ΟΙΚΟΝΟΜΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ

ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS

SCHOOL OF INFORMATION SCIENCES AND TECHNOLOGY
DEPARTMENT OF STATISTICS

UNDERGRADUATE STUDIES GUIDE
2024-2025

ATHENS, OCTOBER 2024

Athens University of Economics and Business – Academic Authorities

Rector: Professor Vasileios Vasdekis
Vice Rector for Academic Affairs: Professor Leonidas Loukakis
Vice Rector for Financial Planning and Infastructure: Assistant Professor Eleanna Galanaki
Vice Rector of Research and Lifelong Learning: Professor Georgia Siougle
Vice Rector for International Cooperation and Growth: Professor Nancy Pouloudi

School of Information Sciences and Technology

Dean: Professor Vassiliki Kalogeraki

Department of Statistics

Head of the Department: Professor Ioannis Ntzoufras

Vice Chairman: Professor Dimitrios Karlis

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PART ONE
ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS

1. General Description of the University

The Athens University of Economics and Business (AUEB), as a Greek Higher Educational Institution, is a public entity overseen by the Ministry of Education, Religious Affairs and Sports.

AUEB is, in order of seniority, the third oldest Higher Education Institution of the country and the first in the field of Economics and Business Administration. The scientific fields of Informatics and Statistics were added later. Since its foundation, AUEB has had a rich history of significant scientific achievements that define its presence and set excellent prospects for the future. It was founded in 1920 as the Grand School of Commerce Studies (Ανωτάτη Σχολή Εμπορικών Σπουδών), with the aim of providing university-level education in the fields of Economics and Business Administration. In 1926, it was renamed as the Grand School of Economic and Commerce Studies (Ανωτάτη Σχολή Οικονομικών και Εμπορικών Επιστημών (Α.Σ.Ο.Ε.Ε.). Until 1955, the School operated with a single-class, three-year curriculum. In 1955, the School adopted a four-year curriculum, with students in their fourth year divided into two Departments, the Department of Economic Studies and the Department of Commercial Studies. In 1970, this division of the student body began taking place in second year students. In 1984, the whole School was divided into three Departments: the Department of Economic Studies, the Department of Business Organization and Administration, and the Department of Statistics and Informatics. In 1979 the first graduate program in Economic Studies was inaugurated, while a corresponding program was introduced by the Department of Business Organization and Administration in 1985.

The Athens University of Economics and Business (AUEB) has historically been recognized in the collective consciousness of the academic community - Greek students and society - as a leading University in its core areas of expertise. Its reputation is based, on the one hand, on faculty, research, and teaching activities, as well as its modern academic programs, and, on the other hand, on its outstanding graduates, who are professionally active both in Greece and abroad.

2. Academic Authorities and Services

The organization and operation of AUEB comply with applicable laws, notably Law N.4957/2022 (A 141).

The administrative bodies of AUEB are:

a) The Board of Administration

b) The Senate

c) The Rector

d) The Vice Rectors

e) The Executive Director

BOARD OF ADMINISTRATION

The Board of Administration is the supreme collective management body of the University and consists of eleven (11) members, six (6) of whom are internal and five (5) are external.

SENATE
The Senate is comprised of:

I. The Rector
II. The School Deans
III. The School Presidents
IV. One representative from each staff category (ΕΕΠ, ΕΔΙΠ, ΕΤΕΠ, and administrative staff)
V. Student representatives, constituting 10% of the total Senate members from categories I to III above.

AUEB ACADEMIC STRUCTURE

The Athens University of Economics and Business (AUEB) is organized into two (2) levels of academic units:
a) Schools and
b) Departments.

Each School consists of at least two (2) Departments, encompassing related scientific fields and fostering an interdisciplinary approach to teaching and research. The School is responsible for supervising and coordinating the operations of its Departments, as well as overseeing the educational and research activities conducted within them, in accordance with the Internal Regulations.

As stipulated by Law 4957/2022 (A 141), as in force, the governing bodies of the School are:
a) The Dean and
b) The Dean's Office.

The Department is the fundamental academic unit of the University, dedicated to advancing a specific field of science, technology, humanities, or the arts through education and research. It comprises faculty members from the Teaching and Research Staff (DEP), Special Teaching Staff (EEP), Laboratory Teaching Staff (EDIP), and Special Technical Laboratory Staff (ETEP).

As stipulated by Law 4957/2022 (A 141), as in force, the governing bodies of the Department are:
a) the General Assembly,
b) the Administrative Council,
c) the Chair, and
d) the Vice-Chair.

The Athens University of Economics and Business comprises **three Schools** and **eight Departments**:

1. **SCHOOL OF ECONOMIC SCIENCES:**
    - Department of International & European Economic Studies
    - Department of Economics

2. **SCHOOL OF BUSINESS:**
    - Department of Management Science and Technology
    - Department of Business Administration
    - Department of Accounting and Finance

- Department of Marketing and Communication

3. **SCHOOL OF INFORMATION SCIENCES AND TECHNOLOGY:**
    - Department of Informatics
    - Department of Statistics

3. List of Offered Programs Leading to an Academic Degree

Detailed information on the curricula is available in the corresponding course guides and on the Departments' websites.

4. Structure of Studies

Undergraduate studies in the Departments of AUEB follow a semester-based system, which is approved by the Department Assembly of each Department. The academic year begins on September 1st and ends on August 31st of the following year. Academic activities are divided into two semesters, the winter semester and the spring semester.

The duration of undergraduate studies is four years (eight semesters). Each semester lasts 13 weeks and is interrupted by the Christmas and Easter breaks. At the end of each semester there is there is a four-week examination period.

At the completion of the June examination period no classes take place until the end of the academic year.

September's examination period (repeat exams) begins in the last week of August and lasts four weeks, followed by the start of winter semester classes.

The exact dates for the start and end of semesters and examination periods are determined by the Studies Unit, ratified by the Senate, and published in the University's academic calendar.

5. Enrollment

Admission to the Department is primarily achieved though the Panhellenic Examinations. The enrollment of successful candidates, takes place each September via the electronic enrollment system of the Ministry of Education, Research, and Religious Affairs.

6. Primary Regulations (Including Procedures for Academic Recognition)

A selection of AUEB's Basic Regulations includes:

- ✓ AUEB Internal Regulation
- ✓ Regulations for Postgraduate and PhD Programs
- ✓ Operating Regulations of the Internal Audit Unit
- ✓ Standard Internal Operating Regulations for AUEB Labs
- ✓ Internal Operating Regulations of the Vocational Training and Lifelong Learning Center of AUEB and its Organizational Structure
- ✓ Operating Regulations of AUEB's Teaching and Learning Support Center
- ✓ Regulations for AUEB's Practical Training Program
- ✓ Operating Regulations of AUEB's Technology and Innovation Transfer Unit
- ✓ Regulations for AUEB's Summer Study Programs

7. Personnel

The University staff comprises the following categories:

- **TEACHING STAFF:**
  - ✓ Faculty members categorized as (a) Professors, (b) Associate Professors, (c) Assistant Professors.
  - ✓ Emeritus Professors
  - ✓ Visiting Professors
  - ✓ Special Teaching Staff
  - ✓ Laboratory Teaching Staff
  - ✓ Special Technical Laboratory Staff
  - ✓ Scientific Associates
  - ✓ University and Academic Scholars
  - ✓ Scientific Personnel
  - ✓ Contract Lecturers
  - ✓ Teachers on secondment

- **ADMINISTRATIVE STAFF**

8. Services

The Athens University of Economics and Business provides both administrative and **student support services**, including catering, housing, library access, and sports facilities, for students, administrative staff, and faculty members. More information on the organization and operation of the University's services is available on its official website (http://www.aueb.gr).

9. ECTS Coordinator

The ECTS Coordinator of the University is the Head of the Quality Assurance Unit (Μονάδας Διασφάλισης Ποιότητας-ΜΟΔΙΠ). The coordinator ensures the University's compliance with the principles and regulations of the European Credit Transfer and Accumulation System (ECTS), oversees their implementation and ensures the smooth process of ECTS unit transfer and accumulation.

10. Academic Year/ Semester Important Dates *

- Winter Semester: October 7, 2024 – January 17, 2025
- Christmas Holidays: December 21, 2024 – January 6, 2025
- Fall Semester Exams Period: January 20, 2025 – February 14, 2025
- Spring Semester: February 17, 2025 – May 30, 2025
- Easter Holidays: April 12, 2025 – April 27, 2025
- Spring Semester Exams Period: May 27, 2025 – June 21, 2025

** According to the 2024-25 Academic Calendar*

11. Official Holidays

- ✓ October 28, 2025
- ✓ January 6, 2025 (Epiphany)
- ✓ January 30, 2025 (Three Hierarchs)

- ✓ March 3, 2025 (Clean Monday)
- ✓ March 25, 2025 (Greek Independence Day)
- ✓ May 1, 2025
- ✓ June 9, 2024 (Pentecost Monday)

PART TWO
DEPARTMENT OF STATISTICS

The Hellenic Authority for Higher Education (HAHE) has **certified** that the Undergraduate Study Program of the Department of Statistics of the Athens University of Economics and Business is in full compliance with the HAHE Quality Standards and the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG 2015). This certification corresponds to Level 6 of the National and European Qualifications Framework. The accreditation is valid for five years, from May 29, 2020, to May 28, 2025. The accreditation report is available at the following link: https://www.aueb.gr/en/node/20747.

A. GENERAL DESCRIPTION

A1. Establishment and Operation

Under Presidential Decree (PD) 377/1989, which officially renamed ASOEE to Athens University of Economics and Business (AUEB), the Department of Statistics was founded in June 1989. This followed the earlier establishment of the joint Department of Statistics and Informatics under PD 313/1984. However, Statistics had already been part of AUEB's academic curriculum, appearing in the University's first Yearbook (1927-1928) as a course.

With PD 78/2013 titled "Establishment – Foundation of Schools in the Athens University of Economics and Business", the School of Information Sciences and Technology was created, incorporating the Departments of Statistics and Informatics. This structure follows a global trend seen in leading U.S. and European universities, bringing these disciplines together to foster collaboration, synergy, and research innovation. The School's mission is threefold: education, research and contribution to society.

The primary educational objective is to develop highly skilled professionals in Statistics and Informatics, equipping them with the expertise to stay ahead of rapid technological advancements. The undergraduate programs balance a solid theoretical foundation with personalized specialization, while the postgraduate programs focus on high-demand fields of specialization. The curriculum is updated every two to three years, ensuring that students receive cutting-edge scientific knowledge. By emphasizing timeless core principles and methodological depth, the degrees retain their long-term relevance and value.

AUEB graduates enjoy high employability rates both in Greece and abroad, often excelling as senior executives in corporations, banks, and organizations, while many have successfully launched their own businesses.

The School maintains a dynamic research environment, engaging in extensive international collaborations and securing competitive funding. Faculty members and students frequently earn global recognition, including awards, distinctions, and patents. By continuously engaging in international academic developments, the School of Information Sciences and Technology fosters multidimensional excellence, significantly contributing to societal progress.

The Department of Statistics of the Athens University of Economics and Business is the first and only university Department in Greece dedicated exclusively to Statistics. The undergraduate degree awarded by the Department is issued by the School of Information Sciences and Technology and bears the Department's name.

Academic Title Offered:
Degree in Statistics

Admission Requirements
Students are admitted by the Department through the Pan-Hellenic Examination system and according to the regulations governing special student categories. Registration takes place each September via the mandatory electronic registration system, following the guidelines set by the Ministry of Education, Religious Affairs, and Sports. As there are no other Departments equivalent to the Department of Statistics, student transfers are not permitted (*Government Gazette ΦΕΚ 4002/22.06.2023, τ.Β'*).

Educational and Professional Aims

The Department of Statistics aims to advance and disseminate knowledge in the field of statistical science and its related disciplines—both theoretical and applied—through research and education. It prepares graduates with the skills and expertise to apply appropriate statistical analysis methods across various domains, including economics, social sciences, business, administration, research, and education.

Access to Further Studies

Graduates of the Department of Statistics have access to postgraduate programs in a wide range of fields, both in Greece and abroad. Their strong foundation in mathematics and statistics, combined with expertise in quantitative and computational analysis methods, provides them with a competitive advantage. Additionally, the flexibility to choose courses from other Departments enhances their academic breadth and allows them to tailor their studies toward their desired specialization in postgraduate education.

A2. Facilities

Department of Statistics Labs

To support the undergraduate and postgraduate programs of the Department of Statistics and to promote research, the Department operates three (3) research labs equipped with computers, with a total capacity of 57 computers and one (1) educational lab with a total capacity of 51 computers.

The Department of Statistics laboratories are as follows:

Research Labs:

i. **Laboratory of Statistical Methodology**, which is located on the 2nd floor of the Evelpidon 47A and Lefkados 33 building and is available to postgraduate students of the Department. It features one central computer and a local network of 27 PCs running Windows OS with internet access, **1 PC for the instructor, 4 additional workstations and one server (a total of 32 PCs), 1 interactive table, 4 projectors and 4 laptops**.
ii. **Stochastic Modelling and Applications Laboratory**, which is located on the 2nd floor of the Troias 2 and Kimolou str. building, room 208 (co-housed with the Computational and Bayesian Statistical Laboratory).

iii. **Computational and Bayesian Statistical Laboratory**, which is located on the 2nd floor of the Troias 2 and Kimolou str. building, room 208 (co-housed with the Stochastic Modeling and Applications Laboratory). **Both labs are equipped with 38 computers.**

Educational Lab:

i. **Laboratory of Applied Statistics, Probability and Data Analysis,** which consists of two separate spaces. The main space is located on the 3rd floor of the Antoniadou wing in the main AUEB building (room A35). It is open to Undergraduate students, PhD candidates and temporary teaching staff. The laboratory is equipped with 4 SUN servers/workstations, 2 UPS, 1 DELL server connected to a local network of 40 PCs, 1 PC for the professor, 2 printers, 1 scanner, 1 overhead projector and 1 projector connected to the PC. In a separate area of the lab, there are 10 additional workstations for PhD candidates (total: 51 PCs).

   The second space is located on the 4th floor of the Antoniadou wing (room A45) and is shared with the Educational Lab of the Department of Informatics *(not currently in use).*

Computer Centre

AUEB's Computer Center (**CE**) is responsible for providing computer infrastructure for educational and research applications.

The central IT systems of the CE operate on a stack of servers with sufficient and continuously expanding capacity. These servers support various functions, including user authentication for controlled access to CE resources, file storage for users, automated software reinstallation on CE laboratory computers, protection against malicious software (viruses) and high-speed network connectivity, accessible from anywhere within the University.

The CE provides three teaching and practice rooms, available to all students and Departments. These computers operate in a Windows environment with centralized management of user accounts and resources. They also have full access to applications installed on the central CE systems.

All members of the academic community, i.e. undergraduate and postgraduate students, faculty, and university staff, can access CE's resources. Interested users can register for the CE and University e-services via the URegister service.

Students can request a password reminder electronically, without needing to visit the CE in person. In addition to direct access to the CE through the teaching and practice rooms, which operate throughout the day, users can access central systems and email services 24/7.

Network Operating Centre

AUEB's Network Operating Centre (NOC) is responsible for managing the University's entire network infrastructure, including both voice (telephony) and data services. NOC monitors, maintains and coordinates all University networks. It also hosts the servers for most of the University's services (websites, e-class, administrative secretariats, etc.), excluding those of the Computer Center. Additionally, NOC manages network security systems to protect against cyberattacks.

A backbone fiber optic network using Gigabit Ethernet technology operates across all University buildings. The University's main buildings are connected to this backbone via a fiber optic ring, while some auxiliary buildings are linked through wireless laser or microwave connections.

All University buildings feature structured voice and data cabling, with horizontal (in-floor) and vertical (inter-floor) wiring, connecting offices and laboratories to the backbone network at speeds of 100 Mbps or 1000 Mbps. Additionally, the University provides wireless broadband access in classrooms and public areas of all buildings.

The University is connected to the Internet via the Greek Research and Technology Network (GNSS) through a Gigabit Ethernet optical fiber link. As a result, all users benefit from extremely high-speed Internet access through the backbone and access networks. Finally, through the Eduroam international system, all University users can connect to the wireless networks of hundreds of educational and research institutions worldwide. Likewise, users from these institutions can seamlessly access AUEB's wireless network.

E-class

AUEB operates a comprehensive Course Management System that supports Asynchronous eLearning Services, accessible via a standard web browser (https://eclass.aueb.gr). Through e-Class, lecturers distribute course materials such as notes, presentations, exercises, and announcements, while students can submit their assignments electronically. e-Class is used in all courses of the Department of Statistics to facilitate communication between students and instructors.

B. DEPARTMENT OF STATISTICS PERSONNEL

B1. Faculty Members (Δ.Ε.Π.)

Professors

Vasdekis Vasileios, holds a Degree in Mathematics from the University of Athens (1988), an MSc in Applied Statistics from Oxford University (1989), and a Ph.D in Statistics from Oxford University (1993). His research interests include a) repeated and longitudinal measurements, b) latent variable models, c) statistical inference using composite likelihoods. URL: https://www.aueb.gr/en/faculty_page/vasdekis-vasilios

Yannakopoulos Athanassios holds a Degree in Mathematics from the University of Athens (1989) and a Ph.D. in Mathematics from Warwick University (1993). His research interests focus on Stochastic Analysis and Applications, Stochastic Differential Equations and Mathematical Modeling using Random and Deterministic Dynamical Systems with applications in Insurance, Finance, and Modern Technologies. URL: https://www.aueb.gr/en/faculty_page/yannacopoulos-athanasios

Dellaportas Petros, holds a Ph.D. from the University of Plymouth, an MSc from the university of Sheffield, and a Degree in Mathematics from the University of Athens. His research interests include: MCMC theory, Bayesian Model Determination, Inference and Simulation methods for Stochastic Differential Equations, Time Series Forecasting, Financial Statistics, Sparsity. URL: https://www.aueb.gr/en/faculty_page/dellaportas-petros

Zazanis Michail, obtained an Engineering Diploma from the National Technical University of Athens (1982), an M.Sc. in Applied Mathematics from the Division of Applied Sciences, Harvard University (1983), and a Ph.D. in Applied Mathematics from Harvard University (1986). His research interests focus on Applied Probability Theory. URL: https://www.aueb.gr/en/faculty_page/zazanis-michael

Karlis Dimitrios earned a BSc. in Statistics from the Department of Statistics, AUEB (1992) and a Ph.D. in Statistics from the same Department (1999). His research interest includes mixture models, computational statistics with a focus on stochastic algorithms, multivariate count data analysis, statistical models for sports data analysis and modeling dependent data using copulas. URL: https://www.aueb.gr/en/faculty_page/karlis-dimitrios

Kyriakidis Epameinondas, earned a B.Sc. in Mathematics from the University of Athens (1985), an M.Sc. in Statistics from Imperial College London, and a Ph.D. in Stochastic Operational Research (1990) from Birkbeck College. His research interests focus on a) stochastic dynamic programming theory and applications, b) control of population and epidemic processes, c) optimal preventive and corrective maintenance of production systems and d) optimal vehicle routing problems.

URL: https://www.aueb.gr/en/faculty_page/kyriakidis-epaminondas

Ntzoufras Ioannis, earned a B.Sc. in Statistics and Insurance Science, from the University of Piraeus (1994), an M.Sc. in Statistics with Applications in Medicine (with distinction) from the University of Southampton (1995), and a Ph.D. from the Department of Statistics, Athens University of Economics and Business (1999). His research interests focus on topics of Bayesian and computational statistics, categorical data analysis, statistical modeling, and model and variable selection methodology. He is also particularly interested in the application of advanced statistical models to problems in Medical research, Psychometrics, and Sports Analytics. URL: https://www.aueb.gr/en/faculty_page/ntzoufras-ioannis

Psarakis Stylianos, holds a Degree in Mathematics from the University of Crete (1986) and a Ph.D. from the Department of Statistics, AUEB (1993). His research interests focus on: a) Statistical Quality Control, b) Distribution Theory and c) Multivariate Statistical Analysis.

URL: https://www.aueb.gr/en/faculty_page/psarakis-stelios

Associate Professors

Vrontos Ioannis, earned a B.Sc. in Statistics, from the Athens University of Economics and Business (1995), an M.Sc. in Statistics (1997) and a Ph.D. in Statistics (2001). His research interests focus on Bayesian Methodology, Time Series Modeling, Applied Finance, Optimal Asset Portfolio Allocation and alternative investment strategies for high-risk assets.

URL: https://www.aueb.gr/en/faculty_page/vrontos-ioannis

Ioannidis Evangelos earned a Degree in Mathematics from the University of Heidelberg, Germany (1987), with a diploma-thesis in non-parametric Statistics. He obtained his Ph.D. in Mathematics (1993) from the same University, focusing on spectral analysis of time series. His current research interests include co-integration methods, application of bootstrap to unit-root-testing, Multivariate Spectral Analysis and its applications in economic data analysis, as well as Official Statistics, particularly survey sampling. URL: https://www.aueb.gr/en/faculty_page/ioannidis-evangelos

Besbeas Panagiotis, holds a degree in Mathematics with a specialization in Statistics (with honors) from University of Kent (1994). He graduated with distinction from the University of Kent (1995) and obtained a Ph.D. in Statistics (1999) from the same University. His research interests include: a) Applied Statistics, b) Statistical Computing and c) Ecological Statistics. URL: https://www.aueb.gr/en/faculty_page/besbeas-panagiotis

Papageorgiou Ioulia, earned a B.Sc. in Mathematics (2.1) from the University of Ioannina, specializing in Statistics and a Ph.D. in Statistics, from the same University. Her research interests include Sampling Theory, Model Based Clustering, Mixture Models, and Applications to Archaeometry. URL: https://www.aueb.gr/en/faculty_page/papageorgiou-ioulia

Pavlopoulos Charalampos, received a B.Sc. in Mathematics from the University of Patras, Greece (1985), followed by an M.A. (1988) and a Ph.D. (1991) in Statistics from the University of Maryland, College Park, Maryland, USA. His research interests focus on stochastic modeling of rainfall processes, scaling statistical properties of spatio-temporal rainfall fields, time series models, and spatial and environmental statistics. URL: https://www.aueb.gr/en/faculty_page/pavlopoulos-charalampos-harry

Tsiamyrtzis Panagiotis, holds a degree in Mathematics from the Aristotle University of Thessaloniki (1994), an M.Sc. in Statistics (1997) and a Ph.D. in Statistics (2000) from the University of Minnesota, USA. His research interests focus on a) Bayesian statistical process and quality control and b) statistical problems in computational physiology.

URL: https://www.aueb.gr/en/faculty_page/tsiamyrtzis-panagiotis

Assistant Professors

Stavros Vakeroudis earned a degree in Applied Mathematics from the School of Applied Mathematical and Physical Sciences of the National Technical University of Athens (2004). He continued his postgraduate studies in Paris, obtaining an M.Sc. in Probabilities and Applications from Pierre et Marie Curie-Paris VI University (2006), followed by a Ph.D. in the Science of Mathematics from the same

University (2011). His research interests focus on stochastic analysis, stochastic processes, stochastic modeling, actuarial mathematics, risk theory, financial mathematics and actuarial science.

URL: https://www.aueb.gr/en/faculty_page/vakeroudis-stavros

Demiris Nikolaos studied Mathematics at the University of Patras and earned an M.Sc. from AUEB and a Ph.D. from the University of Nottingham. His research interests mainly concern Bayesian Statistics, applications of Bayesian methods in Biostatistics, health economics and epidemic modeling and analysis. URL: https://www.aueb.gr/en/faculty_page/demiris-nikolaos

Zympidis Alexandros, received a first-class honors Degree in Mathematics from the University of Athens, followed by an M.Sc. (with distinction) and a Ph.D. in Actuarial Science from the City University of London. His primary research interests include a) stochastic modeling of insurance and pension systems, b) applications of fractional Brownian motion and c) H∞ optimal control. URL: https://www.aueb.gr/en/faculty_page/zimbidis-alexandros

Papastamoulis Panagiotis, earned a Degree in Mathematics from the University of Patras (2003), an M.Sc. in Applied Statistics from the University of Piraeus (2005) and a Ph.D. in Statistics from the same University (2010). His research interests focus on estimating distribution mixtures, cluster analysis, Bayesian and Computational Statistics and inference in large-scale Bioinformatics data. URL: https://www.aueb.gr/en/faculty_page/papastamoulis-panagiotis

Penteli Xanthi-Xanthipi, earned a Degree in Statistics from the Athens University of Economics and Business (2003), an M.Sc. in Biostatistics from the University of Athens (2006) and a Ph.D. from the Department of Statistics, Athens University of Economics and Business (2011). Her research interests focus on statistical modeling and inference for time series, discrete data analysis and biostatistics. URL: https://www.aueb.gr/en/faculty_page/penteli-xanthi-xanthipi

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Alexandros Zymbidis	12 Derigni str, 6th floor	210-8203**418**	aaz@aueb.gr
Papastamoulis Panagiotis	12 Kodrigtonos str, 5th floor	210-8203**591**	papastamoulis@aueb.gr
Xanthi Penteli	12 Kodrigtonos str, 1st floor	210-8203**454**	xpedeli@aueb.gr

B2. Special Teaching Laboratorial Staff of the School of Information Sciences and Technology employed in the Department of Statistics

Mamaloukas Christos, holds a Degree in Applied Mathematics from the Aristotle University of Thessaloniki (1984) and a Ph.D. from the Polytechnic School of the Aristotle University of Thessaloniki (2000). His research interests focus on a) Applied Mathematics, b) Computational Mathematics, c) Differential Equations and d) PC Programming and Mathematical Software.

