations of the empirical values of the resultant characteristic from its theoretical values; correlation coefficient and index; communication stability factor.

Table 4

№ of the enterprise	Feed costs per 1 cow, kg of feed units	Hopes of milk for 1 cow, kg
1	32,1	2200
2	33,7	2340
3	35,1	2420
4	37,9	2540
5	39,8	2600
6	43,2	2900
7	45,8	3100

**Critical questions:**

1. The general concept of connections and relationships in the economy.
2. Give a brief description of functional relationships.
3. What is correlation-regression analysis used for?
4. The content and value of the correlation coefficient.
5. Calculation of the linear correlation coefficient and correlation index.
6. The concept of multiple correlation.
7. Multiple correlation index and its content.
8. What characterizes the correlation and determination coefficients, within which they change.

**Theme 11. Graphic display of statistical data**

**The purpose of the lesson:** to acquire the skills of presenting statistical information in the form of graphs and maps

Task 1.

Construct a bar chart using conditional data on grain yields in dynamics.

Table 1

Indicators / Years	2016	2017	2018	2019	2020
Cereals	19,7	19,4	27,1	27,3	18,2

Task 2.

Using conditional data on the composition of fixed assets of agricultural enterprises, million UAH to build a pie chart.

Table 2

## The composition of fixed assets of agricultural enterprises

Total fixed assets	Buildings, structures, transmitting devices	Machinery and equipment	Working and productive livestock	Perennial plantings	Vehicles, equipment, etc.
71760,4	49034,1	10306	1866,4	1108,8	9445,1

Task 3.

Using the conditional data of the table on sown areas this year about crops build a pie chart.

Table 3

## Sown area of agricultural crops, thousand hectares in the reporting year

The entire sown area	Cereals	Technical crops	Potatoes and melons	Fodder crops
25081	12495	5357	2155	5074

**Critical questions :**

1. Explain the concept of "statistical graph" and purpose.
2. Describe the main types of graphics.
3. Give the method of constructing linear, bar, sector and other graphs.
4. What types of graphs can be used to display the dynamics of phenomena and structure.

## Test tasks for the first module

1. What is statistical science? Choose the correct answer.

- 1) A peculiar method of cognition.
- 2) Statistics is an independent social science that studies the quantitative side of mass social phenomena in inseparable connection with their qualitative side.
- 3) Method of developing principles of data collection and processing.
- 4) Study of interrelations and patterns of development of phenomena.

2. Which of the following provisions applies to the definition of the general theory of statistics?

- 1) A branch of statistics that studies the quantitative side of mass phenomena.
- 2) The study of general rules and methods of studying mass social phenomena.
- 3) Branch of mathematical knowledge.
- 4) Develops rational methods of systematization of data processing and analysis of statistical observations.

3. What does the theory of statistics study?

- 1) Quantitative side of mass social phenomena and processes occurring in the national economy.
- 2) General rules and methods of statistical research.
- 3) Relationships between individual units of social phenomena.
- 4) The quantitative side of mass phenomena in the sphere of production.

4. Find the correct definition of the statistical population.

- 1) Signs that reflect the size or scope of phenomena and processes.
- 2) Signs that give a characteristic directly to the units of observation.
- 3) Primary elements of mass homogeneous phenomena.
- 4) The mass of homogeneous elements (phenomena, facts, etc.) that have a single qualitative basis.

5. What is a unit of the population?

- 1) A set of material objects actually existing in time and space.
- 2) Individual primary elements or individual phenomena that make up the statistical population.

- 3) Varying signs of mass phenomena and processes.
- 4) Secondary signs of the studied phenomena.

6. What is the subject of statistics as a social science?

- 1) Quantitative analysis of individual units of the statistical population.
- 2) A set of techniques and methods for studying social phenomena.
- 3) Quantitative side of mass social phenomena in specific conditions of space and time.
- 4) The study of quantitative phenomena of socio - economic phenomena.

