

UNIVERSITY OF ECONOMICS - VARNA
FACULTY OF INFORMATICS
DEPARTMENT STATISTICS AND APPLIED MATHEMATICS

Adopted by the FC (record № 9/ 24.04.2024)

Adopted by the DC (record № 6/ 15.04.2024)

ACCEPTED BY:

Dean:

(Prof. Vladimir Sulov, PhD)

SYLLABUS

SUBJECT: FUNDAMENTALS OF STATISTICS

DEGREE PROGRAMME: All programs taught in English; BACHELOR'S DEGREE

YEAR OF STUDY: 2; SEMESTER: 4;

TOTAL STUDENT WORKLOAD: 270 hours; incl. curricular 75 hours

CREDITS: 9

DISTRIBUTION OF STUDENT WORKLOAD ACCORDING TO THE CURRICULUM

<i>TYPE OF STUDY HOURS</i>	WORKLOAD, hours	TEACHING HOURS PER WEEK, hours
CURRICULAR: incl. - LECTURES - SEMINARS / LAB. EXERCISES	45 30	3 2
EXTRACURRICULAR	195	-

Prepared by:

1.
(Assoc. Prof. Radan Miryanov, PhD)
2.
(Chief Assist. Prof. Svetlana Todorova, PhD)

Head of the department
of „Statistics and Applied Mathematics“:
(Assoc. Prof. Tanka Milkova, PhD)

I. ANNOTATION

The Fundamentals of Statistics covers descriptive statistics, sampling and sampling distributions, statistical inference, relationships between variables, formulating and testing hypotheses, and regression analysis in the context of business and economics. This is an introductory course with an emphasis on applications of statistical methods and techniques of the basic concepts of probability, descriptive and inferential statistics, and their usefulness in the decision-making process. The course is based on a combination of lectures and computer-lab practice. The class sessions will be in an interactive lecture/discussion format. Use of Excel's Data Analysis ToolPak is an integral part of the course.

Learning Objective of the course:

- **Content-Based Learning Outcomes**

Students will be able to:

- *Become fluent in the use and understanding of statistical terminology.*
- *Describe data sets numerically and graphically.*
- *Distinguish among the various sampling techniques and develop and use sampling distributions for means and proportions.*
- *Apply inferential statistics such as confidence intervals estimation and hypothesis testing using the logic of statistical inference.*
- *Create and interpret regression models and their output.*
- *Interpret and communicate statistical results.*

- **Skill-Based Learning Outcomes**

Beyond understanding of the course content, students should:

- *Recognize business applications where statistics can be applied.*
- *Demonstrate a proficiency in using Excel.*
- *Enhance critical evaluation, correct interpretation, problem solving, and presentation of the results based on research studies.*
- *Improve logical thinking skills, technology utilization, and information gathering.*

- **Perspectives:**

Students will have the opportunity to:

- *Appreciate the utility of fundamentals of statistics in addressing a diverse range of problems from areas such as marketing, management, accounting, economics, behavioral sciences, etc.*
- *Be aware that statistical concepts transcend national boundaries.*
- *Recognize the impact of their analyses on the broader society and the attendant ethical obligations to perform their work responsibly.*

The objectives of the course "Fundamentals of Statistics" developed the following key competencies:

- *Mathematical competencies (ability to solve problems, formulate solutions, apply formulas, models, concepts, deal with statistical data; develop mathematical and statistical thinking);*
- *Digital competencies (ability to search the relevant information, deal with spreadsheets, databases, and Statistical software);*
- *Personal competencies (skills for solving the real-world problems);*
- *Entrepreneurial competencies (development of critical thinking of statistical data; analytical thinking, forecasting; teamwork, awareness of socio-economic trends; creativity, and curiosity);*

II. THEMATIC CONTENT

No	TITLE OF UNIT AND SUBTOPICS	NUMBER OF HOURS		
		L	S	L.E.
1. Introduction to Statistics		3	2	
1.1.	Course Introduction and Objectives. Definition of Statistics			
1.2.	Statistical Terminology: Population, Sample, Population Parameter and Sample Statistics			
1.3.	Descriptive versus Inferential Statistics			
1.4.	Types of Variables (Quantitative and Qualitative)			
1.5.	Cross-sectional versus Time-series Data			
1.6.	Scales of Measurement (Nominal, Ordinal, Interval and Ratio)			
1.7.	Data Sources			
1.8.	Applications of Statistics in Business and Economics			
2. Descriptive Statistics: Tabular and Graphical Presentations		3	2	
2.1.	Summarizing Qualitative Data			
2.2.	Summarizing Quantitative Data			
2.3.	Scatter Diagram			
3. Numerical Descriptive Measures		6	4	
3.1.	Measures of Central Tendency: Mode, Median, and Mean			
3.2.	Measures of Locations: Quartiles and Percentiles			
3.3.	Measures of Dispersion (Variability): Range, IQR, Variance, Standard Deviation, and Coefficient of Variation			
3.4.	Measures of Distribution Shape and Boxplot			
3.5.	Measures of Association between Two Variables			
4. Introduction to Probability and Discrete Probability Distributions		3	2	
4.1.	Fundamental Probability Concepts and Counting Rules. Contingency Tables and Probabilities			
4.2.	Random Variables and Discrete Probability Distributions			
4.3.	Expected value, Variance, and Standard Deviation			
4.4.	Binomial Probability Distribution			
5. Continuous Probability Distributions		3	2	
5.1.	Continuous Random Variables			
5.2.	Normal Probability Distribution			
5.3.	Solving Problems with Normal Distributions			
5.4.	Normal Approximation of Binomial Probabilities			
6. Sampling and Sampling Distributions		3	2	
6.1.	Non-probability and Probability Sampling			
6.2.	Simple Random Samples			
6.3.	The Sampling Distribution of the Sample Mean			
6.4.	The Sampling Distribution of the Sample Proportion			
7. Interval Estimation		3	2	
7.1.	Confidence Interval for a Population Mean - Use of the Normal and the t-distribution			
7.2.	Confidence Interval for the Population Proportion			
7.3.	Selecting the Required Sample Size			