URL1: https://www.aueb.gr/en/faculty_page/mamaloukas-christos and
URL2:*http://scholar.google.co.in/citations?user=fZuGhmQAAAAJ&hl=en&cstart=0&pagesize=20*

Tsompanaki Evgenia, holds a B.Sc. in Mathematics with a major in Statistics and Operational Research, from the Department of Mathematics, University of Patras, an M.Sc. in Statistics, from the Department of Statistics, Athens University of Economics and Business and a Ph.D. in Statistics, from the Department of Statistics, Athens University of Economics and Business. Her main research interests include Multivariate Analysis, Latent Variable Models, Categorical Data, Missing and Influential Data, Applications to Health and Social Sciences. URL: https://www.aueb.gr/en/faculty_page/tsompanaki-evgenia

B3. Special Technical Laboratorial Staff (Ε.Τ.Ε.Π.)

Mihou Tatiana holds a Degree in Statistics, from the Department of Statistics, Athens University of Economics and Business (2001).

B4. Administrative Staff

Laboratorial Infrastructure Support Staff (Antoniadou Building, 3rd floor)

- **Moraitis Nikolaos**

Secretariat Personnel (Derigni Building, Ground Floor)

- **Chatzipanagiotou Kyriaki,** Deputy Head, holds a B.Sc. in Statistics from the Department of Statistics, Athens University of Economics and Business (1995), and an M.Sc. in Statistics from the Department of Statistics, Athens University of Economics and Business (2011).
- **Anastasiou Sofia,** Graduate of the School of Physical Education and Sport Science, Democritus University of Thrace (2000).
- **Spyropoulou Aliki,** graduate of ATEI of Halkida in Business Management (2000), with a postgraduate Degree in Business Management from the Hellenic Open University (2010).

Support Staff for Postgraduate Studies (Evelpidon Building, 47A Evelpidon & 33 Lefkados str., 7th floor)

- **Smyrnaki Argyro**, holds a Degree in Statistics, from the Department of Statistics, Athens University of Economics and Business (1996), and an M.Sc. in Human Resources Management (2016), from the Department of Marketing & Communication and the Department of Management Science and Technology, Athens University of Economics& Business.
- **Chrysanthopoulou Maro,** holds a Degree in Statistics, from the Department of Statistics, Athens University of Economics and Business (2004) and an M.Sc. in Statistics, from the Department of Statistics, Athens University of Economics and Business (2006).

C. DEPARTMENT OF STATISTICS STUDY PROGRAM

C1. Learning Outcomes

Upon successful completion of their studies at the Department of Statistics, graduates will be able to:

- Understand the fundamentals of probability theory, the mathematical foundations of statistics, and the principles of statistical reasoning and inference.
- Comprehend the concept of uncertainty and how statistics, probability and modern data science enhance decision making in uncertain environments.
- Design, collect and analyze statistical data while recognizing the limitations at each stage of the process.
- Interpret and communicate the results of a statistical analysis effectively.
- Analyze data using statistical software packages and other computational tools.
- Demonstrate knowledge of how to prevent the misuse of statistical methods and the misinterpretation of results.
- Translate research assumptions into statistical models that can be analyzed using appropriate statistical methods.
- Critically evaluate research publications that use statistical methods and assess the validity of their statistical arguments.

C2. Studies Regulation

Basic **principles** and rules of the program are as follows:

1. The program aligns with the curricula of European Universities with which the Department cooperates, as it follows the European Credit Transfer System (ECTS). The system is based on Credit Unit (ECTS), with each course assigned a specific number of ECTS credits as indicated in the program.
2. The ECTS allocation for each course is determined by considering the total workload, including lectures, assignments, required preparation, and other academic activities.
3. Students complete their studies and are awarded a degree upon successfully completing courses totaling at least 240 ECTS credits. Courses can be completed through examinations, exemption, or equivalence recognition under the Erasmus program.
4. According to the Department's indicative curriculum, each academic year consists of educational activities corresponding to 60 ECTS credits.
5. The program includes 14 compulsory courses.

Starting from the academic year 2021-22 the Department of Statistics, in collaboration with the Department of Informatics, has introduced course cycles. These cycles consist of specific courses from both Departments, grouped by subject area. The available course cycles are:

- Data Science
- Operational Research
- Applied Mathematics

These cycles are not compulsory, but provide students with the flexibility to acquire additional knowledge in their field of interest.

C3. Courses Categories

1. The program's courses are divided into 2 main categories:
    1. **14 compulsory courses** which must be completed by all students
    2. **Elective courses** which are further divided into:
        1. Courses offered by the Department of Statistics
        2. Courses offered by other Departments
2. Compulsory courses are offered during the first 6 semesters (8 courses in the first year, 4 courses in the second year and 2 courses in the third year). This structure ensures that students develop the necessary background to make informed course selections in later semesters.
3. In the last two semesters, no compulsory courses are offered. This allows students the flexibility to design a personalized study program, that covers core statistical knowledge through compulsory Statistics courses and provides opportunities to explore individual academic and professional interests
4. During the **first two semesters,** students may enroll in courses with a **maximum of 30 ECTS credits**.
5. During the 3rd and 4thsemester, students may enroll in courses with a **maximum of 40 ECTS credits per semester.**
6. During the 5th and 6thsemester, students may enroll in courses with a **maximum of 40 ECTS credits per semester.**
7. During the 7th and 8thsemester students may enroll in courses with a **maximum of 48 ECTS credits per semester.** An exception is allowed only for the "Practical Training" course.
8. Beyond the 4th year, students may enroll in courses with a **maximum of 48 ECTS credits per semester**. An exception is allowed only for the "Practical Training" course.

In particular, the maximum ECTS credits per semesters are displayed in the table below:

	Maximum ECTS's	
Year	**Winter Semester**	**Spring Semester**
1st	30 ECTS	30 ECTS
2nd	40 ECTS	40 ECTS
3rd	40 ECTS	40 ECTS
4th	48 ECTS + Practical Training	48 ECTS + Practical Training
5thand above	48 ECTS + Practical Training	48 ECTS + Practical Training

9. When selecting courses for each semester, **compulsory courses from previous semesters that the student has not passed—and that are offered in the specific semester of interest—must be prioritized over all other courses.**
10. The program includes **prerequisite courses.** "Estimation and Hypothesis Testing" of the 3rd semester is a prerequisite course for "Linear Models" of the 4th Semester. "Linear Models" is a prerequisite course for "Generalized Linear Models" of the 5th Semester and for "Data Analysis" of the 6th Semester. Additionally, the courses "Estimation and Hypothesis Testing" and "Linear Models" are repeated in the 4th and 5th semesters, respectively.

11. Apart from the 14 compulsory courses that amount to 108 ECTS, student must earn **at least** 72 ECTS from elective courses offered by the Department of Statistics. The remaining 60 ECTS credits, for the Degree can be obtained either from elective courses offered by the Department of Statistics or from courses offered by other Departments of the University.
12. "Practical Training" is an elective course. This means that its credits are not counted toward the required 72 ECTS credits from elective courses offered by the Department of Statistics.
13. The list of offered courses is announced each year and depends on the availability of the teaching personnel. Some elective courses may not be offered if no instructor is available.
14. By getting the Degree, students can obtain a computer certificate equivalent to ECDL in the public sector if, during their studies, they have successfully attended four of the following courses:

INFORMATICS KNOWLEDGE COURSES

Course Title	Department
INTRODUCTION TO PROGRAMMING USING R	STAT
INTRODUCTION TO PROBABILITY AND STATISTICS USING R	STAT
DATA ANALYSIS	STAT
SIMULATION	STAT
NUMERICAL METHODS IN STATISTICS	STAT
DATABASES	DET OR INF
COMMUNICATION NETWORKS	INF
COMPUTER NETWORKS	INF
DATA MANAGEMENT & ANALYSIS SYSTEMS (Formerly: DATABASE DESIGN)	INF
ARTIFICIAL INTELLIGENCE	INF
MACHINE LEARNING	INF
DATA MINING	INF
INFORMATION RETRIEVAL SYSTEMS	INF

15. Students can enroll in the Teacher Education Program. More information is available at: https://www.dept.aueb.gr/en/tep.
16. Lastly, students have the opportunity to attend one semester at a similar Department in a University abroad, through the ERASMUS+ program. Successfully completed courses are recognized as equivalent to courses of the Department and are included in the student's transcript of records. For more information about student mobility visit:

    https://www.aueb.gr/en/erasmus.

C4. General Structure of the Studies Program

The general structure of the studies program is shown in the table below.

1st Semester	2nd Semester
• Probabilities I (C)	• Probabilities II (C)

• Calculus I (C) • Linear Algebra I (C) • Introduction to Programming using R (C) • Statistics I: Probabilities and Estimation*	• Calculus II (C) • Linear Algebra II (C) • Introduction to Probability and Statistics using R (C) • Statistics II: Inference and Regression *
3rd Semester	**4th Semester**
• Estimation and Hypothesis Testing (C) • Stochastic Procedures I (C) • Introduction to Mathematical Analysis • Bayesian Statistics • Introduction to Economics • Introduction to Accounting Information Systems • ERASMUS BIP: Mixed Mobility for Studies**	• Linear Models (C) • Time Series Analysis (C) • Demographic Statistics • Sampling • Mathematical Methods • Actuarial Science I
5th Semester	**6th Semester**
• Generalized Linear Models (C) • Experimental Design and Analysis • Statistical Quality Control • Theoretical Statistics • Introduction to Operations Research	• Data Analysis (C) • Simulation • Multivariate Statistical Analysis • Biostatistics I • Probability Theory • Official Statistics • Numerical Methods in Statistics • Introduction to Database Management
7th Semester	**8th Semester**
• Methods of Statistical and Machine Learning • Biostatistics II • Econometrics • Stochastic Processes II • Actuarial Science II • Bayesian Inference • Special Topics in Probability and Statistics • Bachelor Thesis • Practical Training	• Categorical Data Analysis • Advanced Sampling Methods • Statistical Methods for the Environment and Ecology • Non-Parametric Statistics • Research Methodology • Special Topics in Probability and Statistics • Bachelor Thesis • Practical Training

(C): compulsory courses

Notes:

- Courses marked with an asterisk (*) “Statistics I: Probabilities and Estimation” and “Statistics II: Inference and Regression” will be offered only to Erasmus students, during the 2024-25 academic year.
- The course marked with two asterisks (**) “ERASMUS BIP: Mixed Mobility for Studies” will be offered only when a Multilateral Inter-Institutional Agreement exists between Universities, with specific selection criteria and a limited number of students (IKY financing). **Each student may enroll in the program only once during their studies**.
- Elective courses are offered only if an instructor is available.
- Tutoring sessions are provided for all compulsory courses and, depending on availability, may also be offered for elective courses.
- All courses consist of four hours of weekly instruction, plus two hours of tutorials, where applicable.

- Each course's examination method is determined by the instructor and may include assignments, exercises, intermediate exams, etc.
- Students may also select elective courses from a list of offerings by other Departments.

Beginning in the academic year 2021-22, the Department of Statistics introduced a seminar series to **bridge the gap between theory and practical applications of statistical methods**. The seminar's objective is to spark students' interest in statistical science, its applications, and its career prospects. More specifically:

- Each seminar lasts between 45 to 60 minutes and is held once a month, or more frequently, depending on the lecturer's availability.
- There are no final exams, and attendance is optional.
- The seminar is open to all undergraduate students of the Department, not just first-year students.
- The seminar content is presented at a level accessible to first-year students, without the complexity of a research seminar. Topics include:
  - ✓ Statistical applications with significant social impact such as the COVID-19 pandemic, clinical trials, sports analytics, economics, Enigma codebreaking, market research, and psychometrics.
  - ✓ Engaging statistical problems from relevant publications in international journals (e.g., Significance).
  - ✓ Current advancements in statistical research and applications, including statistical learning and big data analytics.
  - ✓ Practical statistical applications in business sectors, such as insurance, banking, and pharmaceutical companies.

In addition, beginning in the academic year 2021-22, the Department of Statistics introduced Microsoft **Excel** lab seminars, for first-year students, focusing on specialized tools for creating databases, statistical tables, and graphical representations of statistical results.

- The Microsoft Excel lab is **optional.**
- The lab has a short duration (e.g., 2 hours/ week for 6 weeks) and may be offered twice a year.
- Successful attendance, demonstrated through exams or an exemption exercise, does not yield credit units and is not counted toward degree requirements.
- Successful completion is recorded only in the diploma's annex, received during the Graduation Ceremony.
- Upon request, a "Certificate of Successful Attendance" (without grade indication) is issued, signed by the Department Chair.
- Participation is limited based on available workstations, and selection criteria are determined by the faculty member in charge.

C.12 Elective Courses Offered by Other Departments for the Academic Year 2024-25

Winter Semester

Semester	Code	ECTS	Course Cat.	COURSE TITLE	DEPARTMENT
A	1131	6	E.E.	GENERAL ECONOMIC HISTORY	SCHOOL OF ECONOMIC SCIENCES
C	1193	6	E.E.	PRINCIPALS OF SOCIOLOGY (not offered during the 2024-25 academic year)	SCHOOL OF ECONOMIC SCIENCES
C	1311	6	E.E.	MACROECONOMIC THEORY I	SCHOOL OF ECONOMIC SCIENCES
C	1313	6	E.E.	MICROECONOMIC THEORY I	SCHOOL OF ECONOMIC SCIENCES
E	1550	6	E.E.	PUBLIC FINANCE I	SCHOOL OF ECONOMIC SCIENCES
Z	2612	6	E.E.	COST ACCOUNTING	BUSINESS ADMINISTRATION
Z	3070	6	E.E.	TEACHER TRAINING INTERNSHIP I	INFORMATICS
Z	3074	6	E.E.	INTRODUCTION TO PEDAGOGY	INFORMATICS
Z	3075	6	E.E.	ORGANIZATION AND MANAGEMENT OF EDUCATION AN D EDUCATIONAL INSTITUTIONS	INFORMATICS
Z	3076	6	E.E.	INTRODUCTION TO METHODOLOGY OF TEACHING - ANALYTICAL PROGRAMS	INFORMATICS
Z	3078	6	E.E.	EDUCATIONAL EVALUATION	INFORMATICS
A	3117	6	E.E.	DISCRETE MATHEMATICS	INFORMATICS
A	3125	6	E.E.	INTRODUCTION TO PROGRAMMING	INFORMATICS
C	3230	8	E.E.	COMPUTATIONAL MATHEMATICS (2 classes)	INFORMATICS
C	3321	8	E.E.	COMPUTER PROGRAMMING WITH C++	INFORMATICS
C	3335	7	E.E.	DATA STRUCTURES	INFORMATICS
E	3515	7	E.E.	LOGIC	INFORMATICS
E	3531	7	E.E.	ARTIFICIAL INTELLIGENCE*	INFORMATICS
E	3541	8	E.E.	SOFTWARE ANALYSIS AND DESIGN	INFORMATICS
E	3571	8	E.E.	COMMUNICATION NETWORKS	INFORMATICS
Z	3632	6	E.E.	TOPICS IN ALGORITHMS*	INFORMATICS
Z	3745	6	E.E.	MACHINE LEARNING*	INFORMATICS
Z	3812	6	E.E.	SPECIAL TOPICS OF OPERATIONS RESEARCH (not offered during the 2024-25 academic year)	INFORMATICS
A	4107	6	E.E.	FINANCIAL LAW	INTERNATIONAL & EUROPEAN ECONOMIC STUDIES
Z	4137	6	E.E.	PORTFOLIO MANAGEMENT	INTERNATIONAL & EUROPEAN ECONOMIC STUDIES
A	4110	6	E.E.	INTRODUCTION TO POLITICS AND INTERNATIONAL RELATIONS	INTERNATIONAL & EUROPEAN ECONOMIC STUDIES
C	5634	6	E.E.	MARKETING RESEARCH	MARKETING
C	5636	6	E.E.	MARKETING	MARKETING
A	5411	6	E.E.	INTRODUCTION TO BUSINESS ADMINISTRATION	MARKETING
A	5622	6	E.E.	INTRODUCTION TO MARKETING	MARKETING
Γ	8117	6	E.E.	DATABASES*	MANAGEMENT SCIENCE AND TECHNOLOGY
E	8123	6	E.E.	OPTIMIZATION METHODS IN MANAGEMENT SCIENCE	MANAGEMENT SCIENCE AND TECHNOLOGY

Z	8137	6	E.E.	BUSINESS INTELLIGENCE AND BIG DATA ANALYSIS (prerequisite is 8117 – Databases)	MANAGEMENT SCIENCE AND TECHNOLOGY
Z	8143	6	E.E.	COMBINATIONAL OPTIMIZATION	MANAGEMENT SCIENCE AND TECHNOLOGY
Z	8154	6	E.E.	ENTREPRENEURSHIP	MANAGEMENT SCIENCE AND TECHNOLOGY

** Has prerequisites, as already mentioned*

Spring Semester

Semester	Code	ECTS	Course Cat.	COURSE TITLE	DEPARTMENT
D	1402	6	E.E.	MICROECONOMIC THEORY II	SCHOOL OF ECONOMIC SCIENCES
D	1412	6	E.E.	MACROECONOMIC THEORY II	SCHOOL OF ECONOMIC SCIENCES
D	2410	6	E.E.	ADVANCED FINANCIAL ACCOUNTING (LOGISTICS II)	BUSINESS ADMINISTRATION
D	2416	6	E.E.	FINANCIAL MANAGEMENT I	BUSINESS ADMINISTRATION
E	2610	6	E.E.	OPERATIONAL POLICY AND STRATEGY	BUSINESS ADMINISTRATION
E	2622	6	E.E.	INVESTMENT MANAGEMENT	BUSINESS ADMINISTRATION
F	3080	6	E.E.	TEACHER TRAINING INTERNSHIP II	INFORMATICS
F	3084	6	E.E.	GENERAL AND EVOLUTIONARY PSYCHOLOGY	INFORMATICS
F	3085	6	E.E.	QUALITY IN EDUCATION AND TEACHING	INFORMATICS
F	3086	6	E.E.	INTRODUCTION TO COMPUTERS - EDUCATIONAL APPLICATIONS	INFORMATICS
F	3087	6	E.E.	SPECIAL EDUCATION METHODOLOGY - TEACHING ECONOMIC COURSES	INFORMATICS
B	3222	6	E.E.	COMPUTER PROGRAMMING USING JAVA (2 classes)	INFORMATICS
D	3432	7	E.E.	ALGORITHMS*	INFORMATICS
D	3436	8	E.E.	DATABASES* (2 classes)	INFORMATICS
H	3513	6	E.E.	APPLIED NUMERICAL ANALYSIS * *(Formerly: APPLIED NUMERICAL ANALYSIS)*	INFORMATICS
E	3543	7	E.E.	DATABASES SYSTEMS DESIGN *(old title: DATABASES)*	INFORMATICS
E	3672	7	E.E.	COMPUTER NETWORKS	INFORMATICS
H	3584	6	E.E.	TECHNOLOGICAL INNOVATION AND ENTREPRENEURSHI	INFORMATICS
H	3612	6	E.E.	SPECIAL TOPICS OF DISCRETE MATHEMATICS*	INFORMATICS
H	3713	6	E.E.	GAME AND DECISION THEORY*	INFORMATICS
H	3814	6	E.E.	INFORMATION THEORY* *(Not offered during the 2024-25 academic year)*	INFORMATICS
H	3644	6	E.E.	INFORMATION RETRIEVAL SYSTEMS*	INFORMATICS
H	3743	6	E.E.	APPLIED DATA ANALYTICS DATA MINING *(Formerly:* DATA MINING*, DATA MINING FROM LARGE DATABASES AND THE WEB)*	INFORMATICS
D	5414	6	E.E.	HUMAN RESOURCES MANAGEMENT	MARKETING
ΣΤ	5626	6	E.E.	DIGITAL MARKETING	MARKETING
H	7138	6	E.E.	RISK MANAGEMENT	ACCOUNTING & FINANCE
B	8106	6	E.E.	PROGRAMMING I	MANAGEMENT SCIENCE AND TECHNOLOGY
D	8116	6	E.E.	MATHEMATICAL PROGRAMMING	MANAGEMENT SCIENCE AND TECHNOLOGY
E	8132	6	E.E.	FOOD SUPPLY CHAIN MANAGEMENT	MANAGEMENT SCIENCE AND TECHNOLOGY

E	8134	6	E.E.	PRODUCTION AND OPERATIONS MANAGEMENT	MANAGEMENT SCIENCE AND TECHNOLOGY
E	8146	6	E.E.	ELECTRONIC COMMERCE	MANAGEMENT SCIENCE AND TECHNOLOGY

** Has prerequisites, as already mentioned*

Note: Only students accepted into the "Teacher Education Program" are eligible to enroll in the Informatics course: "Digital Educational Content Creation & Usage in Contemporary Learning methodologies", 6 ECTS.

Final Exams

Exams take place at the end of each semester, as well as during the repetitive exam period in September.

Exams and Evaluation/ Grading Rules

Assessment is conducted in accordance with University regulations.

Department's ECTS Coordinator

The Department's ECTS Coordinator is Professor D. Karlis.

MODULE COURSES

Starting from the academic year 2021-22 the Department of Statistics, in collaboration with the Department of Informatics, introduced modules consisting of specific courses from both Departments that are related to specialized subject areas. The available modules are:

- Data Science
- Operational Research
- Applied Mathematics

Each module's courses provide students with flexibility to gain additional knowledge in their chosen subject.

Module Completion: To complete a module, a student must successfully pass **at least 5 module courses**, which must not overlap with courses from other modules. Additionally, at least two of these courses must be taken from either the Department of Informatics or the Department of Management of Science and Technology.

Non – Compulsoriness: Modules are not compulsory, and students are free to take courses from any modules. If a student completes a module this is recorded in the **Diploma's annex**.

The course titles and their distribution across modules are shown in the table below:

Cod.	Course	Data Science	Operational Research	Applied Mathematics	Semester	ECTS
6023	Linear Models (STAT)	✓			4th	8
6005	Data Analysis (STAT)	✓			6th	8
6136	Multivariate Statistical Analysis (STAT)	✓			6th	8
3531	Artificial Intelligence (INF)	✓			5th	7
3745	Machine Learning (INF)	✓			7th	6
3743	Data Mining (INF) *(Formerly: Data Mining from Large Databases and the Web)*	✓			8th	6
3436	Databases (INF or DET)	✓			4th	8
6127	Methods of Statistical and Machine Learning (STAT)	✓			7th	8
3644	Information Retrieval Systems (INF)	✓			8th	6
6126	Stochastic Processes I (STAT)		✓	✓	3rd	8
6153	Introduction to Operations Research (STAT)		✓	✓	6th	7
6057	Stochastic Processes II (STAT)		✓	✓	7th	8
6123	Statistical Quality Control (STAT)		✓		4th	7
6145	Time Series Analysis (STAT)		✓		4th	8
6125	Simulation (STAT)		✓		6th	7
3432	Algorithms (INF)		✓		4th	7
3713	Decision and Game Theory (INF)		✓		8th	6
3632	Special Topics in Algorithms (INF)		✓		7th	6
8116	Mathematical Programming (DET)		✓		4th	6
8143	Combinatorial Optimization (DET)		✓	✓	7th	6
6124	Probabilities II (STAT)			✓	2nd	7,5
6082	Linear Algebra II (STAT)			✓	2nd	7,5

Cod.	Course	Data Science	Operational Research	Applied Mathematics	Semester	ECTS
6133	Introduction to Mathematical Analysis (STAT)			✓	3rd	7
6143	Mathematical Methods (STAT)			✓	4th	7
6116	Probability Theory (STAT)			✓	6th	8
6115	Numerical Methods in Statistics (STAT)			✓	6th	7
6256	Special Topics in Statistics and Probability (STAP): Introduction to Measurement Theory with regard to Probability and Statistics (STAT)			✓	8th	7
3117	Discrete Mathematics (INF)			✓	1st	6
3513	Numerical Linear Algebra *(Formerly: Applied Numerical Analysis)* (INF)			✓	8th	6
3612	Special Topics in Discrete Mathematics (INF)			✓	8th	6
3814	Information Theory (INF)			✓	8th	6

The teaching semester and the ECTS credits for courses offered by either the Department of Statistics or other Departments may be subject to modification.