7. What is a statistical observation?

- 1) Collection and analysis of data on mass social phenomena.
- 2) Primary processing of mass data.
- 3) Planned scientifically-organized collection of data on the phenomena and processes of public life by registration on a pre-designed monitoring program.
- 4) Study of quantitative relationships of phenomena according to a pre-developed program of observation.

8. What is the object of statistical observation?

- 1) The set of social phenomena and processes that are subject to statistical observation.
- 2) A set of mass social phenomena.
- 3) Elements of the phenomena which are carriers of the essential signs which are subject to registration.
- 4) Units of social phenomena to be observed.

9. What is a unit of statistical observation?

- 1) The primary element of the object of study, which is the carrier of the essential features and properties to be registered.
- 2) The primary element of a mass social phenomenon.
- 3) Some components of a mass social phenomenon.
- 4) Several elements of the object of statistical observation.

10. Determine what type of observation (taking into account the facts in time) is the registration of births and deaths, which is carried out by the registry office and village councils?

- 1) Current.
- 2) Periodic.
- 3) Disposable.

11. Determine to which type of observation (for the completeness of the coverage of population units) is the census.

- 1) Solid.
- 2) Inconsistent.

12. What observation errors are called registration errors?

- 1) Errors that occur due to incorrect establishment of facts or their incorrect entry in the form.
- 2) Errors that occur due to various random causes.
- 3) Errors that occur due to non-accidental causes.
- 4) Errors that occur due to distortion of reality.

13. Errors in recalculation are revealed. Choose the correct control option.

- 1) Logical.
- 2) Arithmetic.
- 3) External.

14. What is the content of the statistical summary?.

- 1) Grouping data by certain characteristics.
- 2) Summation of data on the number of population units and the values of their characteristics.
- 3) Tabular and graphical design of the obtained data.
- 4) A set of techniques that allow the collection of mass data.

15. What is called statistical grouping?

- 1) Summary of calculation results in statistical tables.
- 2) Rational form of presentation of results of inspection of the phenomena.
- 3) Construction of a variation series.
- 4) Distribution of the statistical population into parts (groups) on a number of characteristic features.

16. Find the wrong option to the question: What is the essence of combinational grouping?

- 1) Grouping on two grounds
- 2) Grouping by two or more features.
- 3) Grouping by one attribute.
- 4) Grouping on several grounds.

17. Name the types of groupings depending on the tasks they solve.

- 1) Effective and factorial.
- 2) Effectively - factor.
- 3) Variation.
- 4) Structural, analytical and typological.

18. What are the advantages of combinational groupings compared to groupings with one feature?

- 1) Determination of the influence of one trait on another trait.
- 2) Determining the influence of several traits on other traits.
- 3) Ability to highlight the influence of the main features on other features.
- 4) Ability to select the types of studied features.

19. What kind of groupings solves the problem of studying the causal relationships between the studied features?

- 1) Combinational.
- 2) Structural.
- 3) Analytical.
- 4) Typological.

20. What statistical table is called simple?

- 1) The subject contains a list of observation units.
- 2) The subject contains groups of units of observation on one feature.
- 3) The table contains absolute and relative values.
- 4) The subject contains groups of observation units for two or more features.

21. What statistical table is called a combination?

- 1) The subject contains one or more features.
- 2) The subject contains groups of two or more features.

- 3) The subject contains groups of observation units.
- 4) The subject contains groups of observation units for two or more features.

22. Which of the following answers goes beyond the types of distribution?

- 1) Attributive, variational.
- 2) Discrete.
- 3) Intervals.
- 4) Structural.

23. Name the constituent elements of statistical series of distribution.

1. Option.
- 2). Frequency.
- 3). Frequency.
- 4). Option and frequency.

24. What kind of graphs of distribution series depicts interval variation series?

- 1) Proving ground.
- 2) Histogram.
- 3) Cumulate.
- 4) Ogiva.

25. Find the correct answer to the definition of absolute indicators.

- 1) Indicators that reflect the size of the quantitative characteristics of the studied phenomena.
- 2) Indicators that reflect the size of the quantitative characteristics of individual units.
- 3) Indicators that reflect the quantitative characteristics of the population.
- 4) Indicators that reflect the quantitative and qualitative characteristics of the studied phenomena.