8. Hypothesis Testing		3	2	
8.1.	Introduction to Hypothesis Testing: One and Two- tailed Tests; Type I and Type II Errors			
8.2.	Hypothesis Testing for a Population Mean - Use of the Normal and the t-distribution			
8.3.	Hypothesis Testing for a Population Proportion			
8.4.	Relationship between Interval Estimation and Hypothesis Testing			
9. Statistical Inference Concerning Two Populations		3	2	
9.1.	Inference Concerning the Difference between Two Means: Independent Samples			
9.2.	Inference Concerning Mean Differences: Matched Paired Samples			
10. Additional Inferences		3	2	
10.1.	Analysis of Variance: One-way ANOVA			
10.2.	Chi-squared Test of Independence			
11. Regression Analysis and Correlation		6	4	
11.1.	Introduction to Simple Linear Regression and Correlation: Determining the Equation of the Regression Line			
11.2.	Model Assumptions and Residual Analysis			
11.3.	Multiple Linear Regression			
11.4.	Goodness-of-fit Measures: The Standard Error of the Estimate, the Coefficient of Determination R^2 , Tests of Significance			
12. Time-Series Analysis and Forecasting		3	2	
12.1.	Introduction to Time-series Analysis and Forecasting			
12.2.	Time-series Components (Trend Component, Seasonality Component, Cyclical Component, and Irregular Component)			
12.3.	Regression Trend Analysis and Forecasting			
13. Index Numbers		3	2	
13.1.	Simple Price Indices			
13.2.	Weighted Aggregate Price Index			
13.3.	Index of Volume			
Total:		45	30	

III. FORMS OF CONTROL:

No. by row	TYPE AND FORM OF CONTROL	Number	extracurricular, hours
1.	Midterm control		
1.1.	Midterm Exam (theoretical and practical problems 50:50)	1	30
1.2.	Quizzes (theoretical and practical problems 50:50)	2	30
1.3.	Team Projects (based on real-world data)	2	60
Total midterm control:		5	120
2.	Final term control		
2.1.	Examination –Final Exam (theoretical and practical problems 40:60)	1	75
Total final term control:		1	75
Total for all types of control:		7	195

IV. LITERATURE

REQUIRED (BASIC) LITERATURE:

1. Mann, Prem S. *Introductory Statistics*. 8th edition, Singapore: John Wiley & Sons Ltd, 2013, XVIII, 652 p., A1-AN11, I1-I16, 978-1-118-31870-6. (*Library of the University of Economics*)
2. Newbold, Paul. William L. Carlson and Betty M. Thorne. *Statistics for business and economics*, 8th edition, Pearson, 2013, 795 p., 978-0-13-274565-9. (*Web Page of the Course*).

RECOMMENDED (ADDITIONAL) LITERATURE:

1. Anderson, David R., et al. *Statistics for Business and Economics*, Cengage Learning, 12th edition, 2014, XVI, 638 p., 978-1-4080-7223-3. (*Library of the University of Economics, e-sources: <https://eclipse.ue-varna.bg/catalog/view/LG5YHN87EG>*)
2. Jaggia Sanjiv, Alison Kelly, *Business Statistics – Communicating with Numbers*, 4th edition, McGraw-Hill Publishers, 2022, 800 p., 978-1264218882 (e-book).
3. Lee, Nick, Peters, Mike. *Business Statistics Using EXCEL and SPSS*. Los Angeles: SAGE Publisher, 2016, XVI, 561 p., 978-1-84860-219-9. (*Library of the University of Economics*)
4. Todorova, S. *Statistics for Data Analysis Using Microsoft Excel*. Izvestia Journal of the Union of Scientists -Varna, 2019, Economic Sciences Series 8 (2), pp. 68-74, 2019, ISSN 1314-7390 – print. (*Library of the University of Economics, e-sources: <https://eclipse.ue-varna.bg/catalog/view/BGZKT2BD7G>*)
5. Weiss, Neil A. *Introductory Statistics*. 9th edition, Edinburgh: Pearson, 2014, II, 894 p., 978-1-292-02201-9. (*Library of the University of Economics*)
6. Winston, Wayne L. *Microsoft Excel Data Analysis and Business Modeling*, Microsoft Press, 2016, XXVI, 837 p., 978-1-5093-0421-9. (*Library of the University of Economics*)