COMMON MODULES INFORMATICS – STATISTICS - <u>PREREQUISITES</u>

DATA SCIENCE MODULE

TITLE	PREREQUISITES
Artificial Intelligence (INF)	Calculus II (STAT) or Algorithms (INF)
Machine Learning (INF)	Calculus II (STAT) or Artificial Intelligence (INF)
Data Mining (INF) *(Formerly: Data Mining from Large Databases and the Web)*	Databases (INF) or Artificial Intelligence (INF)
Databases (INF or DET)	Introduction to Programming using R (STAT) or Programming with JAVA(INF)
Methods of Statistical and Machine Learning (STAT)	--------
Multivariate Statistical Analysis (STAT)	--------
Information Retrieval Systems (INF)	Introduction to Programming using R (STAT) or Computer Programming in Java (INF)
Linear Models (STAT)	Estimation – Hypothesis Testing (STAT)
Data Analysis (STAT)	Linear Models (STAT)

OPERATIONAL RESEARCH MODULE

TITLE	PREREQUISITES
Algorithms (INF)	Introduction to Programming using R (STAT)
Introduction to Operations Research (STAT)	-----
Decision and Game Theory (INF)	Calculus I (STAT), **and** Probabilities I (STAT) **or** Probabilities II (STAT)
Stochastic Processes II (STAT)	-----
Simulation (STAT)	-----
Topics in Algorithms (INF)	Databases (INF) **Or** Algorithms (INF)
Mathematical Programming (DET)	-----
Statistical Quality Control (STAT)	-----
Combinatorial Optimization (DET)	-----
Time Series Analysis (STAT)	-----

APPLIED MATHEMATICS MODULE

TITLE	PREREQUISITES
Discrete Mathematics (INF)	-----
Numerical Methods in Statistics (STAT)	-----
Introduction to Operations Research (STAT)	-----
Introduction to Mathematical Analysis (STAT)	------
Mathematical Methods (STAT)	-----
Stochastic Processes II (STAT)	-----
Introduction to Measurement Theory with regard to Probability and Statistics (STAT)	-----
Probability Theory (STAT)	-----
Topics in Discrete Mathematics (INF)	Discrete Mathematics (INF)
Information Theory (INF)	Probabilities I (STAT) **or** Probabilities II (STAT)
Combinatorial Optimization (DET)	-----
Applied Numerical Algebra *(Formerly: Applied Numerical Analysis)* (INF)	Calculus II (STAT) **and** Computational Mathematics (INF) **or** Numerical Methods in Statistics

C5. Educational Support

1. In the courses offered by the Department of Statistics (apart from the theoretical ones), particularly in the compulsory ones, part of the time is dedicated to the students practicing with statistical packages suitable for the subject that is being taught. There is a lab operating in the Department which is used by undergraduate students to complete assignments, and to search for and collect data and bibliographic material to help them complete these assignments. For this reason, many statistical packages as well as other applications such as word processors, graphical packages, databases, etc. are installed in the lab. The lab also has copies of the Practical Training reports prepared by students, and as well as copies of the Department's pre-publications. Occasionally, the lab holds seminars on topics related to the Department, as well as undergraduate courses, in coordination with the lab supervisor.
2. When deemed necessary, tutoring is offered. Tutoring hours and the room location are announced on the University's website (https://www.aueb.gr/en). During these hours, students can seek assistance to solve exercises, ask questions or receive help understanding concepts.

C6. General Rules

Maximum study duration and part time study

1. The maximum duration for completing first cycle studies, which have a minimum duration of eight (8) academic semesters for graduation, is this period, extended by four (4) academic semesters. After completing the maximum period of study, and notwithstanding the next following paragraphs, an act of deletion is issued by the responsible body.
2. The procedural details and supporting documents for the exceptional extension of the maximum study duration, as stated in paragraph 1, due to serious health reasons of the student, their first-degree blood relatives or a person with whom the student has a civil partnership agreement, will be determined according to the University's internal regulation.
3. The following individuals are eligible to submit applications for part-time study:
    a) Students who prove to work at least twenty (20) hours a week
    b) Students with disabilities and special educational needs.
    c) Students who are also athletes and belong to sports clubs registered to the electronic record of sports (Article 142 of Law **N. 4714/2020** (A' 148)), maintained by the General Secretariat for Sports, under the following conditions:
        1. For the years in which they rank in the 1st to 8th place in Panhellenic individual sports championships, with participation of at least twelve (12) athletes and eight (8) sports clubs, or compete in clubs in the two (2) upper categories of group sports, or participate as members of national teams, or
        2. Participate, even once during their studies, in the Olympics, Special Olympics or the Olympics for the deaf.

    For part – time students each semester counts as half. These students cannot take courses that exceed half the number of semester courses described in the study guide.
4. Students who have not exceeded the maximum duration of studies, as described in paragraph 1, may apply to interrupt their studies, for a period of no more than 2 years. This interruption can be taken all at once or for a duration of one (1) semester; however, the total interruption cannot exceed the maximum period of two years. The students' status is suspended during the interruption and participation in any educational process is not allowed.

Other Rules

1. The study program does not have specific directions in the strict sense. However, each student can shape their direction and desired specialization by selecting a specific Course Module.
2. Each student can also broaden their knowledge in other academic fields of the University (i.e., Economics, Administration, Marketing, Informatics etc.) by choosing appropriate elective courses. This selection is made in collaboration with their Studies Advisor. This approach to designing their studies, offers students the freedom to make choices based on their interests.
3. The semesters for the elective courses are only indicative. Students in later semesters can also enroll in these courses.
4. The elective courses offered by the Department of Statistics are determined based on the program's needs, faculty availability, and student interest in attending them.
5. The minimum number of students required for a course to be taught is 8. In exceptional cases, a course may be taught with fewer students, but only with a decision from the Department's Assembly.
6. In addition to the courses offered in the Department's curriculum, students can also choose other courses offered from other Departments, selected from a list of available options.
7. Student Internal Mobility Program between first cycle University Programs: The purpose of the Internal Mobility Program is to provide each student—enrolled in a first cycle study program and who

has not exceeded the minimum study duration—with the opportunity to transfer to another School or Department of a different University, whether similar or not, for one academic semester. During this period, students may attend academic activities and be evaluated accordingly.

The maximum number of students eligible to transfer to other Universities is limited to 10% of the total number of first-year admissions in the Department of Statistics.

Applications for the mobility program must be submitted exclusively electronically through a special digital platform managed by the Ministry of Education. Applications are accepted twice a year, once per academic semester.

The beneficiaries, the prerequisites for participation, the application submission, the evaluation process, as well as other information on the specific program are outlined in the Official Gazette 2904/02.05.2023, vol. B.

8. The Degree's grade is the weighted average of the grades of the individual courses, where the weighting coefficients correspond to each course's ECTS credits.
9. All the Department's announcements are uploaded on the Department's website (https://www.dept.aueb.gr/en/stat-0).
10. Faculty members must keep their course pages up to date on the University's eClass platform.
11. Grades may optionally be posted on the Department's website and/or on the eClass course page. However, the official grade announcement is made through e-Γραμματεία **(https://aueb.gr/el/content/e-grammateia-0).**
12. The studies program contains the titles of the compulsory and elective courses, their content, their weekly teaching hours (which include the type of teaching work that is carried out), and the time sequence or interdependence of the courses.
13. The above provisions are part of the Department's internal regulation. These provisions are communicated to the students through the Undergraduate Studies Guide, which is released at the beginning of each academic year. The guide lists the program's courses, the semesters in which they are offered, their classification, and the corresponding ECTS credits. This information is advisory in nature.
14. **Bachelor Dissertation**: The dissertation may only be undertaken in the 4th year of studies or later. To be eligible, a student must have successfully completed all compulsory courses and achieved an average grade of 7 or higher in these courses. The dissertation spans one academic semester. A supervisor is assigned, along with two additional faculty members who serve as examiners. The dissertation is presented on a designated date and time, typically during or shortly before the corresponding exam period. Further details can be found in the Studies Guide.
15. Practical Training: Students may participate in the practical training only once. This involves applying statistical methods in a working environment, either in the public or private sector. To begin the training, the student must obtain the consent of their Supervisor and the approval of the Practical Training Coordinator appointed by the Department, and then complete the relevant forms available on the Department's website. The training may commence after the completion of the 6th semester, typically after the summer. Students must have earned at least 80 ECTS and passed at least 8 compulsory courses. Depending on the subject and duration, the training may yield between 6 and 14 ECTS. The number of ECTS is determined by the Practical Training Coordinator, based on a proposal from the student's Supervisor. Preparatory seminars are held before each training period. More information is available in the relevant section of the Studies Guide and at the following URL: https://www.aueb.gr/en/internship.
16. ERASMUS BIP: Blended Intensive Programme (Mixed Mobility for Studies):

    Since the academic year 2022–2023, the Department of Statistics has included the course "ERASMUS BIP: Mixed Mobility for Studies" in its Undergraduate Curriculum, with the following characteristics:

- ECTS: Minimum of 3 and up to 6 credits, depending on the duration of stay at the Host University.
- Course type: Elective.
- Academic coordinators: Assistant Professor P. Papastamoulis and Dr. St. Vakeroudis.
- Participation: Each student may participate in the program only once during their studies.
- Assessment: Pass/Fail, based on a 10–15-minute presentation and consultation between the academic coordinators of the Department and the Host University.
- Eligibility criteria: Students must meet all of the following:
    1. Be in at least their second year of study;
    2. Have earned a minimum of 60 ECTS credits at the time of application, including credits from first-year courses;
    3. Demonstrate good knowledge of the Host Institution's language (minimum level B2).

Criteria for Selection and Placement at Host Universities

To select students for participation in the program and to assign placements at Host Universities, the following factors are also taken into consideration:

1. The student's grade point average (GPA) at the time of application submission.
2. The total number of earned ECTS credits in relation to the expected number of credits for the student's current semester.
3. Fulfillment of any specific requirements set by the Host University, such as language proficiency, minimum number of earned credits, prerequisite courses, etc.

According to the decision of the Department's Assembly, if a student fails to meet their academic obligations, they must return the funds received, or they will not be eligible to receive the remaining 20% of the funding from IKY.

17. According to applicable law, the Studies Guide is reviewed every April.

C7. Courses Attendance, Selection and Examination

- **Course Selection**: To participate in course exams, students must complete and submit an electronic course declaration through the University's Electronic Secretariat (e-Γραμματεία): https://aueb.gr/el/content/e-grammateia-0. Submission takes place on dates announced by the University at the beginning of each semester and is mandatory. If a student fails to submit the declaration, any exam results—even if passed—will be annulled.
- **Final Submission:** For the form to be definitively submitted to the Electronic Secretariat, it must be saved.
- **Textbook Selection:** Similarly, students must submit their textbook selections electronically via the **EUDOXUS** platform (https://eudoxus.gr/). It should be noted that **Course Selection** and **Textbook Selection** are independent procedures and do **not** substitute for one another. Penalties apply if a student selects and receives a textbook for a course they have not declared.
- **Timetable Coordination:** Teaching hours for courses within the same semester are scheduled to avoid overlaps.
- **Course Duration:** Each course runs for 13 weeks, with 4 lecture hours per week. Most courses also include laboratory sessions, which are dedicated to exercises and addressing students' questions.

- Grading System: Course grades range from 0 to 10, with half-point increments (e.g., 0.5). A grade of 5.0 or higher is required to pass. The final degree grade is calculated as the weighted average of the individual course grades, with weighting coefficients corresponding to each course's ECTS credits. More specifically:
  Excellent: 8,51 – 10

  Very Good: 6,51 - 8,5

  Good: 5 - 6,5

  The passing grade is 5 or higher.
- For courses taught in the winter semester exams take place from the end of January to the beginning of February. For courses taught in the spring semester, exams take place in June and July. Finally, courses from both semesters are examined again in September. If a student fails the exams of a course they have taken during the Winter or Spring Semester, they can retake the exams in September.
- **Course Re-examination**: Students who have passed a course but wish to be re-examined may submit a request to the Department's Secretariat, following the relevant announcement by the Directorate of Education. By submitting this request, the previously earned grade is canceled. The following restrictions apply:
  - Each student has the right to use this feature 4 times (for 4 courses), during their studies.
  - The application must be submitted during the period between the examination period in which the student passed the course and the examination period in which the course will be examined again. Obviously, the student can be examined in this course at any time in the future.

C8. Scholarships and Awards

The Department of Statistics and the University's Career Office, in order to support undergraduate students and acknowledge and encourage excellence, would like to inform interested parties about scholarships derived from collaborations with other organizations, institutions, and businesses. These scholarships are announced on the university's website (https://www.aueb.gr/el/content/scholarships) and on the Department's website (https://www.dept.aueb.gr/en/stat/content/scholarships).

Also, the AUEB Property Management & Development S.A. also manages the bequests from the "Georgia Nikolakopoulou" and "Faidonas G. Chatzigeorgiou" foundations, which provide scholarships to students with limited financial resources, based on their academic performance.

The **State Scholarships Foundation (IKY)** also grants performance scholarships to diligent students and aims to ensure equal participation in education of those with low income and those belonging to vulnerable social groups. This action is cofounded by Greece and the European Union (European Social Fund) through the Operational Program "Human Resources Development, Education and Lifelong Learning 2014 – 2020".

In the academic year 2021-22, the Department of Statistics introduced a Rewards Program for Undergraduate Students with EXCELLENT PERFORMANCE, as well as a Rewards Program for Undergraduate Students with GOOD PERFORMANCE. In particular:

A. REWARDS PROGRAM FOR EXCELLENT PERFORMANCE OF UNDERGRADUATE STUDENTS of the Department of Statistics

- Beneficiary for the scholarship/ reward are the **best three (3) undergraduate students** with excellent performance per year of study – unless there is a private funding to reward more students – that achieved the highest average grade, in combination with the aggregation of specific ECTS's, as specified below.

- The average grade for the undergraduate student's reward is at **least seven (7).**
- It must be pointed out that the undergraduate students eligible for the reward in the 1st, 2nd, 3rd and 4th year must have accumulated specific ECTS. More specifically, for the 1st year 60 ECTS are required, for the 2nd year at least 120 ECTS in total, for the 3rd year at least 180 ECTS in total and for the 4rth year at least 240 ECTS in total.
- In calculating the average grade and the number of ECTS's, all courses (and their respective ECTS's) in which students received a passing grade in all three exams periods, are taken into account.
- Starting from the 2021–2022 academic year, the three (3) top graduates will be awarded—unless additional private funding is available to reward more students. A minimum final grade of 7.50 (seven and a half) is required to be eligible for the award.
- For graduating students, the duration of studies is not taken into account—only the final average grade matters. If a graduating student is also eligible for an award due to excellent performance during the 4th year of studies, they may receive both awards, as they are granted for different reasons: one for outstanding 4th-year performance and the other for achieving one of the highest final degree grades.
- The reward amounts to **150 euro for the 1st, 100 euro for the 2nd and 50 euro for the 3rd.** These amounts are a contribution of the Department and may be modified depending on the Department's financial availability or may be replaced or modified depending on possible sponsorships available.
- Along with the reward, an Award of Academic Performance will also be issued. It will be signed solely by the Head of the Department and will include all relevant details of the award.
- In the case of a tie, all tying students receive the REWARD and the AWARD OF ACADEMIC PERFORMANCE.
- Students who already hold a Higher Education Degree or are exempted from some courses, are not eligible for the EXCELLENT PERFORMANCE AWARD and can only receive an ACADEMIC PERFORMANCE AWARD.
- Academic Performance Awards are granted in the period from March to April of the next academic year. Following a reasoned decision of the Department's Assembly, this period may be modified.
- The student's REWARD will be mentioned in the section "6.1 Additional Information" of their Diploma (both in the Greek and the English version of the Diploma).

B. REWARDS PROGRAM FOR GOOD PERFORMANCE OF UNDERGRADUATE STUDENTS of the Department of Statistics

- Beneficiary for the scholarship/ reward are the **undergraduate students** that achieve a good performance in the curriculum courses, in combination with the aggregation of specific ECTS's, as specified below.
- The minimum average grade required for the undergraduate student award is **seven (7).**
- It must be pointed out that the undergraduate students eligible for the reward in the 1st, 2nd, 3rd and 4th year must have accumulated specific ECTS. More specifically, for the 1st year 60 ECTS are required, for the 2nd year at least 120 ECTS in total, for the 3rd year at least 180 ECTS in total and for the 4rth year at least 240 ECTS in total.
- In calculating the average grade and the number of ECTS's, all courses (and their respective ECTS's) in which students received a passing grade in all three exams periods, are taken into account.

- The REWARD amounts to the symbolic amount of 15 euro and will be accompanied by an "ACADEMIC PERFORMANCE AWARD" which will be signed by the Head of the Department of Statistics, containing all of the details of the award. The reward's amount is a contribution of the Department and may be modified in relation to the Department's financial availability or can be replaced or modified depending on possible private sponsorships/ donations. The possibility of not providing a monetary sum as a scholarship/reward, but instead offering a symbolic gift such as a book, USB, or other similar items, will be explored.
- In case of a tie, all tying students receive the REWARD and the AWARD OF ACADEMIC PERFORMANCE.
- Students who already hold a Higher Education Degree or are exempted from some courses are only eligible for the GOOD PERFORMANCE AWARD.
- Academic Performance Awards are granted in the period from March to April of the next academic year. Following a reasoned decision of the Department's Assembly, this period may be modified.
- The student's REWARD will be mentioned in the section "6.1 Additional Information" of their Diploma (both in the Greek and the English version of the Diploma).

Finally, since the academic year 2018-19, the Department of Statistics began **awarding scholarships and performance rewards to undergraduate students** based purely on academic criteria, funded by the Department's resources. More specifically:

Each graduate student of the Department that completes their undergraduate studies in four (4) years with an average of at least eight and fifty-one (8.51), can be eligible to a full scholarship (in the form of 100% exemption from tuition fees) for attending a Postgraduate Program of the Department of Statistics. This scholarship is available for the next **three (3) years**, following the year of graduation, provided that the student submits a request after being selected for the program.

C9. Complaint Management Procedure

In the context of strengthening the student-centered educational process, **a complaints management procedure** has been adopted for both students and other members of the Department, such as teaching, laboratory, and administrative staff.

The procedure concerns all complaints related to the quality of the educational and administrative services offered by the Department, and is as follows:

- To record complaints made by members of the academic community directly associated with the Department (students, graduates, faculty members, EDIP and ETEP members, administrative staff etc.) a "complaint form" is available on the Department's website (https://www.dept.aueb.gr/sites/default/files/stat/entypa/2223/Aitisi_paraponon_V2_color.pdf).
- Once the complaint is recorded, it is submitted to the Department's secretariat.
- The Secretariat (either undergraduate or postgraduate) issues a report, which is sent to the Head of the Department and the student's Faculty Advisor.
- The Head of the Department looks into the problem and informs the concerning body. For example, if the complaint concerns the structure of the Undergraduate Studies Program, the relevant Committee is informed, etc.).
- It is then evaluated whether the problem should be discussed in the Department's Assembly for any necessary corrective actions.
- The student is informed of the actions taken and of any decision of the Department's Assembly.
- It is noted that all complaints are considered data that are processed and taken into consideration in any reform of the study program.

C10. Bachelor Dissertation

Within the framework of the educational process, students, on their 4th year (or later) of study, can conduct a Bachelor Dissertation on a wide range of cognitive areas covered by the Department of Statistics. This guide aims to define the process of assignment, execution and evaluation of the Bachelor Dissertation, ensuring the standards of the studies and the Department's reliability.

General Rules for Applying

- For a student to be able to apply for the dissertation, they must have successfully attended all compulsory courses and hold an average on these courses, of (at least) 7 (seven).
- Successful fulfillment of the dissertation is awarded with 8 ECTS.
- The dissertation is conducted under the supervision of a faculty member.
- Each student can enroll in the Bachelor Dissertation after completing the 6th semester.
- The student must complete and submit the form labeled "Submission of Proposal for Bachelor Dissertation", to the Department's Secretariat, in which the dissertation's subject, the supervisor and the subject's summary are declared.

Special Teaching Staff (E.DI.P.) members who hold a Ph.D. or are in their final academic rank are eligible to supervise a dissertation, provided they have the support of a faculty member.

Assignment

The faculty members announce the Dissertation's subject that they are willing to supervise, either through the Department's website and the laboratories or through the Department's secretariat. Students can contact the professor for further information. The Department's Assembly is then informed about the assignment of the dissertation and appoints a three-member Evaluation Committee, after taking into consideration the supervisor's proposal. The supervisor is appointed as Chair of the Committee.

Conducting the Dissertation

Conducting the Thesis is based on the approved proposal. Work progress is regularly monitored in cooperation with the supervisor.

Writing Procedure

The dissertation must contain the following:

- Full bibliography review
- Description of the computational procedure and the methodology
- Description of the computational process and the methodology used
- Presentation and discussion of the outcomes
- Conclusions and suggestions for future work
- Data that document the conclusions, in the form of appendices, such as tables, charts etc.
- Abstract in Greek and English for documentation purposes.

Detailed guidelines on how to write the dissertation can be found at the following link:

https://www.dept.aueb.gr/en/stat/content/bachelor-dissertation.

Presentation Procedure

The student delivers an electronic copy of their dissertation to the members of the Evaluation Committee and to the Department's Secretariat at least 7 days prior to the dissertation's presentation.

The presentation takes place at a specific date, time and place, during or just before the exam period.

For the date to be set, the student must come to an agreement with the supervisor and the Department's secretariat. Members of the academic community can attend the presentation. At the end of the presentation, the student answers questions from the Evaluation Committee and the audience. The presentation should last no more than 20 minutes, followed by a 15-minute Q&A session.

Evaluation Procedure

After completing the presentation procedure and after the student has answered all questions, the Committee meets in order to evaluate the dissertation and grant the final grade. The Committee then completes the relevant proceedings, which are submitted to the Secretariat. The final grade is recorded to the Department's Electronic Secretariat (e-Grammateia) for the current examination period.

Dissertation Submission

The student submits the dissertation electronically and in a hard copy to the Department's secretariat, after incorporating any corrections/observations that may have occurred after the presentation.

C11. Practical Training

The Department of Statistics, since its foundation in 1989, has established **"Practical Training"** in its curriculum. It was the first Department in the University that offered this service.

The "AUEB STUDENTS PRACTICAL TRAINING" program is implemented through the "Human Resources Development, Education and Lifelong Learning" and "Competitiveness, Entrepreneurship and Innovation 2014 - 2020" operational programs and is co-funded from the European Union (European Social Fund) and from national resources.

Alternatively, in case that there are no National Strategic Reference Framework (NSRF) funds available at a certain period, interested students can participate in the self-funded "AUEB STUDENTS PRACTICAL TRAINING 2016-2020" program. This program is funded entirely by the Company, which must deposit the corresponding amount for the compensation and insurance in the case of a student's accident, to a bank account held by the Special Account for Research and Development, at the end of the term Internships. Students can participate **only once** in the Practical Training program (either with NSRF funds, or with other resources). Practical training is an elective course with the code 6801 and offers 6 – 14 ECTS. Students must apply for Practical Training at the semester it is offered and implemented.

Program's Aims

The main scope of the Practical Training program is for students to obtain professional experience and for the participating organizations and companies to understand the need to use Statistics in decision making. It refers to applying statistical methods in the private or public sector workplaces. This way, students can utilize their academic knowledge and practically apply them in their workplace.

Exposing students to real working conditions contributes to their better integration into the productive system, both in the Greek and international markets. The aim is to establish a two-way communication channel between the Department of Statistics and the production sector—addressing the statistical needs of the sector, the Department's capacity to meet those needs, and the broader potential that Statistics can offer.

Through this channel, the **Department of Statistics** gathers valuable information, enabling it to continuously adapt the curriculum to meet the evolving needs of the market.

Statistical science is by default an applied one. Its development came through practical problems and is essential for our students to witness the use of Statistics in the workplace. It is also vital for business

executives to observe how the use of statistics can assist them in more rational decision making. This way, the market is informed of the potential benefits from utilizing statistically trained scientists. It is characteristic that many students are hired by interested companies upon the completion of their training period.

More information on Practical Training and the relevant university regulations, is available on the AUEB Career Office website: https://www.aueb.gr/en/internship.

Briefly, the following are mentioned:

Terms and Conditions

The Practical Training Program is addressed to students that have completed the **6th semester (3rd year)**, have compiled at least 80 ECTS, have successfully been tested at, at least, 8 compulsory courses until the exams period prior to their application date, and have participated in a relevant informative meeting/ seminar organized by the Practical Training Office [The minimum academic requirements serve as a one-off exclusion criterion in the selection process].
In cases where the number of available internship positions is lower than the number of student applications, the following evaluation criteria are additionally applied. These criteria, which are uniformly applied across all Departments, aim to ensure sound financial management of co-financed operations, as well as to promote transparency, equal treatment, and non-discrimination among applicants.

Evaluation Criteria: Once the minimum academic requirements have been verified and non-eligible submissions have been excluded, the evaluation process begins based on the following criteria, each of which is scored on a scale from 0 to 100 points:

a) Average Grade of the successfully completed courses, up until the exams period prior to their application. The average grade is multiplied by 20 and this criterion carries a weight of 80%.
b) Total credits (ECTS) accumulated by the student from courses in which the student has been successfully evaluated, in relation to the minimum credits required to obtain a degree. This criterion carries a weight of 10%.
c) The student's year of study. For the 3rd or 4th year the student receives 100 points. For each year after the 4th the student loses 10 points. This criterion carries a weight of 10%.

If two or more students received the same number of points, the one with the highest average score in the exams period prior to the application will be selected.

In case an application is cancelled, the corresponding NSRF funding is attributed to the first runner up based on the announced ranking. In case of a delayed cancellation of a student's application, and if the first runner-up has already been placed through the self-financed project, the next runner-up will be selected. If there is no runner-up, the funding amount is carried over to the next semester.

Especially for students belonging to the disabled category (according to relevant certification by the disability certification center), paragraph 12 of the Internal Regulation for Practical Training applies.

Students Applications – Objections

a) The call for student applications for the internship program is published on specific dates for each period, in coordination with the Institutional Director, on the Internship and Career Office website.
b) The students' applications can only be submitted online through the AUEB Internship Information System, in specified dates, announced on the Internship's Office website, as well as at the individual Department's websites. The minimum duration for submitting applications is 10 calendar days.

c) The applications are evaluated by the Department's Internship Committee (based on the decision taken by the Department's Assembly) and the temporary and finite results are announced at the Internship Office website and the Department's website.
d) After the provisional results are announced, interested students can submit a written objection to the Department's Secretariat within five (5) working days since the announcement of the results. Objections are reviewed by the Objection Committee set by the Department.
e) After the evaluation of applications and any submitted objections, and following the validation of the official results, the responsible Committee publishes the results table—including candidate rankings—on the Internship Office website. The accepted online applications are then entered into the AUEB Internship Information System by the Internship Office.
f) The Department of Statistics Assembly validates the final table of results.
g) Students are being informed on whether their application has been accepted or declined, via email.