26. When calculating the relative values, which serves as a basis for comparison in the formula of the ratio of absolute indicators?

- 1) Numerator.
- 2) Denominator.



- 3) 100%.
- 4) Report value.

27. In what units are the relative indicators displayed when the base value is taken as 1000?

- 1) In percentage.
- 2) In coefficients.
- 3) In ppm.
- 4) In prodecemil.

28. Which of the following values characterize the relationship between the same indicators?

- 1) Relative indicators of intensity.
- 2) Relative values of coordination.
- 3) Relative values of the structure.
- 4) Integrated relative values.

29. What is the relative value of the change of phenomena and processes over time?

- 1) The relative size of the structure.
- 2) The relative magnitude of the comparison.
- 3) The relative magnitude of the intensity.
- 4) The relative magnitude of the dynamics.

30. What relative value characterizes the relationship between the components of the whole?

- 1) The relative magnitude of coordination.
- 2) The relative size of the structure.
- 3) The relative magnitude of the comparison.
- 4) The relative magnitude of the intensity.

31. The plan provides for an increase in store turnover by 7.1%. Actual turnover in the reporting period compared to the base increased by 8.3%. Determine the percentage of implementation of the turnover plan in the reporting period?

- 1)  $8.3 - 7.1 + 100.0 = 101.2$

- 2)  $\frac{1,083}{1,071} = 101,1$
- 3)  $\frac{108,3 \times 107,1}{100,0} = 116,0$

32. The population of Ukraine on January 1, 20XX was 46.7 million people, and the territory - 603.7 thousand square km. Choose the correct option to calculate the relative intensity.

- 1)  $\frac{46,7}{603,7}$
- 2)  $\frac{603,7}{46,7}$

33. Production of sugar - sand in Ukraine in the 20XX was 8746 thousand tons, and in France - 4301 thousand tons. Choose the wrong option to calculate the relative value of the comparison.

- 1)  $\frac{8746}{4301}$
- 2)  $\frac{4301}{8746}$
- 3)  $8746 - 4301$

34. To what kind of measuring instruments of absolute values belongs the indicator of the amount of feed consumption in feed units?

- 1) To the cost.
- 2) To natural.
- 3) To conditionally - natural.
- 4) To labor.

35. What kind of relative values is the indicator: the yield of calves per 100 cows?

- 1) Intensity.
- 2) Structures.

- 3) Comparison.
- 4) Coordination.

36. Sales of milk and dairy products in the reporting period are characterized by the following data.

Products	Conversion factor in milk	Implemented, c	
		according to the plan	actually
Milk	1,0	270	281
Butter	23,0	20	21

Choose the correct option for calculating the implementation of the plan for the sale of dairy products in conventional terms.

- 1)  $\frac{281 + 21}{270 + 20} \times 100$ .
- 2)  $\frac{281 \times 1 + 21 \times 23}{270 \times 1 + 20 \times 23} \times 100$ .
- 3)  $\frac{\frac{281}{1} + \frac{21}{23}}{270 + 20} \times 100$

37. What is the average value?

- 1) Typical feature size of a set of objects or a series of speakers.
- 2) Generalizing characteristics of the compared sizes of the same values.
- 3) An indicator that characterizes the ratio of individual quantities.
- 4) The result of multiple measurements of the same feature.

38. Which of the averages belongs to the power averages?

- 1) Geometric.
- 2) Arithmetic.
- 3) Harmonious.
- 4) Square.

39. To what kind of means the indicator of a sign which meets most often in a distribution number belongs?

- 1) The arithmetic mean.
- 2) Geometric mean.
- 3) Fashion.

4).Average harmonic.

40. What kind of means belongs to the variant that falls in the middle of the variation series?

- 1) Fashion.
- 2) Median.
- 3) Arithmetic.
- 4) Square.

41. What kind of average is used when the weight of the sign is not specified, but hidden in the products?

- 1) Arithmetic.
- 2) Harmonious.
- 3) Chronological.
- 4) Geometric.

42. What kind of average is used when the repeatability of each option is the same ?.

- 1) Arithmetic simple.
- 2) Arithmetic weighted.
- 3) Geometric.
- 4) Harmonious.

43. What kind of average is calculated when the option characterizes the set at a certain point in time?

- 1) Arithmetic.
- 2) Harmonious.
- 3) Chronological.
- 4) Square.

### Test control of the 2nd module

1. Using the data, choose the correct option for calculating the average monthly salary of one employee.

No salary	Monthly salary, UAH	Number of employees, pers.
1.	860	5
2.	940	11

1)  $\frac{860 + 940}{2}$ .

2)  $\frac{860 \times 5 + 940 \times 11}{5 + 11}$ .

2. Gross harvest and wheat yield in 201XXr. characterized by the following linguistic data:

Indicators	Gross collection, t.	Yield, c \ ha
Winter wheat	21326	38,0
Spring wheat	605	27,5

1)  $\frac{38,0 + 27,5}{2}$ .

2)  $\frac{21326 + 605}{38,0} + \frac{605}{27,5}$ .

3. Using data on the amount of capital investment in agriculture. Enterprises of the district determine the average amount of capital investment of one enterprise, million UAH.

Volume of capital investments, UAH million	Number of enterprises
20-40	14
40-60	10
60-80	6

1)  $(20+40):2=30$

$(40+60):2=50$

$(60+80):2=70$

$\frac{(30 \times 14) + (50 \times 10) + (70 \times 6)}{14 + 10 + 6}$ .

$$2) \frac{30 + 50 + 70}{3}$$

4. What is the statistical characteristic of the center of frequency distribution in the distribution series?

- 1) The arithmetic mean.
- 2) Dispersion.
- 3) Fashion.
- 4) Median.

5. What will happen to the arithmetic mean if you add or subtract the same value to each variant of a series of distributions?

- 1) It will not change.
- 2) It will increase.
- 3) It will decrease.
- 4) It will increase or decrease by the same amount.

6. If the variants of a series are multiplied or divided by the same value, which will be with the arithmetic mean?

- 1) Increase or decrease.
- 2) It will not change.
- 3) Increase or decrease the same number of times.
- 4) It will change by the appropriate amount.

7. Which of the requirements provides the method of statistical groupings.

- 1) The average should be as little as possible subject to the action of random oscillations.
- 2) The set of objects must be qualitatively homogeneous.
- 3) The average should be calculated for the whole range of phenomena.
- 4) The population should be large enough.

8. What indicator characterizes the absolute degree of variation of the trait in the statistical population?

- 1) The scope of variation.
- 2) The standard deviation.
- 3) The mean square of the deviation.
- 4) Coefficient of variation.

9. What indicator characterizes the relative degree of variation in the statistical population?

- 1) Coefficient of variation.
- 2) The standard deviation.
- 3) Dispersion.
- 4) The scope of variation.

10. At what size of the coefficient of variation is the variation considered weak?

- 1) 5-10%.
- 3) 10-20%.
- 4) 21-50%.

11. Which of the following ratios of variances does not meet the rule of adding variance?

- 1)  $\sigma^2_{заг} = \sigma^2_{міжг} + \sigma^2_{зал}$
- 2)  $\sigma^2_{міжг} = \sigma^2_{заг} - \sigma^2_{зал}$
- 3)  $\sigma^2_{зал} = \sigma^2_{заг} - \sigma^2_{міжг}$
- 4)  $\sigma^2_{міжг} = \sigma^2_{заг} + \sigma^2_{зал}$

12. Which indicator gives the least accurate (approximate) estimate of variation?

- 1) Dispersion.
- 2) Coefficient of variation.
- 3) Linear deviation.
- 4) Coefficient of variation.

13. What is the name of the type of statistical observation, in which only part of the population units selected on the basis of scientifically developed principles are subject to survey?

- 1) Selective.
- 2) Solid.
- 3) Survey of the main array.
- 4) Questionnaire.

14. What is used the method of selection in the sample, if the selection of units from the general population is carried out at regular intervals?