Choice of Host

a) Through the Practical Training Informative System, which is connected to the "Atlas" Central Support System of the Student Practical training of the Ministry of Education, Religious Affairs and Sports, students selected to participate in the Program can electronically express their interest in the available positions.
b) Upon completion of the relevant interviews, students select the institution where they will conduct their internship. They must then inform the responsible employee at the Practical Training Office to arrange the formal procedures and the necessary documents to commence the training.
c) Every position offered to undergraduate students is published and recorded in the ATLAS informative system, as required by the current legislation.
d) Students are not allowed to conduct Practical Training at an institution where a relative (3rd degree and beyond, in direct line, collateral line, or by marriage, including a spouse, with the legal representative of the organization) is employed. Additionally, in cases of kinship up to the third degree or a marital relationship with an individual employed by the host institution, that individual may not be designated as the student's supervisor.

Practical Training Duration

The duration of the Practical Training is set at three (3) months of full-time employment or six (6) months of part-time employment (full time employment corresponds to 40 hours per week and part time employment corresponds to 20 hours per week). If the host institution's full-time schedule differs from the 8-hour schedule, this can be arranged. Practical Training can take place during the two academic semesters (winter and spring), as well as during the summer period.

The duration of the Internship must be declared in the ERGANI System by the Host Institution, based on the signed Private Internship Agreement. The Host is obliged to send the submitted form E3.5 to the Practical Training Office, both at the start and at the end of the Internship.

Internal Regulation for the Implementation of the Internship Program – Department of Statistics: https://www.aueb.gr/el/internship/content/proypotheseis-kai-oroi-symmetohis

Communication - Information

Eleftheria Nifli, Maria Kanella and Antonis Roussos

Central Practical Training Office

Athens University of Economics and Business

13 Elpidos str, 104 34 (3rd floor), tel: 210 8203825

E-mail: apan@aueb.gr

The Department of Statistics Practical Training Office accepts students Monday to Friday, 11:00 – 15:00

D. COURSE DESCRIPTION

1º YEAR

A' Semester

Probabilities I (code: 6001)

Course Type: Compulsory

Course level: First cycle

Instructor: E. Kyriakidis, Professor, Department of Statistics

E.C.T.S.: 7,5

Desired Learning Outcomes: Upon successful completion of the course, students will be able to: Understand how probabilities correspond to events, solve problems using probabilities laws, apply Bayes' rule to review and update probabilities, and select the appropriate probabilistic model for a given problem.

Prerequisites: none

Syllabus: Discrete probability spaces, elementary combinatorial analysis. Probability properties. Conditional Probabilities, Law of Total Probability. Bayes' theorem. Discrete random variables, Joint distribution of random variables. Independence. Mean value, Variance, Covariance, correlation coefficient. Cauchy-Schwarz inequality, Markov and Chebyshev inequalities. Uniform, binomial, geometric hypergeometric distribution, and Poisson distribution. Conditional mean value. The Weak Law of Large Numbers. Probability generating function. Multinomial and Multivariate hypergeometric distribution.

Continuous distributions. Distribution function and probability density function. Mean, variance. Uniform, exponential and normal distribution. Gamma and Beta distributions. Moment generating functions. Joint continuous variable distribution. Independence. Random variables simulation using the inverse transformation method.

Recommended Reading

- Κούτρας Μ. (2016). Εισαγωγή στη Θεωρία Πιθανοτήτων και Εφαρμογές, Εκδόσεις ΤΣΟΤΡΑΣ ΑΝ ΑΘΑΝΑΣΙΟΣ.
- Feller, W. (1968). An Introduction to Probability Theory and its Applications. Wiley, N.Y.
- Hoel P., Port S., Stone C. (2009). Εισαγωγή στη Θεωρία Πιθανοτήτων, ΙΤΕ Παν/κές Εκδόσεις Κρήτης, 2009.
- Hogg, R. and Graig, A. (1970). Introduction to Mathematical Statistics, Third Ed., The Macmillan Co., New York.
- Hogg,R.V. and Tanis,E.A. (2000). Probability and Statistical Inference. Prentice Hall.
- Mendenhall, W., Beavec R.J. & Beaver, B.M. (1999). Introduction to Probability & Statistics (10th edition), Duxbury Press.
- Mood, A., Graybill, F. and Boes, D. (1974). Introduction of the Theory of Statistics. McGraw-Hill.
- Ross, S. (1976). A First Course in Probability. Collier, Macmillan, New York.
- Ross, S. (1983). Introduction to Probability Models. 2nd Ed. Academic Press, New York.
- Roussas, G.G. (2003). An introduction to Probability and Statistical Inference. Academic Press.

- Ε.Ξεκαλάκη, Ι.Πανάρετος (1998). Πιθανότητες και Στοιχεία Στοχαστικών Ανελίξεων.

Teaching Method: Face to Face

Teaching includes: Class lectures. Tutorial. Assignments. Self-Study.

Student Assessment Method: Final written exam at the end of the semester.

Teaching Language: Greek

Calculus I (code: 6041)

Course Type: Compulsory

Course level: First cycle

Instructor: Al. Zymbidis, Assistant Professor, Department of Statistics

E.C.T.S.: 7,5

Desired Learning Outcomes: Upon successful completion of the course, students will have a solid understanding of the elementary concepts and techniques of Infinite Calculus and will be able to apply them to Probability and Statistics problems.

Prerequisites: none

Syllabus: Axiomatic foundation of the system of real numbers. Axioms of domain and order, axiom of the least upper bound and the Archimedean property. Monotonic and bounded functions, continuity of a function, Bolzano's theorem, Mean-value theorem, extreme value theorem and uniform continuity. Elements of set theory. Definition of the derivative of a function, calculus of derivatives, higher-order derivatives, and theorems of Rolle, Mean-Value, and L'Hospital's Rule. Riemann' s integral, properties of the integral (additivity, triangular inequality, linearity), continuity and differentiability of the integral function, integrability of continuous functions, Mean-value theorem for integrals, indefinite integral of a function, Fundamental theorem of Infinitesimal Calculus. Techniques of integration (change of variable, integration by parts, etc.), logarithm and the exponential function, generalized integrals, examples and applications. Subsets of R, points of accumulation, sequences of real numbers, monotonic sequences, subsequences and the Cauchy criterion for convergence, Bolzano-Weierstrass theorem, theorems of sequence convergence. Series of real numbers, series with positive terms, convergence criteria and absolute convergence of series. Taylor’s theorem and Taylor series.

Recommended Reading

- Αθανασιάδης Χ.Ε, Γιαννακούλιας Ε., Γιωτόπουλος Σ.Χ. (2009). Γενικά Μαθηματικά, Απειροστικός Λογισμός, Τόμος 1, Εκδόσεις Συμμετρία.
- Spivak, M. (2010). Διαφορικός και Ολοκληρωτικός Λογισμός, 2η έκδοση, ΙΤΕ Πανεπιστημιακές Εκδόσεις Κρήτης.
- Finney R.L., Weir M.D., and Giordano F.R. (2004). Απειροστικός Λογισμός, τόμος Ι, Πανεπιστημιακές Εκδόσεις Κρήτης.
- Apostol, T. M. (1967). Calculus, Vol.1, 2nd edition, Wiley.

Teaching Method: Face to Face.

Student Assessment Method: Final written exam at the end of the semester.

Teaching Language: Greek.

Linear Algebra I (code: 6051)

Course Type: Compulsory

Course level: First cycle

Instructor: E. Ioannidis, Associate Professor, Department of Statistics

E.C.T.S.: 7,5

Desired Learning Outcomes: In depth understanding of the concepts introduced in the course, so that students may answer questions demonstrating this understanding, obtaining a geometric insight of concepts such as projection, and finally, applying this knowledge to solving exercises such as: obtaining the LDU factorization of a matrix, inverting a matrix and calculating a projection matrix.

Prerequisites: none

Syllabus: Elements and calculus in R^n, lines and planes in R^n. Matrices and matrix multiplication, Elementary matrices. Linear systems: The Gauss algorithm and the factorization PA=LDU. Inverse and transposed matrices. Symmetric matrices and the Cholesky factorization. Vector spaces and subspaces. Linear systems: the solution of m equations with n unknowns and the rank of a matrix. Linear independence, bases and dimension. The four fundamental subspaces of a matrix. The fundamental theorem of Linear Algebra. Linear transformations of R^n and matrices. Orthogonal subspaces, and orthogonal complement of a subspace. Projections and least squares approximations.

Recommended Reading

- Gilbert Strang (1999). Γραμμική Άλγεβρα και Εφαρμογές, Πανεπιστημιακές Εκδόσεις Κρήτης.
- Lipschutz, S., LipsonMarcLars (2013). Γραμμική Άλγεβρα, $5_η$ Έκδοση, Εκδόσεις Τζιόλα.
- Ε. Ξεκαλάκη & Ι. Πανάρετος (1993). Γραμμική Άλγεβρα για Στατιστικές Εφαρμογές, Αθήνα.
- Η. Φλυτζάνης (1999). Γραμμική Άλγεβρα & Εφαρμογές, Τεύχος Α: Γραμμική Άλγεβρα, Το Οικονομικό.
- Γ.Δονάτος-Μ.Αδάμ (2008). Γραμμική Άλγεβρα Θεωρία και Εφαρμογές, Gutenberg.
- Graybill, F. A. (1969). Introduction to Matrices with Applications in Statistics, Wadsworth, Belmont, CA.
- Harville, D. A. (1997). Matrix Algebra from a Statistician's perspective, Springer.
- Healy, M.J.R. (1995). Matrices for Statistics, Oxford University Press.
- Searle, S. R. (1982). Matrix Algebra Useful for Statistics, Wiley.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Tutorial. Assignments. Self-Study.

Student Assessment Method: Final written exam at the end of the semester. Home Assignment.

Teaching Language: Greek.

Introduction to Programming using R (code: 6122)

Course Type: Compulsory

Course level: First cycle

Instructor: P. Besbeas, Associate Professor, I. Vrontos, Associate Professor, Department of Statistics

E.C.T.S.: 7,5

Desired Learning Outcomes: Upon successful completion of the course students will be able to manage and import data in R, perform basic R operations, create and analyze simple functions in R.

Prerequisites: none

Syllabus: Introduction to computers. Basic principles of programming. Introduction to R: basic elements of R; command and window environment. Arithmetic operations. Graphs. Objects and object types. Composite commands: for, while, repeat. Creating programs. Results Lists. Special commands. Graphs in R, creating multiple graphs. Functions. Functions with multiple outputs.

Recommended Reading

- Ντζούφρας Ι., Καρλής Δ. (2016). Εισαγωγή στον Προγραμματισμό και στη Στατιστική Ανάλυση με R, Εκδόσεις Ελληνικά Ακαδημαϊκά Συγγράμματα και Βοηθήματα-Αποθετήριο "Κάλλιπος".
- Δ. Φουσκάκης (2013). Ανάλυση Δεδομένων με Χρήση της R . Εκδόσεις Τσότρας. Αθήνα.
- Crawley, M. (2014). Εισαγωγή στη στατιστική ανάλυση με την R (ελληνική μετάφραση). Εκδόσεις BrokenHill.
- Field, A., Miles, J and Field, Z. (2012). Discovering Statistics Using R. Sage publications Ltd.

Teaching Method: Face to Face

Teaching includes: Class lectures. Lab Exercise. Tutorials.

Written exam at the end of the semester (80%). Written assignments (20%). Lab exercises (extra small bonus contribution to the final grade).

Student Assessment Method: Written exam at the end of the semester (80%). Written Assignment (20%). Lab exercises (extra small bonus contribution to the final grade).

Teaching Language: Greek.

Statistics I: Probabilities and Estimation (code: 9079)

Course Type: Elective

Course level: First cycle

Instructor: Ch. Thomadakis, Assigned Lecturer

E.C.T.S.: 6

Desired Learning Outcomes: Through the course, students will understand the basic principles, theorems and applications of statistics and probability, enabling them to clearly describe concepts such as sample space, random experiments, and random variables. They will be able to distinguish between the various discrete and continuous distributions and solve related problems. ―Students will also learn how to examine whether an estimator is unbiased, consistent, and sufficient. Additionally, they will be able to successfully use various methods of parameter estimation (maximum likelihood method, moments method etc.) and correctly construct confidence intervals for various parameters of interest.

Prerequisites: A solid understanding of Calculus is recommended.

Syllabus: Random Experiment. Sample Space. Kolmogorov axiom, Probabilities Properties. Law of total Probability. Bayes formula. Discrete and continuous random variables. Mean and variance of random variables. Binomial Distribution. Geometrical Distribution. Poisson Distribution. Hypergeometric Distribution. Uniform Distribution. Exponential Distribution. Normal Distribution. Central Limit Theorem. Law of the large numbers. Estimating an unknown parameter. Unbiased estimator. Consistent estimator. Adequate Estimator. Rao-Blackwell Theorem. Cramer-Rao lower bound. Maximum Likelihood Method. Moments Method. Confidence intervals for a normal population with known and unknown variance. Confidence intervals for the difference of normal populations means. Confidence intervals for ratios. Confidence intervals for a normal population's variance.

Recommended Reading

- Mark L. Berenson, David M. Levine, Kathryn A. Szabat & David F. Stephan (2019). Basic Business Statistics, 14th edition. Pearson, NY.
- An Introduction to Probability and Statistics. (2015). Rohatgi, K. Vijay & Ehsanes Saleh, A. K. MD. Wiley.
- Probability and Statistics, 3rd edition. DeGroot, Morris H., & Mark J. Schervish. Boston, MA: Addison-Wesley, 2002. ISBN: 0201524880.
- Mendenhall W., Beaver R. & Beaver B. (2013). Introduction to probability and statistics. Brooks/Cole: Boston.
- https://www.openintro.org/book/os/
- https://openstax.org/details/books/introductory-business-statistics

Teaching Method: Face to Face

Teaching includes: Class lectures. Lab Exercise. Written assignments. Self-Study.

Student Assessment Method: Written exam at the end of the semester. Written assignments.

Teaching Language: English

B' Semester

Probabilities II (code: 6142)

Course Type: Compulsory

Course level: First cycle

Instructors: P. Dellaportas, Professor – St. Vakeroudis, Assistant Professor, Department of Statistics

E.C.T.S.: 7,5

Desired Learning Outcomes: Upon successful completion of the course, students will have developed a more comprehensive and in-depth understanding of the concepts introduced in the introductory probability course. They will also possess the foundational knowledge required for more advanced topics involving multivariate distributions and joint analysis, such as multivariate analysis, multivariate techniques, and statistical modeling.

Prerequisites: A solid understanding of Introduction to Probability is recommended.

Syllabus: Joint random variables distribution, Conditional probability density, conditional mean value. Random variable functions, density transformations, distribution of sums of independent random variables, density convolution. Ordered samples. X^2, t, and F distributions. Multivariate distributions. Multivariate Normal Distribution. Convergence in distribution. Central Limit Theorem.

Recommended Reading

- Ross, S. (2011). Βασικές Αρχές θεωρίας πιθανοτήτων, Εκδόσεις Κλειδαριθμός ΕΠΕ.
- Κούτρας Μ. (2016). Εισαγωγή στη θεωρία Πιθανοτήτων και Εφαρμογές, Εκδόσεις Τσότρας.
- Παπαϊωάννου Τ. (1997). Θεωρία Πιθανοτήτων και Στατιστικής, Εκδόσεις Σταμούλης Α.Ε.
- Feller, W. (1968). An Introduction to Probability Theory and its Applications. Wiley, N.Y.
- Hoel P., Port S., Stone C. (2009). Εισαγωγή στη Θεωρία Πιθανοτήτων, ΙΤΕ Παν/κές Εκδόσεις Κρήτης.
- Hogg, R. and Graig, A. (1970). Introduction to Mathematical Statistics, Third Ed., The Macmillan Co., New York.
- Hogg,R.V. and Tanis,E.A. (2000). Probability and Statistical Inference. Prentice Hall.

- Mendenhall, W., Beavec R.J. & Beaver, B.M. (1999). Introduction to Probability & Statistics (10th edition), Duxbury Press.
- Mood, A., Graybill, F. and Boes, D. (1974). Introduction of the Theory of Statistics. McGraw-Hill.
- Ross, S. (1976). A First Course in Probability. Collier, Macmillan, New York.
- Ross, S. (1983). Introduction to Probability Models. 2nd Ed. Academic Press, New York.
- Gut, Alan. (2009). A Second Course in Probability, 2nd ed. Springer Verlag.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Tutorial. Assignments. Self-Study.

Student Assessment Method: Written exam at the end of the semester.

Teaching Language: Greek.

Calculus II (code: 6042)

Course Type: Compulsory

Course level: First cycle

Instructor: A. Yannacopoulos, Professor, Department of Statistics

E.C.T.S.: 7,5

Desired Learning Outcomes: Upon successful completion of the course, students will be able to understand and apply basic concepts related to (a) series of functions and (b) functions of more than one variable (partial derivatives, optimization with or without constraints, including techniques such as Lagrange multipliers or the Kuhn-Tucker conditions, multiple integrals, etc.). The course emphasizes the future application of these concepts in statistics, probability, computer science, and various fields related to economics and management sciences.

Prerequisites: none

Syllabus: Series of functions (power series, Taylor series, Fourier series) and applications. Pointwise and uniform convergence and applications. Geometry of R^n. Functions of more than one variable. Limits and continuity. Derivatives of functions on R^n. Integration of functions on R^n. Transformations and Jacobian determinant. Optimization, Lagrange multipliers and applications.

Recommended Reading

- Marsden and Tromba (2007). Διανυσματικός Λογισμός (ελληνική μετάφραση). Παν. Εκδ. Κρήτης.
- Thomas and Finney, Weir and Giordano (2001). Απειροστικός Λογισμός, Παν. Εκδ. Κρήτης.
- Αθανασιάδης Χ.Ε, Γιαννακούλιας Ε., Γιωτόπουλος Α. (2010). Γενικά Μαθηματικά, Απειροστικός Λογισμός, Τόμος 1, Εκδόσεις Συμμετρία.
- Κατερίνης, Φλυτζάνης, (2010). Ανώτερα Μαθηματικά, Εκδόσεις Μπένου

Teaching Method: Face to Face.

Teaching includes: Class lectures. Tutorial. Assignments. Self-Study.

Student Assessment Method: Written exam at the end of the semester. Midterms. Home assignment.

Teaching Language: Greek.

Linear Algebra II (code: 6082)

Course Type: Compulsory

Course level: First cycle

Instructor: Assigned Lecturer

E.C.T.S.: 7,5

Desired Learning Outcomes: In-depth understanding of the concepts of the course so that students are able to answer questions related to the course's learning outcomes. They will gain a geometric overview of concepts such as projection, determinants, eigenvalues and eigenvectors. Additionally, students will be able to apply this knowledge to solve practical exercises, including calculating a projection matrix, solving interpolation problems with least squares, matrix diagonalization, and calculating contour lines of a quadratic form.

Prerequisites: none

Syllabus: Least Squares approach, Rectangular matrices, the Gramm-Schmidt rectangularization and A = QR factorization. Determinants. Eigenvalues and characteristic polynomial, eigenvectors and eigen spaces. Matrix diagonization. Matrix powers and spectral theorem for symmetric matrices. Basis coordinates and similar matrices. Quadratic forms in symmetrical matrices: positive, Raleygh quotient, ellipsoids in n – dimensions. Examples from the multivariate normal distribution. Singular values decomposition. Complex matrices, Hermitian matrices, and unitary matrices.

Recommended Reading

- Gilbert Strang (1999). Γραμμική Άλγεβρα και Εφαρμογές, Πανεπιστημιακές Εκδόσεις Κρήτης.
- Ε. Ξεκαλάκη & Ι. Πανάρετος (1993). Γραμμική Άλγεβρα για Στατιστικές Εφαρμογές, Αθήνα.
- Η. Φλυτζάνης (1999). Γραμμική Άλγεβρα & Εφαρμογές, Τεύχος Α: Γραμμική Άλγεβρα, Το Οικονομικό.
- Γ. Δονάτος-Μ. Αδάμ (2008). Γραμμική Άλγεβρα Θεωρία και Εφαρμογές, Gutenberg.
- Graybill, F. A. (1969). Introduction to Matrices with Applications in Statistics, Wadsworth, Belmont, CA.
- Harville, D. A. (1997). Matrix Algebra from a Statistician's perspective, Springer.
- Healy, M.J.R. (1995). Matrices for Statistics, Oxford University Press.
- Searle, S. R. (1982). Matrix Algebra Useful for Statistics, Wiley.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Tutorial. Self-Study.

Student Assessment Method: Written exam at the end of the semester.

Teaching Language: Greek.

Introduction to Probability and Statistics using R (code: 6031)

Course Type: Compulsory

Course level: First cycle

Instructors: Professor D. Karlis, Department of Statistics and Assigned Lecturer

E.C.T.S.: 7,5

Desired Learning Outcomes: Upon successful completion of the course students will be able to: understand and apply basic concepts of Statistics and Probability, familiarize themselves with the key characteristics of Statistics and Probability through simulation, acquire sufficient proficiency in R to implement basic programs for solving fundamental statistical methodologies, create and interpret basic descriptive graphs, manage data effectively and extract useful information from large datasets, and understand the basic characteristics of real-world data.

Prerequisites: none

Syllabus: This course aims to introduce students to the basic principles of statistics and probability using R. Topics covered include: Data collection. Reading and organizing data. Data management. The basic idea of simulation. Probability games using computer and R. Law of large numbers and other key

probability results. Introduction and comparison of distributions. Basic principles of descriptive statistics. Describing data using the appropriate graphs and measures. Tabulating and presenting data. Introduction to linear regression. Statistical terminology and the media, probabilities, inference. Case studies. Examples from everyday life.

Recommended Reading

- Αγγελής Β., Δημάκη Α. (2010). Στατιστική Τόμος Α, Εκδόσεις σοφία.
- Δαμιανού Χ., Κούτρας Μ. (2003). Εισαγωγή στη Στατιστική Μέρος Ι, Εκδόσεις Συμμετρία.
- VerzaniJ. (2016). Εισαγωγή στη Στατιστική με την R, Εκδόσεις Κλειδάριθμος ΕΠΕ.
- Gelman, A. Nolan, D. (2002). Teaching Statistics: A bag of tricks. Oxford University Press.
- Dalgaard, P. (2008). Introductory Statistics with R. Springer.
- Kerns, J. (2011). Introduction to Probability and Statistics Using R. Available at http://cran.r-project.org/web/packages/IPSUR/vignettes/IPSUR.pdf
- Horgan, J. (2008). Probability with R: An Introduction with Computer Science Applications. Wiley.
- Crawley, M.J. (2014). Statistics: An Introduction Using R, 2nd Edition, Wiley.
- Δ. Φουσκάκης (2013). Ανάλυση Δεδομένων με Χρήση της R . Εκδόσεις Τσότρας. Αθήνα.
- Crawley, M. J. (2014). Εισαγωγή στη στατιστική ανάλυση με την R (ελληνική μετάφραση). Εκδόσεις Broken Hill.
- Πετράκος, Γ. (2016). Εφαρμογές της Θεωρίας Πιθανοτήτων με τη χρήση της R. Εκδόσεις Τσότρας.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Bibliography study and analysis. Tutorials. Assignments. Self-Study.

Student Assessment Method: Written exam at the end of the semester. Home Assignment. Written Project.

Teaching Language: Greek.

Statistics II: Inference and Regression (code: 9068)

Course level: First cycle

Instructors: Assigned Lecturer

E.C.T.S.: 6

Desired Learning Outcomes: Through teaching of the course students will become familiar with the basic principles of statistical inference, the theory and practice surrounding the concept of statistical correlation, and the theory and practical application of linear models.

Prerequisites: A solid understanding of Probability theory and Point/Interval Estimation is recommended.

Syllabus: Hypothesis Testing, statistical hypotheses, control function, hypothesis testing for population parameters such as mean values, ratios, variances, comparing parameters in two populations, statistical significance level, p-value, power of a test, determining the sample size. Pearson & Spearman statistical correlation. Introduction to regression, simple linear model, statistical linear model, normal linear model, inference in the normal linear model (confidence/prediction intervals and hypothesis testing), transformations, residuals and deviation diagnostics for the linear model hypotheses. Multiple linear models, choosing the optimal model, choosing a model with information criteria (AIC, BIC, Mallows Cp). One factor Analysis of Variance (ANOVA). Applications in R.

Recommended Reading

- Draper, Norman R. & Smith, Harry. (1998). Applied Regression Analysis, 3rd edition. NY: Wiley.
- Fox, John & Weisberg, Sanford (2019). An R Companion to Applied Regression. LA: SAGE.
- Hastie, Trevor; Tibshirani, Robert; Friedman, Jerome. (2017). The Elements of Statistical Learning: Data Mining, Inference, and Prediction. NY: Springer.
- Lehmann, E.L & Romano, P. Joseph. (2008). Testing Statistical Hypotheses. NY: Springer-Verlag.

- Montgomery, C. Douglas; Peck, Elisabeth; Vining, G. Geoffrey. (2012). Introduction to Linear Regression Analysis, 5th Edition. NY: Wiley.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Lab Exercise. Interactive teaching. Written assignments.

Student Assessment Method: Written exam at the end of the semester. Written assignments.

Teaching Language: English.

2^{O} YEAR

C' Semester

Estimation and Hypothesis Testing (code: 6012)

Course Type: Compulsory

Course level: First cycle

Instructor: Professor St. Psarakis, Department of Statistics

E.C.T.S.: 8

Desired Learning Outcomes: Upon successful completion of the course, students will be able to estimate unknown parameters using the appropriate methodology, construct confidence intervals that contain the unknown parameters with the desired probability and perform statistical tests related to specific problems.