- 1) Typical.
- 2) Actually random.
- 3) Mechanical.
- 4) Serial.

15. From the following sample sets, which samples are considered small in terms of observation units?

- 1) Up to 50.
- 2) Up to 70.
- 3) Up to 30.
- 4) Up to 100.

16. What is the name of the property of the sample to reproduce the general population?

- 1) Identity.
- 2) Typicality.
- 3) Representativeness.
- 4) Uniformity.

17. What is the name of the sampling error obtained by the formula:

- 1) Border.
- 2) Average.
- 3) Random.
- 4) Systematic.

18. What is the name of the sampling error obtained by the formula:?

- 1) Border.
- 2) Average.
- 3) Random.
- 4) Systematic.

19. By which formula is determined by the marginal error of the average for non-repeated selection?

- 1)  $m = \frac{\sigma}{\sqrt{n}}$  ;



$$2) m = \sqrt{\frac{\sigma}{n}} \times \left(1 - \frac{n}{N}\right);$$

$$3) \Delta = t \times \sqrt{\frac{\sigma^2}{n}} \times \left(1 - \frac{n}{N}\right);$$

$$4) \Delta = t \times \frac{\sigma}{\sqrt{n}}.$$

20. According to which formula is determined by the average error of the proportion of the trait, if the survey is carried out on the principles of non-re-selection?

$$1) m = \sqrt{\frac{w \times (1 - w)}{n}}.$$

$$2) m = \sqrt{\frac{w \times (1 - w)}{n}} \times \left(1 - \frac{n}{N}\right).$$

$$3) \Delta = t \times \sqrt{\frac{\sigma}{n}} \times \left(1 - \frac{n}{N}\right).$$

$$4) m = \frac{\sigma}{\sqrt[n]{n}}.$$

21. What level of probability is most often used in calculations in the analysis of agro-economic phenomena?

1) 0.683.

2) 0.954.

3) 0.997 th most common

4) 0.999 th most common

22. When deciding on the organization of the sample, which statistical characteristic is considered a criterion?

1) Average.

2) Dispersion.

3) Sampling error.

4) Probability.

23. What method of selection requires a preliminary gradation of the general population into qualitatively different groups?

- 1) Typical.
- 2) Serial.
- 3) Actually random.
- 4) Mechanical.

24. To what kind of time series belong the indicators of livestock at the beginning of each month of the year?

- 1) Instant.
- 2) Intervals.
- 3) Rows of medium.
- 4) Continuous.

25. What kind of heart is calculated by the average annual number of livestock, if we know its number at the beginning of each month of the year?

- 1) Arithmetic.
- 2) Chronological.
- 3) Harmonious.
- 4) Geometric.

26. With the help of which statistical characteristics determine the variation of the dynamics around the average...

- 1) Scope of variation.
- 2) Mean linear deviation.
- 3) Mean square deviation and coefficient of variation.
- 4) Dispersion and oscillation coefficient.

27. What analytical indicator of a number of dynamics characterizes the absolute value of the size of changes in phenomena?

- 1) Growth rate.
- 2) Rate of increase.
- 3) The absolute value of 1% increase.
- 4) Absolute growth.

28. What kind of heart is calculated by the average growth rate?

- 1) Arithmetic.

- 2) Geometric.
- 3) Square.
- 4) Chronological.

29. What statistical characteristics of a number of dynamics determines the trend of the phenomenon?

- 1) Autocorrelation.
- 2) Auto covariance.
- 3) Trend.
- 4) Regression.

30. In which cases use the technique of closing the time series?

- 1) At incomparability of levels of a number of dynamics.
- 2) When identifying patterns of development of the phenomenon.
- 3) When identifying the nature of the main trend of the dynamics.
- 4) When identifying the type of general trend dynamics.

31. What is meant by the general trend of dynamics?

- 1) Trends in the movement of dynamics.
- 2) Tendencies to increase the level of phenomena.
- 3) Tendency to increase or decrease the levels of the series.
- 4) Tendency to increase, stability or decrease in the level of this phenomenon.

32. What techniques to identify the general trend and development and nature of the dynamics should be used when the levels of a number of dynamics vary significantly?

- 1) Smoothing by enlarging the intervals, smoothing with a moving average.
- 2) Construction of graphs of time series.
- 3) Closing the time series.
- 4) Determination of autocorrelation in time series.

33. Which of the answers gives the definition of a statistical index?

- 1) Indicator.
- 2) Relative value.
- 3) Complex indicator.

4) Relative value, which is obtained as a result of comparing complex economic phenomena that are not subject to direct summation.

34. Which indices reflect the ratio of simple unit indicators?

- 1) Total.
- 2) Subindexes.
- 3) Individual.
- 4) General.

35. What is called in the theory of indices of the indicator, the change of which characterizes the index?

- 1) Coordinator.
- 2) Indexed value.
- 3) Eliminated value.
- 4) Average value.

36. What is the index value associated with the indexed?

- 1) Dimension (weight).
- 2) Comparable value.
- 3) Constant.
- 4) Average value.

37. How are indices classified according to the degree of coverage of elements of phenomena?

- 1) Individual, general.
- 2) Individual, aggregate.
- 3) General, total.
- 4) Group, individual.

38. What form of average value is calculated by average indices?

- 1) Arithmetic, harmonic.
- 2) Arithmetic.
- 3) Harmonious.
- 4) Structural.

39. What form of index is used in the analysis, if the initial data carry information about the cost of production of the reporting period in basic prices?

- 1) Arithmetic mean.
- 2) Average harmonic.
- 3) Arithmetic mean or harmonic mean.
- 4) Any medium shape.

40. How to classify indices depending on the period of time taken as a basis for comparison?

- 1) Periodic.
- 2) Basic.
- 3) Chain.
- 4) Basic and chain.

41. What is the relationship between basic and chain indices?

- 1) Direct.
- 2) Converse.
- 3) The product of the base indices is equal to the chain of the last period.
- 4) The product of chain indices is equal to the base of the last period.

42. What term is used in the interpretation of indices, if the basis of comparison in the calculation is 100%.

- 1) Interest.
- 2) Time.
- 3) Ppm.
- 4) Prodecemile.

43. What is the name of the index represented by the relative value that characterizes the dynamics of the two averages?

- 1) Index of variable composition.
- 2) Fixed composition index.
- 3) Index with constant weight.
- 4) Variable weight index.

44. What statistical characteristics are obtained by the product of the structure index and the fixed composition index?

- 1) Index of variable composition.
- 2) Index with variable weights.
- 3) Index with constant weights.
- 4) Average index.

45. What answer reflects the main types of economic indexes?

- 1) Mid-level indexes.
- 2) Labor productivity indexes, physical volume indices, price indices, cost indexes.
- 3) Structure indexes.
- 4) Comrade indexes.

46. What are the indexes that characterize the ratio of levels of phenomena in space?

- 1) General.
- 2) Total.
- 3) Territorial.
- 4) Sub indexes.

47. Which of the answers characterizes the definition of a statistical graph?

- 1) Depiction of phenomena in the figure with the help of symbols.
- 2) Visual representation of statistical data.
- 3) A method of visually presenting statistical data and their relationships using geometric signs or other graphical means.
- 4) Method of visual presentation of statistical data for the purpose of their analysis.

48. How are graphs classified by type of their field?

- 1) Charts, cartograms, card diagrams.
- 2) Linear, columnar, tape.
- 3) Rectangular, circular.
- 4) Figured.

49. What is the name of the correlation, when the sign is considered as the result of two or more factors?

- 1) Rectilinear.
- 2) Curvilinear.
- 3) Simple.
- 4) Multiple.

50. What is the concept of "regression"?

- 1) Connection tightness.
- 2) Mathematical expectation of a variable due to a random change.
- 3) Line, the type of dependence of the average value of the productive feature of the factor.
- 4) Kind of proportional dependence of two variables.

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*Навчальне видання*

**Олена Анатоліївна Луценко, Людмила Анатоліївна  
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«Статистика» на англійській мові  
для студентів науково-навчального інституту бізнесу і  
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