Prerequisites: none

Syllabus: Point estimation, properties of point estimators (consistency, unbiasedness, efficiency, sufficiency), point estimation methods (moment method, least squares, maximum likelihood). Sampling. Confidence intervals for means, rates, variances and their differences for normal and non-normal populations.

Hypothesis testing, statistical hypotheses, hypothesis testing for parameters such as mean values, variations, comparing parameters in two different samples, statistical significance level, p-value, power of a test, sample size calculation.

Recommended Reading

- Αγγελής Β., Δημάκη Α. (2012). Στατιστική Τόμος Α, Εκδόσεις σοφία.
- Δαμιανού Χ., Κούτρας Μ. (2003). Εισαγωγή στη Στατιστική ΜΕΡΟΣ Ι, Εκδόσεις Συμμετρία.
- Πανάρετου Ι, Ξεκαλάκη Ε. Εισαγωγή στη Στατιστική Σκέψη Τόμος ΙΙ.
- Newbold, P., Carlson, W. and Thorne, B. Statistics for Business and Economics.
- Berry, D. and Lindgren, B. Statistics Theory and Methods.
- Freund, J. Mathematical Statistics with applications.
- Walpole, R., Myers, R. and Myers, S. Probability and Statistics.
- Wonnacott, T. H. and Wonnacott, R. J. Introductory Statistics. 4th edition, J. Wiley & Sons.
- Alder, H. L. and Roessler, E. B. Introduction to Probability and Statistics. 6th edition, W. H. Freeman & Company.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Bibliography study and analysis. Tutorials. Self-Study.

Student Assessment Method: Written exam at the end of the semester.

Teaching Language: Greek.

Stochastic Processes I (code: 6126)

Course Type: Compulsory

Course level: First cycle

Instructor: Associate Professor H. Pavlopoulos, Department of Statistics

E.C.T.S.: 8

Desired Learning Outcomes: Upon successful completion of the course, students will be able to: classify stochastic processes according to the state space and the parameterization set, determine whether a stochastic process is stationary or non-stationary, understand the basic properties of a simple random walk process on the integers, and be familiarized with Poisson and Wiener processes in continuous time, Markov chains in discrete time, and renewal and branching processes.

Prerequisites: Probability I, Probability II, Linear Algebra I, Calculus I.

Syllabus: Discrete probability spaces, probability generating functions, binomial models and Poisson limit theorems. Simple random walk, gambler's ruin, game length, ballot theorems, arc-sine law. Markov chains, matrix of transition probabilities, classification of states. Asymptotic behavior, stationary distribution, stability equations. Time reversibility, Kolmogorov's criterion, random walks on graphs. Speed of convergence to stationary distribution, potential matrices. Perfect simulation and the Propp-Wilson algorithm. Branching processes and probability of extinction. Poisson process, Markov chains in continuous time, Kolomogorov's differential equations, birth - death - migration process.

Recommended Reading

- Χρυσαφίνου Ουρανία (2008). Εισαγωγή στις Στοχαστικές Ανελίξεις. Εκδόσεις Σοφία.
- Καλπαζίδου Σ. (1991). Στοιχεία θεωρίας στοχαστικών ανελίξεων, Εκδόσεις Ζήτη.
- Cox, D.R. and Miller, H.D. (1965). Theory of Stochastic Process, Methuen, London.
- Ross, S. M. (2002). Introduction to Probability Models, 8th edition, Academic Press.
- Karlin S. and H. Taylor (1975). A First Course in Stochastic Processes, Academic Press.
- Grimmett, G.R. and D.R. Stirzaker (2001). Probability and Random Processes. Oxford University Press.
- Norris, J.R. (1998). Markov Chains, Cambridge University Press.

Teaching Method: Face to Face.

Teaching includes Class lectures. Tutorials. Self-Study.

Student Assessment Method: Written exam at the end of the semester. Problem Solving.

Teaching Language: Greek.

Introduction to Mathematical Analysis (code: 6133)

Course Type: Elective

Course level: First cycle

Instructor: Professor A. Yannacopoulos, Department of Statistics

E.C.T.S.: 7

Desired Learning Outcomes: Upon successful completion of the course, students will be familiarized with the basic concepts of mathematical analysis and their concrete applications, focusing on their future applications in Statistics, Probability, Computer Science, and various other fields of study, related to economics.

Prerequisites: none

Syllabus: Introduction to Real Analysis. Fundamental concepts from set theory. The set of real numbers. Sequences and series of real numbers.

Real functions, continuous, uniformly continuous, monotone and convex functions. Stieltjes integral and functions of bounded variation. Metric spaces and continuous functions in metric spaces. Uniform convergence of sequences and series of functions. Linear spaces with norm and inner product spaces (Banach and Hilbert spaces). Short introduction to Lebesgue measure and integration. Applications of these concepts in probability, statistics and scientific computation.

Recommended Reading

- K. Saxe. (2002). Beginning Functional Analysis, Springer Series on Undergraduate Mathematics.
- A.N. Yannacopoulos. (2016). Introduction to Mathematical Analysis, Lecture Notes.
- Johnsonbaugh, R. and W. Pfaffenberger (1981). Foundations of mathematical analysis. M. Dekker (New York, NY).
- Labarre, A. E. (2008). Intermediate mathematical analysis. Dover Publications
- Bobrowski, A. (2005). Functional analysis for probability and stochastic processes: an introduction. Cambridge University Press.
- Rudin, W. (1964). Principles of mathematical analysis, Volume 3. McGraw-Hill New York.
- Severini, T. A. (2005). Elements of distribution theory, Volume 17. Cambridge University Press.
- Jacod, J. and P. E. Protter (2003). Probability essentials. Springer.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Tutorials. Assignments. Self-Study.

Student Assessment Method: Written exam at the end of the semester. Home assignment.

Teaching Language: Greek.

Bayesian Statistics (code: 6106)

Course Type: Elective

Course level: First cycle

Instructor: Assistant Professor N. Demiris, Department of Statistics

E.C.T.S.: 7

Desired Learning Outcomes: Upon successful completion of the course, students will be able to handle issues regarding: objective and subjective probability, features in the Bayes approach, the likelihood principle, a-priori distribution and how to choose one (conjugate, non-informative, improper, Jeffreys, a-priori mixtures), Sufficiency and sequential updating, Multivariate Bayesian statistics, Statistical inference: (decision theory, Bayes risk, Bayes rule, MINIMAX rule, point estimate, interval estimation, hypothesis testing), predictive distribution.

Prerequisites: none

Syllabus: The aim of this course is to introduce students to the Bayesian approach to statistics and to compare it with the classic (frequentist) approach to statistics. The course covers the following topics: objective and subjective probability, features of the Bayesian approach, the likelihood principle. A-priori distribution and how to choose one (conjugate, non-informative, improper, Jeffreys, a-priori mixtures). Sufficiency and sequential updating. Multivariate Bayesian statistics. Statistical inference: decision theory, Bayes risk, Bayes rule and MINIMAX. Point estimation, interval estimation, hypothesis testing. Predictive Distribution. Asymptotic theory.

Recommended Reading

- Δελλαπόρτας Π & Τσιαμυρτζής Π. (2012). "Στατιστική κατά Bayes". Πανεπιστημιακές Σημειώσεις.
- Bernardo J. M. & Smith A. F. M., (1994). Bayesian Theory, Wiley, London.

- Carlin B.P. & Louis T.A. (2000). Bayes and Empirical Bayes Methods for Data Analysis, Chapman and Hall/CRC.
- O' Hagan A. and Forster J. (2004). Kendall's advanced Theory of Statistics, Volume 2b: Bayesian Inference, Edward Arnold, London.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Studying and analyzing bibliography. Tutorials. Assignments.

Student Assessment Method: Written exam at the end of the semester. Home assignment. Optional quizzes.

Teaching Language: Greek.

Introduction to Economics (code: 6112)

Course Type: Elective

Course level: First cycle

Instructor: St. Yannoulakis, Assigned Lecturer

E.C.T.S.: 7

Desired Learning Outcomes: After successfully completing the course, students will be able to understand the basic concepts of economic science, with a focus on both micro and macro analysis, as well as the tools of economic policy.

Prerequisites: none

Syllabus: Introduction: Basic Principles of Economics, Microeconomics and Macroeconomics, Economic Agents and the Economic Cycle, Economic Model.
Microeconomic Theory: Demand and Supply Model, Consumer Theory, Production Theory, Market Structures, The Role of the State.
Macroeconomic Theory: Key Macroeconomic Indicators (GDP, inflation, interest rates, unemployment), Ethnological Identity, Open Economy and Exchange Rates, The Aggregate Demand and Supply Model, The Role of Monetary Authorities and the European Central Bank, Fiscal Policy and Public Debt.

Recommended Reading

Basic Textbooks:
- N.G. Mankiw και M.Taylor. (2024). "Οικονομική". Εκδόσεις Τζιόλα (6η έκδοση).
- C. McConell, S. Flynn, και S. Brue. (2016). "Εισαγωγή στην Οικονομική Επιστήμη", Εκδόσεις: Rosili.

Other Textbooks:
- D. Begg, G. Vernasca, S. Fischer και R. Dornbusch. (2015). "Εισαγωγή στην Οικονομική", Εκδόσεις Κριτική (3rd Edition).
- G. Mankiw και M. Taylor. (2011). "Αρχές Οικονομικής Θεωρίας", Εκδόσεις: Gutenberg.
- «Μακροοικονομική», O. Blanchard. (2003). "Μακροοικονομική", Εκδόσεις: Επίκεντρο (1st Edition).

Teaching Method: Face to Face

Teaching includes: Class lectures. Seminars. Field exercises. Studying and analyzing bibliography. Interactive teaching. Educational visits. Assignments. Devising a study. Self-Study. Scientists' lectures.

Student Assessment Method: Written exam at the end of the semester. Elaboration questions. Problem solving. Home assignment. Written exam (Project). Presentation. Practical exercises.

Teaching Language: Greek

Introduction to Accounting Information Systems (code: 6163)

Course Type: Elective

Course level: First cycle

Instructor: Halevas Konstantinos, Assistant Professor Department of Accounting and Finance

E.C.T.S.: 7

Desired Learning Outcomes: Recognizes and records Accounting events and prepares Electronic Accounting Statements.

Prerequisites: none

Syllabus: Introducing the basic theoretical framework of Financial Accounting and Reporting. Presentation and preparation of Financial Statements in accordance with International Financial Reporting Standards (Statement of Financial Position, Income Statement, Comprehensive Income Statement, Statement of Changes in Equity, disclosures). Presenting accounting cycle steps and basic accounting records (general ledger), analyzing economic events and their impact in the logistic equation, recording calendar entries, adjusting entries, closing entries, trial balance instruction. Introduction to amortization logistics. Introduction to the operation of an accounting information system, registering economic events and documents to the system, issuing a balance sheet using an accounting information system.

Recommended Reading

- Γκίκας, Δ. και Παπαδάκη Α. (2012). Χρηματοοικονομική Λογιστική, 4η έκδοση, Εκδόσεις Μπένου.
- Μπάλλας Α. και Χέβας Δ. (2010). Εφαρμοσμένες Χρηματοοικονομικής Λογιστικής, Εκδόσεις Μπένου.
- Jerry J. Weygandt, Donald E. Kieso, Paul D. Kimmel. (2013). Financial Accounting, 7th edition, Wiley publications
- An Accounting Information System (AIS).

Teaching Method: Face to Face.

Teaching includes: Class lectures. Lab exercise. Tutorial. Assignments.

Student Assessment Method: Written exam at the end of the semester. Home assignment.

Teaching Language: Greek.

ERASMUS BIP: Mixed Mobility for Studies (code.: 6110-45)

Course Type: Elective

Course level: First cycle

Instructors: Professor Assistant Professor P. Papastamouis, Department of Statistics and Assistant Professor St. Vakeroudis

E.C.T.S.: 3-6, depending on the length of stay to the Host University

Desired Learning Outcomes: Students will be able to:

- Understand basic concepts of Statistical Inference and its practical applications.
- Analyze data using statistical techniques.
- Develop and evaluate statistical models.
- Apply statistical techniques to solve real problems.
- Use statistical packages and software.

- Communicate their results in a clear and understandable way.

Syllabus: Statistical models, Inference and Statistical Learning, Estimating the cumulative distribution function, Bootstrap, Parametric Statistical Inference, Hypothesis testing and p-values, Linear and Logistic Regression, Choosing and evaluating the optimal model, Time Series analysis.

Prerequisites: Students have the right to participate in the program only once (1) during their studies, after applying for participation, following the invitation to express interest in the Blended Mobility for Studies Program.

Criteria of Choice and Placement at Host Universities

To select the students who will participate in the program and assign them to the Host Universities, the following criteria will also be taken into consideration:

1. The student's average score at the time of submitting the application.
2. The total number of earned credits in relation to the expected earned credits for the student's current semester.
3. Fulfillment of any conditions set by the Host University, such as language level, minimum number of earned credits, prerequisite courses, etc.

Recommended Reading

- Larry Wasserman (2003). All of Statistics - A Concise Course in Statistical Inference. Springer New York, NY.
- Trevor Hastie, Robert Tibshirani, Jerome Friedman (2009). - The Elements of Statistical Learning - Data Mining, Inference, and Prediction, Second Edition. Springer New York, NY.

Teaching Method: Online meetings, short visits in person in the Host University, as described in the signed Multilateral Inter-Institutional Agreement between the Universities involved.

Student Assessment Method: pass/fail after a a 10 – 15 min presentation and communication between Academic Officers of the Department and the Host University.

D΄ Semester

Linear Models (code: 6023)

Course Type: Compulsory

Course level: First cycle

Instructor: Assistant Professor P. Papastamoulis, Department of Statistics

E.C.T.S.: 8

Desired Learning Outcomes: After successfully completing this course, students will be able to handle topics concerning the correlation coefficient, simple and multiple linear regression, statistical inference in linear regression, hypothesis testing and diagnostic tests, transformations, general linear model, algorithmic methods for selecting the optimal (sub)model, multicollinearity and dummy variables.

Prerequisites: Estimation - Hypothesis Testing (code: 6012)

Syllabus: Introduction to regression, straight line fitting, model coefficient estimates. Properties of estimated coefficients, mean value, variance, confidence intervals, hypothesis testing, estimation of conditional variance. Predicted values, simple linear regression ANOVA, R^2, F-test (note: definition through SS_Regr and SS_error).

Introduction to multivariate normal distribution. Multiple regression definition, examples. Design matrix, introduction to pseudo variables, general form of linear model, LS estimates and properties (through matrices). Unbiased variance estimate. Maximum likelihood estimation. Multiple correlation coefficient,

model ANOVA, partial F-tests, recursive f-tests. Examples. Simple residuals, standardized and studentized residuals, normality test, Q-Q plots, simple hypothesis testing plots, added variable plots, other plots and hypothesis testing for the model. Simple transformations, influence statistics and diagnostic tests, multicollinearity. Model choice, forward, backward, stepwise methods, all possible regressions, model choice using AIC, BIC, Mallows Cp.

Recommended Reading

- Draper N.R. and Smith, H. (1997). Εφαρμοσμένη Ανάλυση Παλινδρόμησης, Παπαζήσης.
- Κούτρας, Μ. Και Ευαγγελάρας, Χ. (2010). Ανάλυση Παλινδρόμησης: Θεωρία και Εφαρμογές, Σταμούλης.
- Montgomery, D.C., Peck, E.A. and Vining, G.G. (2012). Introduction to Linear Regression Analysis, Wiley.
- Weisberg, S. (2014). Applied Linear Regression, Wiley.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Lab exercise. Tutorials. Self-Study.

Student Assessment Method: Written exam at the end of the semester.

Teaching Language: Greek.

Time Series Analysis (code: 6145)

Course Type: Compulsory

Course level: First cycle

Instructor: Associate Professor I.Vrontos, Department of Statistics

E.C.T.S.: 8

Desired Learning Outcomes: Upon successful completion of the course, students will be able to:

- Determine mathematical time series models
- Estimate numerical parameters of time series models
- Predict values of modeled time series
- Test model fit based on residuals od observed and predicted values

Prerequisites: none

Syllabus: Introduction with examples of time series data. Concepts of stationarity. Autocorrelation function of stationary time series. The additive model with deterministic components (trend, seasonality). Parametric and nonparametric methods of estimating and eliminating deterministic components. Box Cox transformations for eliminating heteroscedasticity. Classical tests for randomness and normality of the stochastic component. Linear filters of stationary time series. Stationary series representation as linear filters of uncorrelated noise and Wold's theorem. Autoregressive moving average model (ARMA), conditions for the existence of causality - reversibility of stationary linear solutions. Calculating the auto-covariance function of causal stationary solutions in the general ARMA (p,q) model. Bartlett's theorem and asymptotic statistical inference for autocorrelations. Predicting the minimum mean squared error. Algorithms for calculating optimal linear predictions functions (Durbin-Levinson, innovations) and its applications in predicting causal stationary ARMA models solutions. Partial autocorrelation function and its estimation.

Fitting causal stationary ARMA models:

a) preliminary estimators for autoregressive AR(p) models (Yule-Walker, least squares), moving average MA(q) models (innovations algorithm), mixed ARMA(p,q) models, (generalized Yule-Walker method), innovations algorithm).

b) maximum likelihood estimation and asymptotic inference. Diagnostic tests and criteria for choosing ARMA models rank (AIC, BIC).

Introduction to ARIMA and SARIMA models for non-stationary time series with a unit root, Dickey - Fuller test.

Recommended Reading

- Μπόρα-Σέντα Ε., Μωυσιάδης Χ.Θ. (1990). Εφαρμοσμένη Στατιστική, Εκδόσεις Ζήτη.
- Zivot, Eric.Wang, Jiahui (2006). Modeling Financial Time Series with S-PLUS, Springer Science and Business Media Inc.
- Shumway, Robert H., Stoffer, David S. (2006). Time Series Analysis and its Applications, Springer Science and Business Media LLC.
- Gilgen, Hans. (2006). Univariate Time Series in Geosciences, Springer-Verlag Berlin Heidelberg.
- Kirchgassner, Gebhard, Wolters, Jurgen. (2007). Introduction to Modern time Series Analysis, Springer-Verlag Berlin Heidelberg.
- Δαμιανού Χαράλαμπος Χ. (2007). ΜΕΘΟΔΟΛΟΓΙΑ ΔΕΙΓΜΑΤΟΛΗΨΙΑΣ, Εκδόσεις σοφία.
- Brockwell, P.J. and R.A. Davis (2002, 2nd Edition). Introduction to Time Series and Forecasting, Springer Verlag.
- Brockwell, P.J. and R.A. Davis (1991, 2nd Edition). Time Series: Theory and Methods, Springer Verlag.
- Cryer, J.D. and K.S. Chan (2008). Time Series Analysis with Applications in R, Springer-Verlag.
- Δημέλη Σ. (2003, 3η Έκδοση). Σύγχρονες Μέθοδοι Ανάλυσης Χρονολογικών Σειρών, Εκδόσεις ΚΡΙΤΙΚΗ, Αθήνα.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Lab exercise. Studying and analyzing bibliography. Tutorials. Assignments. Self-Study.

Student Assessment Method: Written exam at the end of the semester.

Teaching Language: Greek.

Estimation and Hypothesis Testing (code: 6012) - recursive

Course Type: Compulsory

Course level: First cycle

Instructor: Academic Scholar, Department of Statistics

E.C.T.S.: 8

Desired Learning Outcomes: Upon successful completion of the course, students will be able to: estimate unknown parameters using the appropriate methodology, build confidence intervals that contain the unknown parameters with the desired probability and carry out statistical tests regarding specific problems.

Prerequisites: none

Syllabus: Point estimation, properties of point estimators (consistency, unbiasedness, efficiency, sufficiency), point estimation methods (moment method, least squares, maximum likelihood). Sampling and sampling distributions. Confidence intervals for means, rates, variances and their differences in the case of normal and non-normal populations.

Hypothesis testing, statistical hypotheses, hypothesis testing for parameters such as mean values, variations, parameters comparison in two different samples, statistical significance level, p-value, power of a test, sample size calculation.

Recommended Reading

- Αγγελής Β., Δημάκη Α. (2012). Στατιστική Τόμος Α, Εκδόσεις σοφία.
- Δαμιανού Χ., Κούτρας Μ. (2003). Εισαγωγή στη Στατιστική ΜΕΡΟΣ Ι, Εκδόσεις Συμμετρία.
- Πανάρετου Ι, Ξεκαλάκη Ε. Εισαγωγή στη Στατιστική Σκέψη Τόμος ΙΙ.
- Newbold, P., Carlson, W. and Thorne, B. 'Statistics for Business and Economics'.
- Berry, D. and Lindgren, B. 'Statistics Theory and Methods'.
- Freund, J. 'Mathematical Statistics with applications'.
- Walpole, R., Myers, R. and Myers, S. 'Probability and Statistics'.
- Wonnacott, T. H. and Wonnacott, R. J. Introductory Statistics. 4th edition, J. Wiley & Sons.
- Alder, H. L. and Roessler, E. B. Introduction to Probability and Statistics. 6th edition, W. H. Freeman & Company.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Studying and analyzing bibliography. Tutorials. Self-Study.

Student Assessment Method: Written exam at the end of the semester.

Teaching Language: Greek.

Demographic Statistics (code: 6134)

Course Type: Elective

Course level: First cycle

Instructor: Appointed Instructor

E.C.T.S.: 7

Desired Learning Outcomes: Knowledge of statistical techniques for analyzing demographic data and their applications.

Prerequisites: none

Syllabus: Basic concepts: Demographic events, types of demographic data, sources of demographic data, demographic data publications, demographic measures, population evolution – basic equation. Mortality, mortality per cause of death, mortality measures, mortality probability, mortality comparisons – standardization methods, direct and indirect standardization. Life tables: building a life table, the life table as a stationary population, mortality rate, stochastic approach to life table functions. Parametric and non-parametric mortality models, Mortality age, Multiple decrement tables, Fertility measures, reproduction factors, Parametric and non-parametric fertility models. Estimations, projections and population projections: projection techniques, probabilistic population projection.

Recommended Reading

- Παπαδάκης Μ., Τσίμπος Κ. (2004). Δημογραφική Ανάλυση-Αρχές, μέθοδοι, υποδείγματα, Εκδόσεις Σταμούλη Α.Ε.
- Keyfitz, Nathan, Caswell, Hal (2010). Applied Mathematical Demography (Statistics for Biology and Health). Springer.
- Preston, S., Heuveline, P., Guillot, M. (2000). "Demography: Measuring and Modeling Population processes" Blackwell publishing.
- Colin Newell, (1990). Methods and Models in Demography. Guilford Press.
- Shiva S. Halli, K. Vaninadha Rao (1992). Advanced Techniques of Population Analysis, Plenum Pub Corp.
- Κωστάκη, Α. "Δημομετρία". Σημειώσεις διδασκαλίας.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Tutorials. Self-Study and assignment.

Student Assessment Method: Written exams (70% of the final grade) and an assignment using the techniques presented during the course (30% of the final grade).

Teaching Language: Greek.

Sampling (code: 6033)

Course Type: Elective

Course level: First cycle

Instructor: Associate Professor I. Papageorgiou, Department of Statistics

E.C.T.S.: 7

Desired Learning Outcomes: The students who attend and successfully pass the course will be ideally able to apply basic methods of sample selection and combine these methods to collect a sample from a finite population. They will be able to choose the most effective and appropriate plan, depending on the population, among alternatives. Students will also learn to find estimators, their typical errors, confidence intervals and in general, statistical inference based on the sampling method used to collect the data. Additionally, they will gain an understanding of both sampling and non-sampling errors that can affect a survey, learn how to minimize them, and ultimately be able to design an effective questionnaire.

Prerequisites: none

Syllabus: Introductory concepts and definitions. Finite populations, subpopulations, variables. Census survey, sampling survey. Random and non-random sampling. Probability of selecting population units. Finite population parameters, parameter estimation, properties. Sampling frame. Sampling techniques. Simple random sampling. Mean, ratio and proportion estimation. Confidence intervals. Estimating required sample size. Stratified sampling. Parameter estimation. Distributing a sample in strata. Comparing simple random to stratified sampling. Quota sampling. Systematic sampling. Estimating parameters and comparison to other sampling techniques. Probability proportional to size ('PPS') sampling. Cluster sampling. Single stage cluster sampling. Equal and non-equal probability sampling. Two stage cluster sampling. Conducting sampling research. Sampling frame, questionnaire and methods of data collection. Sampling research errors. Methods of avoiding or minimizing errors and correction methods. Non response errors, adjustment and imputation techniques.

Recommended Reading

- Παπαγεωργίου Ι. (2016). Θεωρία Δειγματοληψίας.
- Sarndal, C-E., Swensson, B., Wretman, J. (1992). Model assisted survey sampling. Springer.
- Lohr, S. (2010). Sampling: Design and Analysis. 2nd Edition. Brooks/Cole. Sengage learning.
- Kish, L. (1965). Sampling Surveys. John Wiley & Sons. New York.
- Barnett, V. (1974). Elements of Sampling Theory. The English Universities Press Ltd.
- Pascal Ardilly, Yves Tillé. Sampling Methods: Exercises and Solutions.
- Δαμιανού, Χ. (2006). Μεθοδολογία της Δειγματοληψίας. Τεχνικές και εφαρμογές. Εκδόσεις Σοφία.
- Ξεκαλάκη Ε. (1995). Τεχνικές Δειγματοληψίας. Σημειώσεις, Οικονομικό Πανεπιστήμιο Αθηνών.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Lab exercise. Tutorials. Assignments. Self-Study.

Student Assessment Method: Written exam at the end of the semester.

Teaching Language: Greek.

Mathematical Methods (code: 6143)

Course Type: Elective

Course level: First cycle

Instructor: Assigned Lecturer

E.C.T.S.: 7

Desired Learning Outcomes: Upon successful completion of the course, students will have a good working understanding of the mathematical techniques described in the syllabus.

Prerequisites: knowledge of Calculus I and II, Linear Algebra I and II, will be useful.

Syllabus: Linear recursive relations. Linear differential equations with constant coefficients. Matrix differential equations, the exponential matrix. Orthogonal polynomials. Combinatorial Analysis. Permutations, orders, combinations. Enumeration techniques, binomial coefficients, probability generating functions, partitions. Elements of the graph theory. Optimization under Constraints, Introduction to Convex Analysis.

Recommended Reading

- LipschutzS., LipsonMarcLars. (2013). Γραμμική Άλγεβρα, 5η έκδοση, Εκδόσεις Τζιόλα, ~~2013.~~
- Slomson A. (1991). An introduction to combinatorics, Chapman and Hall.
- Arrowsmith D. K. and Place C. M. Ordinary differential equations. Chapman and Hall.
- Τσουμπελής, Δ. (2008). Συνήθεις Διαφορικές Εξισώσεις, Πανεπιστήμιο Πατρών.
- Χαραλαμπίδης, Χ. (2010). Συνδυαστική Ανάλυση. Εκδόσεις Συμμετρία.
- Bellman, R. (1987). Matrix Analysis. Classics in Applied Mathematics, SIAM Publishing.
- Liu, C.L. (1968). Introduction to Combinatorial Mathematics. McGraw-Hill.
- Strang, G. (1986). Introduction to Applied Mathematics. Wellesley-Cambdridge Press.
- Logan, D.J. (2010). Εφαρμοσμένα Μαθηματικά. Πανεπιστημιακές Εκδόσεις Κρήτης.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Tutorials. Self-Study.

Student Assessment Method: Written exam at the end of the semester.

Teaching Language: Greek.

Actuarial Science I (code: 6135)

Course Type: Elective

Course level: First cycle

Instructor: A. Zymbidis, Assistant Professor, Department of Statistics

E.C.T.S.: 7

Desired Learning Outcomes: At the end of the lectures, the students will be able to deal with the basic problems of pricing, reserving and reinsurance in a general insurance company.

Prerequisites: none

Syllabus: Damage models: Individual and group standard, damage or loss distributions and compensation distributions and their estimation. Application in non-analog risk coverage, asymptotic estimations in the distributions right end, estimating upper limits of stop loss premiums, stop loss and inflation, positive experience clauses. Bankruptcy theory. The surplus procedure, the adjustment factor and its approaches, bankruptcy possibility, discrete surplus procedure, random variables relevant to the surplus procedure. Credibility theory, partial and full credibility, Buhlmann and Buhlmann – Straub models, other models, loss functions, Bayes credibility, time series methods, Kalman filters, application in persons group

insurance. Pricing. Models of insurance against damage: evolution of one-use payments or one insurance year use, Reserve for outstanding losses and allocated and non-allocated settlement expenses, loss reserving methods, total and structural, triangular methods of compensation progress (chain ladder etc.), expected loss ratio, the Reid method, the Bornhuetter-Ferguson method, separate frequency and severity modeling, parametric methods (use of damage functions).

Recommended Reading

- Ζυμπίδης, Α. (2008). Αναλογιστικά Μαθηματικά Γενικών ασφαλίσεων. Εκδόσεις ΟΠΑ.
- Ζυμπίδης, Α. (2008). Θεωρία Κινδύνων,, Εκδόσεις ΟΠΑ.
- Robert L. Brown, Leon R. Gottlieb (2007). Introduction to Ratemaking and Loss Reserving for Property and Casualty Insurance, ACTEX Publications.
- Kaas, R., Goovaerts, M., Dhaene, J., Denuit, M. (2008). Modern Actuarial Risk Theory, Springer, 2nd ed.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Self-Study.

Student Assessment Method: Written exam at the end of the semester.

Teaching Language: Greek.

3ο YEAR

E' Semester

Generalized Linear Models (code: 6176)

Course Type: Compulsory

Course level: First cycle

Instructors: Assistant Professor E. Ioannidis, Department of Statistics

E.C.T.S.: 8

Desired Learning Outcomes: Understanding generalized linear models, the statistical analysis techniques implied and their properties, as well as the ability to apply these methods in data analysis, while properly interpreting the results, and in some depth understanding of the theoretical issues that arise.

Prerequisites: Estimation – Hypothesis Testing (code: 6012), Linear Models (code: 6023)
(Knowledge of Linear Algebra is recommended)

Syllabus: GLM Theory: Covariance matrix and the Wald test. Maximum likelihood estimation: scores and their distribution, asymptotic distribution of the maximum likelihood estimators and the likelihood ratio. The exponential distributions family. Generalized linear model likelihood analysis, maximum likelihood estimation in the generalized linear model: the scores, the Fisher information and the Newton-Raphson algorithm. Relation to weighted least squares. Inference for coefficients. Deviance from the saturated model. Models with an unknown scale parameter. Residuals.

Applications, examples: binomial data: Link functions, coefficients interpretation, inference, overdispersion. One factor analysis (categorical or continuous), two or more factors analysis, with or without interactions: parameterizations, design matrices, coefficients interpretation. Probit and clog-log models examples.

Poisson and log-linear models. Contingency tables, odds ratio and log-linear parameters. Multinomial and multinomial product, equivalency with log-linear, log-linear and logistic regression. Independence, group independence, conditional independence, uniform dependence. Overdispersion, overdispersion test and dispersion index, the negative binomial model and other alternatives.

Recommended Reading

- Agresti, A. (2015). Foundations of Linear and Generalized Linear Models, Wiley Series in Probability and Statistics.
- Agresti, A. (2012). Categorical Data Analysis, 3rd edition, Wiley Series in Probability and Statistics.
- Dobson & Barnett (2008). An Introduction to Generalized Linear Models, Taylor & Francis.
- Fox (2008). Applied Regression Analysis and Generalized Linear Models, Kindle.
- Hosmer, D.W. and Lemeshow, S. (1989, 2000). Applied Logistic Regression. New York: Wiley.
- McGullagh, P and Nelder, J.A. (1989). Generalized Linear Models, London: Chapman and Hall.

Teaching includes: Class lectures. Tutorials. Assignments. Self-Study.

Student Assessment Method: Written exam at the end of the semester. Written exam (Project). Exams on computers at the end of the semester.

Teaching Language: Greek.

Linear Models (code: 6023) - recursive

Course Type: Compulsory

Course level: First cycle

Instructors: Assistant Professor P. Papastamoulis

E.C.T.S.: 8

Desired Learning Outcomes: After successfully completing this course, students will be able to handle topics concerning the correlation coefficient, simple and multiple linear regression, statistical inference in linear regression, hypothesis testing and diagnostic tests, transformations, general linear models, algorithmic methods for choosing the optimal (sub)model, multicollinearity and dummy variables.

Prerequisites: Estimation - Hypothesis Testing (code: 6012)

Syllabus: Introduction to regression, straight line fitting, model coefficient estimates. Properties of estimated coefficients, mean value, variance, confidence intervals, hypothesis testing, estimation of conditional variance. Predicted values, simple linear regression ANOVA, R^2, F-test (note: definition through SS_Regr and SS_error).

Introduction to multivariate normal distribution. Multiple regression definition, examples. Design matrix, introduction to pseudo variables, general form of linear models, LS estimates and properties (through matrices). Unbiased variance estimate. Maximum likelihood estimation. Multiple correlation coefficient, model ANOVA, partial F-tests, recursive f-tests. Examples. Simple residuals, standardized and studentized residuals, normality test, Q-Q plots, simple hypothesis testing plots, added variable plots, other plots and hypothesis testing for the model. Simple transformations, influence statistics and diagnostic tests, multicollinearity. Model choice, forward, backward, stepwise methods, all possible regressions, model choice using AIC, BIC, Mallows Cp.

Recommended Reading

- Draper N.R. and Smith, H. (1997). Εφαρμοσμένη Ανάλυση Παλινδρόμησης, Παπαζήσης.
- Κούτρας, Μ. Και Ευαγγελάρας, Χ. (2010). Ανάλυση Παλινδρόμησης: Θεωρία και Εφαρμογές, Σταμούλης.
- Montgomery, D.C., Peck, E.A. and Vining, G.G. (2012). Introduction to Linear Regression Analysis, Wiley.
- Weisberg, S. (2014). Applied Linear Regression, Wiley.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Lab exercise. Tutorials. Self-Study.

Student Assessment Method: Written exam at the end of the semester.

Teaching Language: Greek.

Statistical Quality Control (code: 6123)

Course Type: Elective

Course level: First cycle

Instructor: Professor St. Psarakis, Department of Statistics

E.C.T.S.: 7

Desired Learning Outcomes: Upon successful completion of the course students will have the skills needed to deal with improving the quality of products or services using statistical methods.

Prerequisites: knowledge of Estimation – Hypothesis Testing will be useful.

Syllabus: Basic concepts of quality control and statistical quality control. Cause and effect charts. Pareto charts. Control charts for variables (R,S). Attributes control charts (p,np,c,u). CUSUM and EWMA control charts. Capability indices. Introduction to multivariate control charts. The six-sigma methodology. Acceptance sampling. Basic experimental design using principals of repetition and blocking.

Recommended Reading

- Montgomery D (2012). Introduction to Statistical Quality Control, 7th Edition Wiley.
- Ταγαράς Γιώργος (2001). Στατιστικός Έλεγχος Ποιότητας. Εκδόσεις ΖΗΤΗ.

Teaching Method: Face to Face.

Teaching includes: Class lectures, Lab exercise, Studying and analyzing bibliography, Tutorial Assignments: Self Study.

Student Assessment Method: Written exam at the end of the semester + Project.

Teaching Language: Greek.

Theoretical Statistics (code: 6144)

Course Type: Elective

Course level: First cycle

Instructor: Associate Professor I. Papageorgiou, Department of Statistics

E.C.T.S.: 8

Desired Learning Outcomes: Upon completion of the course students ideally should be able to: Implement the standard methods to derive estimates for unknown parameters of a population with a known distribution. Evaluate and compare estimates with respect to standard criteria. Construct confidence intervals for the unknown parameters. Construct statistical tests for hypothesis testing about unknown parameters.

Prerequisites: none

Syllabus: Terminology and definition of basic introductory concepts of parametric statistical inference (random sample, sampling space, parametric space, sample distribution, estimating statistical function). Point estimation in decision making theory (loss function, risk function). Criteria for estimator evaluation: Unbiasedness, Minimum Variance, Sufficiency, completeness, maximum Likelihood, efficiency. Methods of finding unbiased estimators of uniformly minimum variance. Fisher information, Cramer-Rao-Frechet inequality. The exponential family of distributions. Lehmann-Scheffe theorem. Maximum Likelihood Estimators (MLE). Invariance and asymptotic properties of the MLE. The concept of estimating parameters with confidence intervals. Methods of constructing confidence intervals. Pivotal quantity and the general method. Optimal confidence intervals. Asymptotic confidence intervals. Introduction to

theory of parametric statistical hypothesis testing (defining the parametric hypothesis, types of errors, control function, power function). Evaluating statistical tests based on the power function. The Neyman-Pearson lemma and its applications in finding a uniformly powerful statistical test of simple hypotheses. Composite hypothesis testing. Likelihood Ratio test (LRT) and asymptotic LRT.

Recommended Reading

- Φερεντίνος Κ. και Παπαϊωάννου Τ. (2000). Μαθηματική Στατιστική, 2η Έκδοση, Εκδόσεις Σταμούλη, Αθήνα.
- Κολυβά-Μαχαίρα Φ. (1998). Μαθηματική Στατιστική, Εκδόσεις Ζήτη.
- Φουσκάκης Δ. (2013). Ανάλυση Δεδομένων με τη Χρήση της R., Εκδόσεις Τσότρας.
- CrawleyM.J. (2013). Στατιστική Ανάλυση με το R., BrokenHillPublishers.
- Ρούσσας Γ. (1994). Στατιστική Συμπερασματολογία, Τόμος Ι - Εκτιμητική, 2η Έκδοση, Εκδόσεις Ζήτη, Θεσσαλονίκη.
- Ρούσσας Γ. (1994). Στατιστική Συμπερασματολογία, Τόμος ΙΙ – Έλεγχοι Υποθέσεων, 2η Έκδοση, Εκδόσεις Ζήτη, Θεσσαλονίκη.
- Bickel P.J. and Doksum K.A. (2007). Mathematical Statistics, vol.I, 2nd Edition – Updated Printing, Pearson Prentice Hall.
- Casella G. and Berger R. (2002). Statistical Inference, 2nd Edition, Duxbury.
- Mood A.M., Graybill F.A. and Boes D.C. (1974). Introduction to the Theory of Statistics, 3rd Edition, McGraw-Hill Book Company.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Tutorial. Assignments. Self-Study.

Student Assessment Method: Written exam at the end of the semester. Home Assignment.

Teaching Language: Greek.

Introduction to Operational Research (code: 6153)

Course Type: Elective

Course level: First cycle

Instructor: Professor E. Kyriakidis, Department of Statistics

E.C.T.S.: 7

Desired Learning Outcomes:

After successfully attending the course, students will be able to solve linear programming problems graphically, with algebraic methods, with the Simplex method and with Excel. They will also be able to find the optimal policy that minimizes the total expected cost for finite-time horizon problems using the method of dynamic programming. They will also be able to find optimal replenishment policies for inventory problems.

Prerequisites: none

Syllabus: The linear programming problem, examples, solution by graphical method, canonical form, properties of solutions, The Simplex algorithm, the M-method, the dual problem of linear programming, sensitivity analysis, the transition problem, the integer programming problem, the dynamic programming problem, the machine maintenance problem, the replacement problem, the Secretary problem. Dynamic Programming, Game theory.

Recommended Reading

- Δ. Φακίνος, Α. Οικονόμου (2003). Εισαγωγή στην Επιχειρησιακή Έρευνα, Εκδόσεις Συμμετρία.
- HillierF., S., LiebermanG.J. (1985). Εισαγωγή στην Επιχειρησιακή Έρευνα, Τόμος Α΄, Τεύχος Α΄, Εκδόσεις Παπαζήσης.

- F. S. Hillier, G. J. Lieberman (2005). Introduction to Operations Research, McGraw-Hill.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Studying and analyzing bibliography. Assignments.

Student Assessment Method: Written exam at the end of the semester.

Teaching Language: Greek.

Design and Analysis of Experiments (code: 6225)

Course Type: Elective

Course level: First cycle

Instructor: Associate Professor P. Tsiamyrtzis, Department of Statistics – Assigned Lecturer

E.C.T.S.: 8

Desired Learning Outcomes: Students are expected to know the basic principles of experimental design and the ANOVA methodology. They are expected to be able to propose the appropriate statistical design of an experiment to answer some research questions, as well as to implement the appropriate statistical analysis to the experimental data, allowing for statistical inference and decision-making.

Prerequisites: knowledge of Linear Algebra and Linear Models is recommended.

Syllabus: Introduction to Experimental Design and Analysis. One factor ANOVA experiment. Multiple Comparisons. Random effects model. Non parametric ANOVA. Randomized Complete Block Design. Latin Squares. Balanced Incomplete Block Design. Factorial Experiments/ ANOVA: two factors with/ without interaction. General factorial experiments/ ANOVA: more than two factors with interactions. 2^k factorial designs. Fractional factorial designs. Nested and Split-plot designs. Examples and case studies using R.

Recommended Reading

- D. C. Montgomery (2020). "Design and analysis of experiments", Wiley.
- A. Dean, D. Voss and D. Draguljic (2017). "Design and Analysis of Experiments", Springer.
- C. F. J. Wu and M. S. Hamada (2021). "Experiments: Planning, Analysis, and Optimization", Wiley.
- J. Lawson (2014). "Design and Analysis of Experiments with R", Chapman & Hall.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Lab Exercise. Writing assignment/assignments.

Student Assessment Method: Written exam at the end of the semester. Project.

Teaching Language: Greek.

F' Semester

Data Analysis (code: 6005)

Course Type: Compulsory

Course level: First cycle

Instructor: Professor I. Ntzoufras, Assistant Professor X. Penteli, Department of Statistics

E.C.T.S.: 8

Desired Learning Outcomes: Upon successful completion of the course, students will be able to:

- Manage real life problems and analyze data in R,
- Perform basic hypothesis testing,
- Construct and interpret regression models, and
- Write statistical reports in a professional manner.

Prerequisites: Estimation – Hypothesis Testing (code: 6012), Linear Models (code: 6023)

Syllabus: Statistical methods in simple problems using statistical packages (emphasis on R and secondary on other statistical packages): Descriptive statistics, visualization, simulating random numbers from theoretical distributions, confidence intervals, hypothesis testing for one and two independent samples, hypothesis testing for two dependent samples, contingency tables, simple and multiple regression analysis, AnCoVa models and analysis for one and two factors (and one continuous explanatory). Case studies and analysis of real datasets from various scientific fields (economics, marketing, social sciences, sports, medicine, psychology etc.). Basic principles for writing professional and scientific reports and presenting data analysis.

Recommended Reading

- Ντζούφρας Ι., Καρλής Δ. (2016). Εισαγωγή στον Προγραμματισμό και στη Στατιστική Ανάλυση με R, Εκδόσεις Ελληνικά Ακαδημαϊκά Ηλεκτρονικά Συγγράμματα και Βοηθήματα-Αποθετήριο "Κάλλιπος''.
- Φουσκάκης Δ. (2013). Ανάλυση Δεδομένων με Χρήση της R. Εκδόσεις Τσότρας. Αθήνα.
- Marques de Sa, Joaquim P. (2008). Applied Statistics Using SPSS, STATISTICA, MATLAB and R, Editions Springer-Verlag.
- Chatterjee S., Handcock M.S., Simonoff J.S. (1995). A Casebook for a First Course in Statistics and Data Analysis. John Wiley & Sons.
- Faraway J.J. (2002). Practical Regression and Anova using R. Free electronic book available at http://cran.r-project.org/doc/contrib/Faraway-PRA.pdf.
- Fox J. & Weisberg H.S. (2011). An R Companion to Applied Regression. 2nd edition. SAGE Publications Inc.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Lab exercises. Studying and analyzing bibliography. Tutorial. Assignments.

Student Assessment Method: Written exam at the end of the semester (50%). Assignment and oral examination/ presentation (50%). Lab exercises (small extra bonus).

Teaching Language: Greek.

Simulation (code: 6125)

Course Type: Elective

Course level: First cycle

Instructor: Professor P. Dellaportas, Department of Statistics

E.C.T.S.: 7

Desired Learning Outcomes: Upon successful completion of the course, students will be able to understand elements of stochastic simulation and implement them on pc.

Prerequisites: none

Syllabus: Generating uniform random variables, reductive generators, random number tests, methods of generating random numbers. The inversion method, the rejection method, component method, other methods. Methods for specific distributions. Dispersion reduction techniques and the Monte Carlo

integration: Monte Carlo simulation, significance sampling, opposite random variables, control random variables. Generating dependent random variables: ranked sample, exponential spaces, multivariate normal distribution, Poisson process, Markov chains, random Markov fields, Gibbs sampler, Particle filtering.

Recommended Reading

- Δελλαπόρτας, Π. (1994). Στοχαστικά Μοντέλα και Προσομοίωση. Σημειώσεις παραδόσεων, Τμήμα Στατιστικής, Οικονομικό Πανεπιστήμιο Αθηνών. Διαθέσιμες στη διεύθυνση http://www.stat-athens.aueb.gr/~ptd/simulation.ps.
- Devroye, L. (1986). Non-Uniform Random Variable Generation, Springer-Verlag, New York.
- Ripley, Brian D. (1987). Stochastic Simulation, John Wiley, New York.
- Robinson, S. (2004). Simulation: The Practice of Model Development and Use, Wiley, Chichest, UK.
- Robert, C., Casella, G. (2010). Introducing Monte Carlo Methods with R. Springer

Teaching Method: Face to Face.

Teaching includes: Class lectures. Lab exercise. Tutorials. Research assignment. Assignments.

Student Assessment Method: Home assignment. Written exam (Project).

Teaching Language: Greek.

Multivariate Statistical Analysis (code: 6136)

Course Type: Elective

Course level: First cycle

Instructor: Professor D. Karlis, Department of Statistics, X. Pedeli, Assistant Professor, Department of Statistics

E.C.T.S.: 8

Desired Learning Outcomes: Upon completion of the course, students will be able to: produce graphs and comprehend relations in their data, apply basic methods of multivariate data analysis, infer on multivariate data, use methods of dimension reduction.

Prerequisites: none

Syllabus: Multivariate data, multivariate descriptive measures, covariance matrix, generalized variance. Plots for multivariate data. Multivariate distributions, basic properties and handling. Multivariate normal distribution. Properties. Estimation. Distributions resulting from the multivariate normal distribution. Principal components analysis, choosing principal components, principal components interpretation. Principal components analysis in sampling data. Factor analysis, the orthogonal factor model. Estimation. Model rotation, results interpretation, applications. The multivariate linear model, multivariate regression, multivariate analysis of variance. The concept of distance and its use for grouping. Structural Equation Modeling.

Recommended Reading

- Σιάρδος Γ. (2005). Μέθοδοι Πολυμεταβλητής Στατιστικής Ανάλυσης, Εκδόσεις Σταμούλη Α.Ε.
- Everitt, Sidney B., Casella, Fienberg G., Olkin S., Ingram. (2005). An R and S-PLUS Companion to Multivariate Analysis, Springer-Verlag London Limited.
- Anderson, T. W. (1984). An Introduction to Multivariate Statistical Analysis, John Wiley & Sons, New York, 2nd edition.
- Bartholomew, D.J., Steele, F., Moustaki, I., Galbraith, J. (2011) Ανάλυση πολυμεταβλητών τεχνικών στις κοινωνικές επιστήμες, Εκδόσεις ΚΛΕΙΔΑΡΙΘΜΟΣ.
- Basilevski, A. (1994). Statistical Factor Analysis and Related Methods. Theory and Applications. John Wiley & Sons.

- Chatfield, C. and Collins, A.J. (1992). Introduction to Multivariate Analysis.
- Jackson, J. (1991). A User's Guide to Principal Components, John Wiley & Sons, Inc., New York, NY.
- Krzanowski, W. J. (1988). Principles of Multivariate Analysis. Oxford University Press.
- Mardia, K. V., Kent, J. T. & Bibby, J. M. (1979). Multivariate Analysis. London: Academic Press.
- Καρλής, Δ. (2005). Πολυμεταβλητή Στατιστική Ανάλυση. Εκδόσεις Σταμούλη.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Tutorials. Research Assignment. Self-Study.

Student Assessment Method: Written exam at the end of the semester. Written exam (Project).

Teaching Language: Greek.

Probability theory (code: 6116)

Course Type: Elective

Course level: First cycle

Instructor: Associate Professor Ch. Pavlopoulos, Department of Statistics

E.C.T.S.: 8

Desired Learning Outcomes: Upon successful completion of the course, students should be able to: determine the probability space of a random experiment with uncountable sample space according to the Lebesgue - Caratheodory extension theorem, to apply advanced probability calculus according to Kolmogorov's axioms, manage random variables as measurable mappings of a given probability space to the Borel line, determine the type of a random variable according to its probability distribution induced on the Borel line (discrete, continuous, mixed), calculate its expected (or mean) value as a Lebesgue integral on the Borel line, to distinguish and verify modes of stochastic convergence of a given sequence of random variables, to apply the laws of large numbers and the central limit theorem.

Prerequisites: knowledge of Probability I and II, Calculus I and II and Introduction to Mathematical Analysis are recommended.

Syllabus: Uncountable sets and the necessity for axiomatic foundation of probability spaces (σ-algebra of events, Kolmogorov's axioms, properties of probability measure). The Lebesgue-Caratheodory extension theorem for construction of probability spaces (summary, applications). Definition of random variables and Borel measurability. Stochastic independence, Borel-Cantelli lemmas, tail events and Kolmogorov's 0-1 law. Expectation of random variables with respect to a probability measure as Lebesgue integral with respect to their probability distributions induced on the Borel line, properties of expected values. Modes of convergence for sequences of random variables (almost certain, in p-th order mean, in probability, in distribution). Limit theorems (monotone convergence, Fatou's lemma, dominated/bounded convergence theorem, uniform integrability, weak and strong laws of large numbers, central limit theorem). Lebesgue's decomposition of a probability distribution on the Borel line to its components (discrete, absolutely continuous, singular continuous), characterization of absolute continuity by the Radon-Nikodym theorem. Conditional expectation, conditional probability and their properties.

Recommended Reading:

- Athreya, Krishna B., Lahiri, Soumendra N. (2006). Measure Theory and Probability Theory, Springer Science and Business Media, LLC.
- Billingsley, P. (1995). Probability and Measure, 3rd Edition, John Wiley & Sons.
- Bhattacharya, Rabi. Waymire, Edward C. (2007). A Basic Course on Probability Theory, Springer Science and Business Media, Inc.

- Rosenthal, J. S. (2006). A First Look at Rigorous Probability Theory, Second Edition, World Scientific.
- Roussas, G.G. (2005). An Introduction to Measure-Theoretic Probability, Elsevier Academic Press.
- Skorokhond, A.V., Prokhorov, Yu.V. (2005). Basic Principles and Applications of Probability Theory, Springer-Verlag Berlin Heidelberg.
- SpringerLink (Online service), Gut A. (2005). Probability: A graduate Course, Springer Science and Business Media, Inc.
- Ρούσσας, Γ. Γ. (1992). Θεωρία Πιθανοτήτων, Εκδόσεις ΖΗΤΗ, Θεσσαλονίκη.
- Καλπαζίδου, Σ. (2002). Στοιχεία Μετροθεωρίας Πιθανοτήτων, Εκδόσεις ΖΗΤΗ, Θεσσαλονίκη.

Teaching Method: Face to Face.

Teaching includes: Class lectures.

Student Assessment Method: Written exam at the end of the semester.

Teaching Language: Greek.

Biostatistics I (code: 6246)

Course Type: Elective

Course level: First cycle

Instructor: Assistant Professor N. Demiris, Department of Statistics

E.C.T.S.: 7

Desired Learning Outcomes: At the end of the course students will: Be familiar with the basic types of medical research. Be able to read a medical study and the corresponding scientific publication. Be able to perform basic analysis of medical data. The course motivates students to continue their studies in Biostatistics and to engage in the field.

Prerequisites: none

Syllabus: Basic principles of epidemiology, morbidity and risk measures, odds ratio, diagnostic tests (Mantel-Hanzel, ROC curves, sensitivity – specificity), case control studies, introduction to clinical trials, sample size estimation, principles of epidemic models, Infectious disease control.

Recommended Reading

- Pagano M. και Gauvreau, K. (2000). Αρχές Βιοστατιστικής. (μτφ. Ρ.Δαφνή) Εκδόσεις ΕΛΛΗΝ Περιστέρι.
- Ιωαννίδης, Ι (2000). Αρχές Αποδεικτικής Ιατρικής: Επιδημιολογία, Δημόσια Υγιεινή, Μέθοδοι Έρευνας, Εκδόσεις Λίτσας, Αθήνα.
- Ντζούφρας Ι. (2010). Εισαγωγή στη Βιοστατιστική και την Επιδημιολογία. Διδακτικές Σημειώσεις. Τμήμα Στατιστικής, Οικονομικό Πανεπιστήμιο Αθηνών [διαθέσιμες μέσω http://eclass.aueb.gr]
- Δεμίρης Ν. (2012). Εισαγωγή στα Επιδημικά Μοντέλα. Διδακτικές Σημειώσεις. Τμήμα Στατιστικής, Οικονομικό Πανεπιστήμιο Αθηνών [διαθέσιμες μέσω http://eclass.aueb.gr]
- Rosner, B. (2010). Fundamentals of Biostatistics. 7th International edition, Brooks/Cole – Νέαέκδοσηπροσεχώς.
- DiekmannO., Heesterbeek, J.A.P. and Britton, T. (2012). Mathematical tools for understanding infectious disease dynamics. First edition, Princeton University Press.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Lab exercise. Tutorials. Assignments. Self-Study. Screenings of films relative to the course and exercises/ tasks based on them. Sometimes we also have guest graduates to talk about their career and about problems and methodologies they face in their work.

Student Assessment Method: Written exam at the end of the semester. Open questions. Problem Solving. Home assignment. Lab exercises. Practical exercises.

Teaching Language: Greek.

Official Statistics (code: 6114)

Course Type: Elective

Course level: First cycle

Instructor: Newly Assigned DEP member or Assigned Lecturer

E.C.T.S.: 7

Desired Learning Outcomes: After successfully completing the course, students will be able to understand the basic concepts and principles of international and National official statistics. They will also be able to know the basic concepts and principles of constructing, estimating and using index numbers.

Prerequisites: none

Syllabus: Introduction, indices, simple and complex numbers, simple size indices, individual indices behavior, base, base change, unifying indices time series, errors, heterogeneity, sampled indices in Greece, indices as random variables.

Family budget surveys, Metadata. Describing and using data and surveys by EUROSTS, OECD, UN, etc.

Recommended Reading

- Τζωρτζόπουλος Π., Α Λειβαδά (2011). «Αριθμοδείκτες Και Επίσημες Στατιστικές», Οικονομικό Πανεπιστήμιο Αθηνών, Αθήνα.
- OECD (2008). "Handbook on Constructing Composite Indicators – Methodology and User Guide".

Teaching Method: Face to Face.

Teaching includes: Class lectures. Seminars. Field exercise. Bibliography study and analysis. Interactive teaching. Scientists' lectures. Educational Visits. Conducting a study. Assignments. Self-study.

Student Assessment Method: Written exam with open notes at the end of the semester. Open questions. Problem solving. Project and project presentation. Practical exercises.

Teaching Language: Greek.

Numerical Methods in Statistics (code: 6115)

Course Type: Elective

Course level: First cycle

Instructor: Professor A. Yannacopoulos, Department of Statistics

E.C.T.S.: 7

Desired Learning Outcomes: At the end of the course students will be able to: use a pc to perform statistical inference. Write basic programs in R to apply statistical inference. Analyze data using computational methods and approaches.

Prerequisites: None

Syllabus: General principles of arithmetic calculations and basic tools in estimating accuracy of said calculations. Arithmetical solving of one variable functions. Bisection methods. Point method. Newton method. Secant method, False position method. Function approximation. Function approximation using least squares. Interpolation and multinomial function approach. Orthogonal polynomials and

applications. Curve fit. Spline functions. Approximation using kernels. Arithmetical linear algebra. Direct methods. Linear systems stability. Matrices factorization, special matrices. LU decomposition, the Cholesky decomposition. Iterative methods of solving linear systems. The Jacobi method, the Gauss-Seidel method and its variants, general iterative method. Special linear systems. Numerical solving of nonlinear systems. Point method for multiple variable functions, Newton method in the multidimensional case. Numerical integration and differentiation methods. Taylor series approach. Monte Carlo integration. Numerical differentiation. Calculating derivatives using interpolation polynomials. Numerical optimization methods. Typical optimization problems, using LaGrange method of multipliers in optimization theory and the Karush–Kuhn–Tucker conditions (KKT). The Steepest Descent method, the Newton method for solving optimization problems with or without equality constraints. Interior point methods – central path method and using bounded functions for solving optimization problems with mixed constraints. Principles of simulation and random search algorithms. Basic idea of global optimization methods. Simulated Annealing algorithmic method. The EM algorithm and its variations.

Recommended Reading

- Burden, R., Faires, J., (2010). Numerical Analysis. Cencage Learning.
- Chapra, S., Canale, R. (2016). Αριθμητικές Μέθοδοι για Μηχανικούς. Εκδόσεις Τζιόλα.
- Gentle, J. (2009). Στοιχεία Υπολογιστικής Στατιστικής. Εκδόσεις Παν. Μακεδονίας.
- Lange, K. (2010). Numerical Analysis for Statisticians. Springer.
- Monahan, J. F. (2011). Numerical methods of statistics. Cambridge University Press.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Tutorials.

Student Assessment Method: Written exam at the end of the semester.

Teaching Language: Greek.

Introduction to Database Management (code: 6245)

Course Type: Elective

Course level: First cycle

Instructor: Under Contract

E.C.T.S.: 7

Desired Learning Outcomes: Upon successful completion of the course students will be able to correctly design and implement a database application, to know how to set simple and complex questions in the database and to define those structures that lead to optimal system performance.

More particularly, they will be able to:

- Model a business or institution's data using Entity Relationship Models or the relational model.
- Write simple or complex questions in SQL, through which they manage a relational database or retrieve data in various ways.
- Use a relational database trading system for all the above.

Prerequisites: knowledge of Linear Algebra and Linear Models is recommended.

Syllabus: Databases began as a simple application in early 70s and grew to one of the most important fields in computer industry, touching hundreds of IT applications. This outcome was somehow expected, since the focus of database research is the description, storage and usage of data. To describe a database application, we need a data model, such as the entity-relationship or the relational model. To retrieve and make use of the stored data, we need a generic query language, such as SQL. Finally, there are

numerous ways to store data, depending on how this will be used. The goal of this course is to educate students on how to design properly, build efficiently and use intelligently a database. Furthermore, it should make apparent the various trade-offs that exist in designing, building and using such an application. The aim of this course is for the students to be able to correctly design and implement a database application, to know how to set simple and complex questions in the database and to define those structures that lead to optimal system performance.

The course contents include:

- Introduction: Purpose, data models, database languages, users, transactions, architecture.
- Entity-Relationship Model: Entities, relationships, attributes, keys, mapping cardinalities, weak entities, E-R diagrams, mapping to tables, examples.
- Relational Model: Relations, relational schema, relational algebra.
- The SQL Language: Basic structure, nested subqueries, aggregation, views, update, procedural and embedded SQL, triggers.
- Relational Design: Integrity constraints, functional dependencies, decomposition, normalization.
- Storing and Indexing: File organization, indexing, hashing, trees.
- Special Topics (if there is time): Data warehousing, OLAP, data mining, data streams, OO DBs.

Recommended Reading

- R. Ramakrishnan & J. Gehrke. (2002). «Συστήματα Διαχείρισης Βάσεων Δεδομένων», Τόμος Α΄ & Β΄, Εκδόσεις Τζιόλα, 2002.
- R. Elmasri S. B. Navathe. (2001). «Θεμελιώδεις Αρχές Συστημάτων Βάσεων Δεδομένων», Τόμος Α' & Β', (μεταφραστική επιμέλεια Μ. Χατζόπουλος), Εκδόσεις Δίαυλος.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Lab Exercise. Writing assignment.

t/assignments.

Student Assessment Method: Written exam at the end of the semester. Project.

Teaching Language: Greek.

4ο YEAR

Z' Semester

Econometrics (code: 6175)

Course Type: Elective

Course level: First cycle

Instructor: Associate Professor I. Vrontos, Department of Statistics

E.C.T.S.: 8

Desired Learning Outcomes: Upon successful completion of the course students will be able to: know, identify, control and suggest ways to deal with violations of classical hypotheses of the classic linear multivariate regression model: autocorrelation - heteroscedasticity and multilinearity using linear algebra. Also, know what is, when they are used, under which conditions and how they are estimated: the simultaneously determined regressions – Systems of interdependent variables, the structural and reduced models and the Seemingly Unrelated Regression Equation Systems. Applications using Eviews (educational version).

Prerequisites: knowledge of Regression and Introduction to economic analysis is recommended.

Syllabus: Introduction to econometrics. Hypotheses and variable stability tests – Hypotheses violations (using linear algebra). Systems of Codependent Variables, Structural – Reduced, Financial systems: Concept – Interpretation – Estimation. Consequences of ignoring explanatory variables endogeny.

Identifying the parameters of structural equations/ regressions of a system: Identification conditions. The case of under-identification and over-identification.

Estimating structural parameters with Indirect Least Squares Method (ILS) – Instrumental Variables Method (IV) – 2SLS – 3SLS.

Seemingly Unrelated Regression Equation Systems (SURE): Estimation, Parameter Heterogeneity Test, models PANEL. Applications with economic data using Eviews.

Recommended Reading

- Τζαβαλής Η., (2008). Οικονομετρία, Εκδόσεις Οικονομικού Πανεπιστημίου Αθηνών.
- JohnstonJ., DinardoJ. (2005). Οικονομετρικές Μέθοδοι, Εκδόσεις Κλειδάριθμος ΕΠΕ.
- Δριτσάκη Ν. Χάιδω, Δριτσάκη Ν. Μελίνα. (2013). Εισαγωγή στην Οικονομετρία με τη Χρήση του Λογισμικού EViews, Εκδ. Κλειδάριθμος.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Seminars. Field exercise. Studying and analyzing Bibliography. Interactive teaching. Scientists' lectures. Educational visits. Assignment. Self-study.

Tutorial. Assignments. Self-Study.

Student Assessment Method: Written exam at the end of the semester. Open questions. Problem solving. Project and project presentation. Practical exercises.

Teaching Language: Greek.

Stochastic Processes II (code: 6057)

Course Type: Elective

Course level: First cycle

Instructors: Professor E. Kyriakidis, Department of Statistics

E.C.T.S.: 8

Desired Learning Outcomes: After successfully completing the course, students will be able to identify basic concepts of Stochastic Processes theory (martingale, Markov processes in continuous time and discrete and continuous state spaces, birth – death processes, infusion processes), as well as to model and solve problems that require these techniques. They will be able to apply fundamental techniques from this theory focused on future applications in statistics and various cognitive objects related to economic sciences, finances, the environment and contemporary technologies.

Prerequisites: none

Syllabus: Markovian processes in continuous time and discrete state space. Generators, forward and backward Kolmogorov functions. Calculating transition probabilities. Birth – death processes and applications. Markjovian processes in discrete time with continuous state spaces.

Martingales in discrete time, stopping times, filtrations (intuitive). Optional Stopping Theorem. Stochastic procedures in continuous time. Brownian motion and its properties. Geometric Brown motion and the Ornstein-Uhlenbeck process. Gaussian processes. Introduction to the stochastic integral. Simulating stochastic processes. Applications in economics, finance, environment and contemporary technologies.

Recommended Reading

- Κουμουλλής Γ. Χ., Νεγρεπόντης Σ. (2005). Θεωρία Μέτρου, Εκδόσεις Συμμετρία.
- Karlin S., Taylor H. M. (1981). A second course in stochastic processes, Academic Press.
- Rogers L. C., Williams D. (2000). Diffusions, Markov processes and Martingales: Volume I, Foundations. Cambridge University press.

- Revuz D., Yor M. (2004). Στοιχηματικές στοχαστικές διαδικασίες συνεχούς χρόνου και κίνηση Brown (ελληνική μετάφραση), Leaders Books.
- Χρυσαφίνου Ουρανία (2008) Εισαγωγή στις Στοχαστικές Ανελίξεις. Εκδόσεις Σοφία.
- Karlin S. and H. Taylor (1975). A First Course in Stochastic Processes, Academic Press.
- Grimmett, G.R. and D.R. Stirzaker (2001). Probability and Random Processes. Oxford University Press.
- Steele, M.J. (2001). Stochastic Calculus and Financial Applications. Springer.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Studying and analyzing bibliography. Self-Study. Simulation lab session.

Student Assessment Method: Written exam at the end of the semester.

Teaching Language: Greek.

Methods of Statistical and Machine Learning (code: 6127)

Course Type: Elective

Course level: First cycle

Instructor: Professor D. Karlis, Department of Statistics

E.C.T.S.: 8

Desired Learning Outcomes: Upon completion of the course students will be able to: apply contemporary statistical methods using the R software to analyze large volumes of data, chart and understand relationships in the data, find groups of observations, create classification rules, apply methods and work with large data sets. At the end of the course, students will be able to construct graphs and understand relationships between data, identify observation clusters in the data, and build classification rules.

Prerequisites: Understanding subjects related to Statistical Inference, Distribution Theory and Linear Algebra will be useful.

Syllabus: Distinguishing statistical learning methods as supervised and unsupervised and determining the type of statistical problems they treat, the concept of distance in Statistics, Clustering (K-means, Hierarchical clustering, Model-based clustering), Classification (LDA, QDA, K-nearest neighbors, Fisher's discriminant analysis). Resampling methods (cross-validation, bootstrap), linear model selection and regularization (subset selection, shrinkage, dimension reduction), multinomial regression, step functions, regression splines, tree methods, support vector machines, neural networks.

Recommended Reading

- Bartholomew D.J., Steele F., Moustaki I., Galbraithe J.I. (2011). Ανάλυση Πολυμεταβλητών Τεχνικών στις Κοινωνικές Επιστήμες, Εκδόσεις Κλειδάριθμος ΕΠΕ.
- Ιωαννίδης Δ., Αθανασιάδης Ι. (2017). Στατιστική και Μηχανική Μάθηση με την R, Εκδόσεις Τζιόλα.
- Rajaraman A., Ullman D.J. (2014). Εξόρυξη από Μεγάλα Σύνολα Δεδομένων, Εκδόσεις Νέων Τεχνολογιών.
- Sidney B., Everitt, Casella G., Fienberg, S., Ingram O. (2005). An R and S-PLUS Companion to Multivariate Analysis, Springer-Verlag London Limited.
- Hastie, Tibshirani and Friedman. (2009). Elements of Statistical Learning, 2nd edition Springer.
- James, Witten, Hastie and Tibshirani. (2011). Introduction to Statistical Learning with applications in R, Springer.
- B. S. Everitt, S. Landau, M. Leese, and D. Stahl. (2011). Cluster Analysis, Fifth Edition, Wiley.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Lab exercise. Studying and analyzing bibliography. Tutorial. Assignments.

Student Assessment Method: Written exam at the end of the semester. Oral exam. Written exam (Project).

Teaching Language: Greek.

Biostatistics II (code: 6118)

Course Type: Elective

Course level: First cycle

Instructor: Associate Professor P. Besbeas, Department of Statistics

E.C.T.S.: 7

Desired Learning Outcomes: Upon successful completion of the course, students will: Know and understand Survival Analysis. Have acquired knowledge about theory and methods, practical skills for survival data analysis, as well as basic and transferable skills for Medical Statistics and Biostatistics.

Prerequisites: none

Syllabus: Survival data and their properties. Survival time functions (survival function, risk function, average residual life) and their interrelationships. Survival time parametric models examples: Exponential, Weibull, Log-logistic etc). Nonparametric survival analysis, estimating functions methods: Product-Limit (Kaplan-Meier) and Nelson-Aalen estimators. Standard errors, types of confidence intervals (plain, log, cloglog) and inference. Methods of comparing survival function: Logrank test and generalizations. Extension to more than two samples.

Parametric survival analysis: Distribution fitting with the maximum likelihood method. Hypothesis testing, asymptotic theory, types of confidence intervals and inference. Generalization for two samples. Survival analysis with instrumental variables: Cox's model of analog risks, partial likelihood and inference. Accelerated Failure Time model. Model interpretation through Bayesian examples. Survival analysis and frailty. Introduction to clinical trials. Designs (parallel, crossover, cross-sectional, etc.). Sample size and power. Treatment allocation randomization, adjustable designs. Meta-analysis.

Recommended Reading

- Μπερσίμης Σ., Σαχλάς Α. (2016). Εφαρμοσμένη Στατιστική με έμφαση στις Επιστήμες Υγείας, Εκδόσεις Τζιόλα.
- Μπερσίμης Σ., Σαχλάς Α. (2016). Εφαρμοσμένη Στατιστική με χρήση του IBM SPSSStatistics 23, Εκδόσεις Τζιόλα.
- PetrieA., SabinC. (2015). Ιατρική Στατιστική με μια ματιά, Εκδόσεις Παρισιάνου Α.Ε.
- PaganoM., GauvreauK. (2002). Αρχές Βιοστατιστικής, Εκδόσεις Έλλην.
- Ιωαννίδης Ι. (2000). Αρχές Αποδεικτικής Ιατρικής, Ιατρικές Εκδόσεις Λίτσας.
- Μπεσμπέας (2015). Ανάλυση Επιβίωσης. Σύγγραμμα (150 σελ.).
- Rosner, B. (2010). Fundamentals of Biostatistics. 7th International edition, Brooks/Cole – Νέα έκδοση θα βγει σύντομα.
- Armitage, P., Berry, G. and Mathews JNS (2002). Statistical Methods in Medical Research. 4th Edition. Blackwell Science.
- Hosmer, D. W., Lemeshow, S. and May S. (2008). Applied Survival Analysis: Regression Modeling of Time to Event Data, Second Edition, Wiley-Blackwell.
- Friedman L.M., Furberg C.D. and DeMets, D.L. (2010). Fundamentals of Clinical Trials. 4th edition, Springer.
- Collett D. (2003). Modelling survival data in medical research, Second edition. Chapman and Hall.
- J.F. Lawless (2002). Statistical Models and Methods for Lifetime Data, Second Edition. Wiley.
- D.R. Cox and D. Oakes (1984). Analysis of survival data. Chapman and Hall.

- S. Piantadosi (2005). Clinical Trials: A Methodological Perspective Second Edition. Wiley.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Lab exercise. Tutorial. Self-Study.

Student Assessment Method: Written exam at the end of the semester.

Teaching Language: Greek.

Actuarial Science II (code: 6124)

Course Type: Elective

Course level: First cycle

Instructor: Assistant Professor A. Zympidis, Department of Statistics

E.C.T.S.: 7

Desired Learning Outcomes: At the end of the course, students will be able to deal with the main problems of pricing and storage of life insurance policies.

Prerequisites: none

Syllabus: Simple mortality matrix and relative functions. Force of mortality, classic mortality laws, actuarial tables and commutation functions, stochastic approach to life insurance. Types of personal insurance, actuarial present values, present values variances and covariances. Types of annuities, actuarial present values and annuities variances, relations between annuities and insurance policies. Insurance (annual, united, payable in installments), approximate relationships between different types of insurance. Recursive and differential relationships for insurances and annuities. Mathematical stocks of all types, differential equations and approximate relations, alternative reserving methods (stochastic and non-stochastic), Joint life and death probability, “multiple head” insurance and annuities, common insurance for Gompertz and Makeham cases, as well as under the assumption for uniform distribution of deaths (UDD). Matrices with multiple output causes, multiple situations standards, disability standards and Markov methods. Retirement models.

Recommended Reading

- Ζυμπίδης Α.(2009). Αναλογιστικά Μαθηματικά Ασφαλίσεων Ζωής.
- Ζυμπίδης Α. (2008). Συνταξιοδοτικά Ταμεία & Αναλογιστικές Μελέτες.
- Neil A. (1986). Life Contingencies, Heinemann Professional Publishing.
- Etienne De Vylder (1997). Life insurance: Actuarial Perspectives, Kluwer Academic Print.
- David C. M. Dickson, Mary Hardy, Mary R. Hardy, Howard R. Water. (2013). Actuarial Mathematics for Life Contingent Risks. Cambridge University Press.
- Arthur W. Anderson (2006). Pension Mathematics for Actuaries, ACTEX Publications.

Teaching Method: Face to Face.

Teaching includes: Class lectures.

Student Assessment Method: Written exam at the end of the semester.

Teaching Language: Greek.

Methods of Bayesian Inference (code: 6168)

Course Type: Elective

Course level: First cycle

Instructor: Assistant Professor P. Papastamoulis, Department of Statistics

E.C.T.S.: 7

Desired Learning Outcomes: After successful completion of the course students will be able to:

- Understand the differences between the classic and the Bayesian approach
- Know the basic principles of the Bayesian approach
- Apply contemporary Bayesian analysis methods to real problems
- Know the tools that will assist them in implementing these analyses

Prerequisites: none

Syllabus: Repetition of the basic principles of Bayesian inference. Markov chain, Monte Carlo and its use in Bayesian Statistics. Variations of this method and extensions. Building MCMC algorithms in R. Bayesian regression. Bayesian models using R and WinBUGS. Deviance information criterion and model complexity. Hierarchical models. Basic principles of Bayesian hypothesis testing, comparing and weighing models.

Recommended Reading

- Ntzoufras, I. (2009). Bayesian Modeling Using WinBUGS. Wiley. Hoboken. USA.
- Carlin B. and Louis T. (2008). Bayes and Empirical Bayes Methods for Data Analysis. 3rd Edition, London: Chapman and Hall.
- Gelman A., Carlin J.B., Stern H.S., Dunson, D.B., Vehtari, A. and Rubin D.B. (2013). Bayesian Data Analysis. Third Edition. Chapman and Hall/CRC.

Teaching Method: Face to Face.

Teaching includes: Class lectures.

Student Assessment Method: Written exam at the end of the semester.

Teaching Language: Greek.

STSP: Methodological Tools of Machine Learning (code: 6157)

Course Type: Elective

Course level: First cycle

Instructor: Professor A. Yannacopoulos and Assistant Professor St. Vakeroudis, Department of Statistics

E.C.T.S.: 7

Desired Learning Outcomes: Students will be able to:

- Deeply understand the functions of fundamental methodological machine learning tools, both analytical and computational
- Apply those tools to study real problems
- Integrate them into developing new techniques

Prerequisites: none

Syllabus: The course focuses on methodological tools of machine learning, such as:

- Reproducing kernel Hilbert spaces and applications
- Manifold learning, data geometry and applications
- Universal approximation theorems and applications to deep learning
- Probability Theory in high dimensions
- Gaussian processes and applications to machine learning

- Familiarization with Python

Recommended Reading

- Hofmann, Thomas, Bernhard Schölkopf, and Alexander J. Smola (2005). "A tutorial review of rkhs methods in machine learning." *Technical Report*.
- Higham, Catherine F., and Desmond J. Higham. (2019). "Deep learning: An introduction for applied mathematicians." *Siam review* 61.4: 860-891.
- Calin, Ovidiu. (2020). *Deep learning architectures*. New York City: Springer International Publishing, Ch. 9.
- Instructor's Notes.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Studying and analyzing bibliography. Assignments. Self-Study.

Student Assessment Method: Project Assignment or/and written exam at the end of the semester.

Teaching Language: Greek.

H' Semester

Categorical Data Analysis (code: 6108)

Course Type: Elective

Course level: First cycle

Instructor: Assigned Lecturer

E.C.T.S.: 8

Desired Learning Outcomes: At the end of the course, students are expected to know how to quantify different dependency forms between two or more categorical data (knowledge), to control which form of dependency appears to apply to a particular set of data (aptitude), to fit logistic regression models and to interpret the results of their data fit (capability).

Prerequisites: none

Syllabus: Types of categorical data. Contingency tables, joint, marginal and conditional probabilities, independence, comparison of proportions in 2x2 contingency tables (difference of proportions, relative risk, odds ratio), types of observational studies (retrospective, cross-sectional, prospective), odds ratio and other measures of correlation in LxJ tables. $\chi^{2\ test}$ of independence, exact tests, partition of the statistical function χ^2, test of independence for ordinal data, tests of linear trend for 2xL tables. Correlated data pairs, comparison of correlated proportions, Mc Nemar test for comparison of marginal proportions, measures of raters' agreement, odds ratio for agreement, kappa measure of agreement. Correlation in multidimensional contingency tables, conditional and marginal odds ratios, Simpson's paradox, partial-conditional independence, homogeneity, collapsibility, Cochran-Mantel-Haenszel tests. Logistic regression, interpretation of model parameters, inference in logistic regression, the case of categorical predictive variables, multiple logistic regression, model selection, test of goodness of fit. Models of logistic regression for polytomous variables.

Recommended Reading

- Agresti A., (2013). Categorical data analysis, Wiley.
- Agresti A., (2007). An Introduction to Categorical Data Analysis, Wiley.
- Hosmer, D., Lemeshow, S. and Sturdivant, R. (2013). Applied Logistic Regression, Wiley.
- Kateri, M. (2014). Contingency Table Analysis, Springer.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Lab exercise. Studying and analyzing bibliography. Assignments. Self-Study.

Student Assessment Method: Assignment. Written exam at the end of the semester.

Teaching Language: Greek.

Advanced Sampling Methods (code: 6128)

Course Type: Elective

Course level: First cycle

Instructor: Assigned Lecturer

E.C.T.S.: 7

Desired Learning Outcomes: Upon successful completion of the course, students will be able to recognize the type of statistical problems in real-time sample surveys as well as to select and apply the appropriate by case methodology. They will also have the ability to evaluate the quality of the results of the selected method.

Prerequisites: Basic knowledge of Statistics will be useful.

Syllabus: Statistical theory of finite populations: populations, sub-populations, variables, parameters. Random sampling, probabilities of selection of units. Sampling with unequal probabilities, sampling weights, self-weighting and non-selfweighiting sampling. Randomization in finite populations, estimation of finite population parameters and calculation of estimators' variances. Design effect. Estimation for sub-populations. Estimation of the distribution function. Graphics for survey data. Estimation for population size and rare populations.

Use of auxiliary information in estimation: Method of generalized regression (ratio estimator, regression estimator, poststratified estimator). Optimal regression estimator. Calibration.

Variance estimation in complex surveys. Resampling methods (random groups, jackknife, bootstrap).

Treatment of non-sampling errors. Methods of adjustment for non-response. Imputation.

Recommended Reading

- Lohr, S. (2010). Sampling: Design and Analysis. 2nd Edition. Brooks/Cole. Sengage learning.
- Sarndal, C-E., Swensson , B., Wretman , J. (1992). Model assisted survey sampling. Springer.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Lab exercise. Self-Study.

Student Assessment Method: Written exam at the end of the semester.

Teaching Language: Greek.

Statistical Methods for the Environment and Ecology (code: 6058)

Course Type: Elective

Course level: First cycle

Instructor: Associate Professor P. Besbeas, Department of Statistics

E.C.T.S.: 8

Desired Learning Outcomes: After successfully completing the course, students should be able to: distinguish between deterministic and statistical criteria for weighing/evaluating environmental contamination, apply contamination weighing criteria in stochastic models of enumerating violations of contamination threshold, compare the compatibility between keeping the statistical criterion and probability of violating the corresponding contamination threshold, determine the (spatial and temporal) distribution of pollutants concentration (produced at a constant rate at a constant source) based on a

stochastic model of molecular diffusion – transmission of the pollutant to the environmental medium, determine probability distribution for pollutant concentration in a fixed point in space based on the theory of consecutive stochastic diffusions, apply stochastic models of population dynamics in estimating the population size based on sampling data with various methods (inventory, survival, distance, retrieval).

Prerequisites: knowledge of Probability I and II and Stochastic Processes I, will be useful.

Syllabus: General overview of topics and problems of interest in environmental statistics and ecology. Criteria of weighing environmental pollutants. Applications of stochastic models in checking the keeping or violation of weighing criteria. Statistical analysis and modeling of extreme values (for example, exceeding the pollutant concentration threshold). Natural process of pollutant diffusion and dilution, and the Plume model of spatial and time distribution of pollutant concentration. The theory of stochastic dilution and asymptotic lognormal diffusion processes for modeling point concentration of pollutants. Introduction to spatial statistics methods, models and estimating the function of spatial scatter (variogram) and the Kringing regression.

Data types from studies of biological organizations and examples. Preliminary analysis of characteristic data sets. Special characteristics of sample distributions and the appropriate models, such as truncated, inflated, mixed. Overdispersion, underdispersion and appropriate models. Individual heterogeneity models. Model fit using maximum likelihood through arithmetic methods and the use of statistical packages (R). Estimating population size and variance. Methods of census and distance sampling. Capture – Recapture methodologies for closed and open populations. Ecological time series and their characteristics. Stochastic models of population dynamics: state – space models and models for simultaneous analyses of survival and census. Examples and applications.

Recommended Reading

- Ott, W. R. (1995). Environmental Statistics and Data Analysis, CRC Press, Inc.
- Barnett, V. (2004). Environmental Statistics: Methods and Applications, Wiley.
- Le, N.D. and Zidek, J.V. (2006). Statistical Analysis of Environmental Space-Time Processes, Springer.
- Williams, K., Nichols, J. and Conroy, M. J. (2002). Analysis and Management of Animal Populations. Academic Press, San Diego, California.
- Μπεσμπέας, Π. (2010). Στατιστικές Μέθοδοι στην Οικολογία, Πανεπιστημιακές Σημειώσεις
- Καρανδεινός Γ. Μ. (2007). Ποσοτικές Οικολογικές Μέθοδοι, Πανεπιστημιακές Εκδόσεις Κρήτης
- Σαϊτάνης Κ., Καρανδεινός Γ.Κ. (2010). Πληθυσμιακή οικολογία - δυναμική πληθυσμών. Έμβρυο.

Teaching Method: Face to Face.

Teaching includes: Class lectures.

Student Assessment Method: Written exam at the end of the semester.

Teaching Language: Greek.

Non-Parametric Statistics (code: 6113)

Course Type: Elective

Course level: First cycle

Instructor: E. Ioannidis. Associate Professor, Department of Statistics

E.C.T.S.: 8

Desired Learning Outcomes: At the end of the course students will be able to: Understand the non-parametric methods described and their properties. Apply these methods in real data analysis and correctly interpret the results.

Prerequisites: none

Syllabus: Nonparametric density estimation, histograms, Nadaraya-Watson estimator: bias, variance, tradeoff between them and bandwidth choice: plug in and cross-validation methods. Nonparametric regression: smoothing techniques. Estimator based on kernels (Nadaraya-Watson), asymptotic development of bias and variance, bandwidth choice, local polynomial regression and splines, variance estimation and confidence intervals. Generalized additive models (and regression trees). Empirical distribution function, empirical process, Kolmogorov –Smirnoff and similar tests. Statistics based on functional of the empirical distribution. Jackknife and Bootstrap: general principles, examples, parametric bootstrap, estimating parameter variance and bootstrap confidence intervals. Nonparametric tests based on ranks and concepts of robustness and asymptotic relative efficiency.

Recommended Reading

- Efron and Tibshirani. (1998). An Introduction to the Bootstrap. Chapman & Hall.
- Fan, J. and Gijbels, I. (1996). Local polynomial modelling and its applications. Chapman & Hall.
- Fox, J. (2000). Nonparametric Simple Regression: Smoothing Scatterplots. Sage Publications.
- Hajek, J. (1969). A Course in Nonparametric Statistics. Holden Day.
- Hastie, T. J. and Tibshirani, R. J. (1990). Generalized Additive Models. Chapman and Hall.
- Hettmansperger, T. and McKean, J. (2011). Robust nonparametric Statistical Methods. Boca Raton: CRC/Taylor & Francis.
- Higgins, J. J. (2004). Introduction to Modern Nonparametric Statistics. Thomson/Brooks/Cole, New York.
- Hollander, M. and Wolfe, D. A., (1999). Nonparametric Statistical Method. Wiley.
- Shao and Tu (1995). The Jackknife and the Bootstrap, Springer.
- Sidak, Z., Sen, P. K. and Hajek, J. (1999). Theory of Rank Tests. Academic Press.
- Silverman, B.W. (1986). Density Estimation for Statistics and Data Analysis. Chapman and Hall.
- Wand, M. P. and Jones, M. C. (1994). Kernel Smoothing. Chapman and Hall.
- Wasserman, L. (2006). All of Nonparametric Statistics. Springer.
- Wood, Generalized Additive Models. Chapman and Hall.
- Ξεκαλάκη , Ε. (2001). Μη παραμετρική στατιστική.

Teaching Method: Face to Face.

Teaching includes: Class lectures. Tutorial. Assignments. Self-Study.

Student Assessment Method: Written exam at the end of the semester. Written Project.

Teaching Language: Greek.

Special Topics in Statistics and Probability (STSP): Introduction to Measurement Theory with reference to Probability and Statistics (code: 6256)

Course Type: Elective

Course level: First cycle

Instructor: St. Vakeroudis, Assistant Professor, Department of Statistics.

E.C.T.S.: 7

Desired Learning Outcomes: After successfully attending the course students will become familiar with the basic concepts of measure theory and integration and will be able to use some of its basic tools. Thus, they will be able to approach the techniques used in the probabilities and statistics from a point of view of measurement theory, as well as the techniques of statistical/mechanical learning.

Prerequisites: none

Syllabus: Sets and functions. Algebra and S-algebra of sets. Open, closed and solid subsets of the real numbers. Constructing the Lebesgue measure in real numbers. Measurable sets according to Borel and Lebesgue. The Cantor set and the Cantor function. Non-measurable sets according to Lebesgue.

Measurable functions according to Lebesgue. Borel Functions. Random variables. Sequences of functions and random variables and convergence concepts (almost certain, in measure).

The Lebesgue integral, construction and properties. Basic convergence theorems, (the Fatou Lemma, monotonous convergence theorem, dominated convergence theorem). Expected price. Convergence in distribution and applications in statistics (estimation, simulation, etc).

Lebesgue spaces of integrable functions and random variables and their structure as metric spaces. Holder and Minkowski inequities, the Beppo-Levi theorem and completeness. Convergence in Lebesgue spaces and applications. The case of L^2, its structure as a Hilbert space, the projection theorem and its relation to conditional mean value, bases and expansions (eg. Karhunen-Loeve transform, etc.).

Product measure, construction and properties and relation to independence. Integration and product measure, Fubini theorem.

Absolute continuity and measure singularity. Hahn-Jordan decomposition. Radon-Nikodym derivation. Measure space as an extension of the functions. Applications in statistics (the conditional average value under a new prism, likelihood, extreme event simulation, consistency) in finance.

Measure space as a metric space and applications. Total change distance, Helinger distance, Kuhlback-Leibler distance (entropy), transportation distance. Applications in model selection statistical and machine learning, etc.

Recommended Reading

- Athreya, Krishna B., and Soumendra N. Lahiri. (2006). Measure theory and probability theory. Springer Science & Business Media.
- Billingsley, P. (2008). Probability and measure. John Wiley & Sons.
- Capinski, M., & Kopp, E., (2003). Measure, Integral and Probability. Springer-Verlag.
- Jacod, J., & Protter, P. E. (2003). Probability essentials. Springer Science & Business Media.
- Καλπαζίδου, Σ. (2002). Στοιχεία μετροθεωρίας πιθανοτήτων. Εκδόσεις ΖΗΤΗ.

Teaching Method: Face to Face.

Teaching includes: Class lectures.

Student Assessment Method: Assignments. Written exam at the end of the semester and/or assignment.

Teaching Language: Greek.

Research Methodology (code: 6117)

Course Type: Elective

Course level: First cycle

Instructor: E. Tsompanaki, Laboratorial Teaching Staff

E.C.T.S.: 7

Desired Learning Outcomes: Upon completion of the course, students will be able to:

- Search for and read scientific papers, and identify the various parts that make up each one.
- Identify problematic points in studies and ethical issues.
- Understand the necessity of using different tools to measure variables of interest and, where necessary, be able to gather information regarding their reliability and validity.
- Shape the different stages in the design of a research study and all its specific characteristics.

Prerequisites: none

Syllabus: The research process. Research - Research Methodology - Research Methods. Research questions. Reading and evaluating literature. Sample collection, Measurement tools, Types of scales,

Validity and reliability indicators, Methods of data collection. Writing a report using a specific citation style. Creating and delivering a presentation.

Recommended Reading

- Veal A.J., Χρήστου Ε. (2022). *Ερευνητικές Μεθοδολογίες στις Κοινωνικές Επιστήμες*. BROKEN HILL PUBLISHERS LTD.
- Καλογεράκη Στ. (2020). *Σχεδιασμός και κατασκευή ερωτηματολογίων στην κοινωνική έρευνα.* Κριτική.
- Δαρβίρη Χρ. (2009). *Μεθοδολογία Έρευνας στο Χώρο της Υγείας.* ΙΑΤΡΙΚΕΣ ΕΚΔΟΣΕΙΣ Π. Χ. ΠΑΣΧΑΛΙΔΗΣ.
- Gall, M., Borg, W & Gall, J. (2013). *Εκπαιδευτική Έρευνα-Βασικές Αρχές*, BROKEN HILL PUBLISHERS LTD.
- Σταλίκας, Α. Κυριάζος, Θ. (2019.) *Μεθοδολογία έρευνας και Στατιστική Με τη χρήση R.*ΜΟΤΙΒΟ ΕΚΔΟΤΙΚΗ Α.Ε.
- Creswell J. D, Creswell W J. (2019). *Σχεδιασμός Έρευνας*. ΠΡΟΠΟΜΠΟΣ.
- Gay R.L, Mills E.G, Airasian, P. (2017). *Εκπαιδευτική Έρευνα.* ΠΡΟΠΟΜΠΟΣ.
- Schindler S. P .(Συγγρ.) - Αποστολάκης Αλ., Κουργιαντάκης Μ. (Επιμ.).(2019). *Μέθοδοι έρευνας για τις επιχειρήσεις.* Εκδόσεις Κριτική Α.Ε.
- Gray D. (Συγγρ.)- Χατζόγλου, Πρ., Δελιάς Π (Επιμ.) (2018). Η ερευνητική μεθοδολογία στον πραγματικό κόσμο. Εκδόσεις Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε.
- Beatty, P. C., Collins, D., Kaye, L., Padilla, J. L., Willis, G. B., & Wilmot, A. (Eds.). (2019). *Advances in questionnaire design, development, evaluation and testing*. John Wiley & Sons. [electronic resource] https://onlinelibrary.wiley.com/doi/book/10.1002/9781119263685.
- Kenett, R., & Salini, S. (2012). *Modern Analysis of Customer Surveys*. Jhon Wiley and Sons. [electronic resource] https://onlinelibrary.wiley.com/doi/book/10.1002/9781119961154.
- Biemer, P. P., Groves, R. M., Lyberg, L. E., Mathiowetz, N. A., & Sudman, S. (Eds.). (2013). *Measurement errors in surveys* (Vol. 548). John Wiley & Sons. [electronic resource] https://onlinelibrary.wiley.com/doi/book/10.1002/9781118150382.

Teaching Method: Face to Face.

Teaching includes: Class lectures.

Student Assessment Method: Written exam at the end of the semester. Project. Project Presentation

Teaching Language: Greek.

Special Topics in Statistics and Probability (STSP): Decision Theory (code: 6178)

Course Type: Elective

Course level: First cycle

Instructor: Assigned Lecturer

E.C.T.S.: 7

Desired Learning Outcomes: Upon successful completion of the course, students will be able to:

- Construct a table of financial outcomes in a decision problem with a finite number of different possibilities and decisions.
- Find the optimal decision based on the criterion of (i) maximize the minimum financial gain, (ii) maximize the maximum financial gain, (iii) the prevailing possibility, (iv) the Hurwicz index and (v) Bayes.
- Construct a table of loss of the chance of financial gain.

- Find the optimal decision based on the criterion of minimizing the expected loss of the chance of financial gain.
- Construct a table of financial outcomes with added information and find the optimal decision.
- Construct a decision tree.
- Locate the points of balance in a game – if there are any.

Prerequisites: none

Syllabus: Decision making under conditions of uncertainty. Calculating the financial outcomes for every combination of an act and a possible event. Decision criteria (criteria based exclusively on the possible financial outcomes). A priori decision-making analysis (Hurwicz alpha index, the Bayes criterion, expected value of complete information. Graphical analysis of decision-making problems. Point and possibility of indifference. The normal distribution in a priori decision making. The Bayes criterion and sensitivity analysis). Decision making and the theory of money utility. Constructing the money utility curve. Expected utility value as a decision criterion. Posterior analysis of decision making (utilization of additional information to improve decisions, creating the tree diagram). Pre-posterior analysis of decision making. Bayesian decision making and classic statistical induction. Introduction to game theory (complete and incomplete information games, two player zero sum games).

Recommended Reading

- Ευάγγελος Μαγείρου. (2012). Παίγνια και Αποφάσεις, Εκδόσεις Κριτική.
- Κ. Μηλολιδάκης. (2009). Θεωρία Παιγνίων, Εκδόσεις Σοφία.
- J. Q. Smith. (1988). Decision Analysis: A Bayesian Approach, Chapman and Hall.
- F. S. Hillier and G. J. Lieberman. (2005). Introduction to Operations Research, Mc GrawHill.

Teaching Method: Face to Face.

Teaching includes: Class lectures.

Student Assessment Method: Written exam at the end of the semester and/or assignment.

Teaching Language: Greek.

Special Topics in Statistics and Probability (STSP): Sports Data Analytics (code: 6238)

Course Type: Elective

Course level: First cycle

Instructor: Professors D. Karlis and I. Ntzoufras, Department of Statistics

E.C.T.S.: 7

Desired Learning Outcomes: Upon successful completion of the course, students will be able to:

- Understand the uncertainty of sporting events.
- Analyze data using correct and appropriate methods from various sports.
- Provide predictions for sporting events.
- Demonstrate knowledge of data analysis and statistical concepts, delivering critically reasoned analysis through written and oral presentations.

Prerequisites: none

Syllabus:

- Review on distributions and GLM
- Type of sports data, data collection and challenges
- Data Visualization of sports data
- Paired comparison models
- Models for football

- Models for basketball
- Models for tennis and other sports
- Performance analysis for various sports. Indices and rationale
- Probabilities and Betting
- Sports Economics
- Other quantitative methods, scheduling
- Applications with real data

Recommended Reading

- Albert, J., Bennett, J., & Cochran, J. J. (Eds.). (2005). *Anthology of statistics in sports*. Society for Industrial and Applied Mathematics.
- Zuccolotto, P., & Manisera, M. (2020). *Basketball data science: With applications in R*. CRC Press.
- Dobson, S., Goddard, J. A., & Dobson, S. (2001). *The economics of football* (Vol. 10). Cambridge: Cambridge University Press.

Teaching Method: Face to Face.

Teaching includes: Class lectures.

Student Assessment Method: Written exam at the end of the semester and project assignments either in-group or individual.

Teaching Language: Greek.

Special Topics in Statistics and Probability (STSP): Quantitative Methods in Pensions and Social Security (code: 6226)

Course Type: Elective

Course level: First cycle

E.C.T.S.: 7

Desired Learning Outcomes: Upon successful completion of the course, students will be able to:

- Understand the different types of pension schemes.
- Understand the relationship between contributions and benefits, and the impact of economic and biometric assumptions on the valuation of pension schemes.
- Assess the adequacy of pension scheme reserves as well as their sustainability.

Prerequisites: none

Syllabus: Structure, systems, and funding sources of Pension Funds, Design of benefit programs, definition of technical basis, Demographic and economic assumptions, Complex actuarial interest functions based on multi-expenditure tables, Population models. Actuarial measures for liability valuation, Standard and supplementary funding cost, Unfunded liability, actuarial gain/loss, Actuarial balance, Categorization and evaluation criteria for funding methods, Accumulated and Projected benefit methods, Separate and total cost methods. Basic principles of Social Security, Actuarial view of the pay-as-you-go system, The international phenomenon of population aging, Qualitative study of key actuarial funding methods, sensitivity analysis of assumptions, Medium to long-term projections, Assets and investments.

Recommended Reading

- Φράγκος Ν., Γιαννακόπουλος Α., Βρόντος Σ. Μαθηματικά-Οικονομικά της Σύνταξης. Πανεπιστημιακές Σημειώσεις.
- Aitken W.H. Pensions Funding and Valuation, ACTEX Publications, Winsted, Connecticut.
- Lee, E.M. An Introduction to Pension Schemes, The Institute of Actuaries and the Faculty of Actuaries.

- McGill, D. M., Brown, K.N., Haley, J.J., Schieber, S.J. Fundamentals of Private Pensions, Philadelphia: University of Pennsylvania Press.
- Subject, H. Pensions, Actuarial Education Company, London.
- Winklevoss, H. E. Pension Mathematics with Numerical Illustrations, Philadelphia: University of Pennsylvania Press.
- Νομοθεσία για την Κοινωνική Ασφάλιση (ν. 2084/92).
- Υπουργείο Εργασίας και Κοινωνικών Ασφαλίσεων Κοινωνικός Προϋπολογισμός έτους 1998.

Teaching Method: Face to Face.

Teaching includes: Class lectures.

Student Assessment Method: Written exam at the end of the semester.

Teaching Language: Greek.

Bachelor Dissertation (code: 6907)

Course Type: Elective

Course level: First cycle

Coordinator: Assistant Professor: St. Vakeroudis, Assistant Professor, Department of Statistics

E.C.T.S.: 8

Desired Learning Outcomes: At the end of the dissertation students will have extensive experience in using interdisciplinary knowledge in a particular area and will have improved their understanding of a research question or problem, the analysis and processing of the relevant evidence and other problem-solving techniques as appropriate.

Prerequisites:

Syllabus: The dissertation may only be undertaken in the 4th year of studies or later. To be eligible, a student must have passed all compulsory courses and have an average grade of at least 7. The dissertation spans one semester and is supervised by an assigned faculty member, with two additional faculty members serving as examiners. Presentations are scheduled on a specific date and time designated for all dissertations, typically during or shortly before the corresponding exam period. The dissertation is worth 8 ECTS credits. (URL: https://www.dept.aueb.gr/en/stat/content/bachelor-dissertation).

Practical Training (code: 6801)

Course Type: Elective

Course level: First cycle

Coordinator: Professor D. Karlis, Department of Statistics

E.C.T.S.: 6-14

Desired Learning Outcomes: Upon completion of the practical training students will be able to:

- Understand how to tackle a statistical problem using real data.
- Comprehend, explore, and formulate a real-world problem of statistical content in the context of statistical analysis.
- Recognize the role of a statistician in a company and understand how to interact with colleagues and function effectively within a team.
- Manage time efficiently when working on a project.

- Handle various types of data from different sources.
- Compile reports on the results of statistical analyses.
- Transfer theoretical knowledge to practical applications.
- Gain work experience and develop work-related skills while discovering the professional environment.
- Learn how to write a CV and select prospective employers or a suitable work environment.

Prerequisites:

Student must:

- Have completed the 5th semester.
- Not have participated previously in practical training.
- Have accumulated at least 80 ECTS.
- Have successfully completed at least 8 compulsory courses.
- Participate in a relevant informative session/seminar organized by the Practical Training office.

PART THREE

C. General Information for Students

AUEB places an emphasis not only on providing students with high quality education, but also on offering high-quality auxiliary student services.

C1. STUDENT CLUB

The operation and administration of Student Clubs in Greek universities was established through the promulgation of Presidential Decree 387/83 and Law 1404/83. The aim of these clubs is to improve students' living standards, entertainment, and social and spiritual well-being through a variety of participatory processes and initiatives. The implementation of these objectives is achieved by ensuring the necessary infrastructure for housing, catering, and sports activities, providing restaurants, cafeterias, reading rooms, and libraries, and organizing lectures, concerts, theater performances, and excursions both in Greece and abroad. Additionally, the clubs promote international student relations, offer foreign language instruction—including Greek as a foreign language for international students and individuals of Greek descent—and implement various other measures to support students. Detailed information about: a) food and housing, b) foreign languages, c) sports and cultural activities, and d) grants and scholarships, is provided on the Student Club's website (https://lesxi.aueb.gr/).

The Student Club of AUEB ensures the provision of free housing to its students under specific conditions, which are detailed on the Student Club's website at https://lesxi.aueb.gr/. Additionally, the University's Student Club operates a Housing Office located in the main building, which compiles apartment rental listings. The central university building also houses a restaurant, where all members of the university community can dine, either for free or at a cost. Free meals are available to those who meet the necessary criteria, which can be obtained from the Student Club office. The cost of living for students, based on current housing and food prices, is reduced accordingly, if the student qualifies for free housing and meals.

C2. ELECTRONIC SERVICES

A significant number of procedures related to both student life and student welfare are conducted electronically through applications provided by the University or the Ministry of Education, Religion, and Sports. These applications are accessible using the same credentials (username & password) and are described below:

- Email (e-mail): All students acquire an email account in the format "username@aueb.gr". Access to the email is granted using the username/password of their academic account. Detailed instructions are available at: https://www.aueb.gr/el/content/webmail-manual.
- Student Record System (e-Secretariat): The e-Secretariat application is the information system through which students may interact with the Department's Secretariat via the web.
- eLearning Platform (eCLASS): The Open eClass platform is a comprehensive eLearning Management System and serves as the Academic Network's proposal for supporting Asynchronous eLearning Services. Usage instructions are provided at: https://eclass.aueb.gr/info/manual.php.
- Wireless Network at the University (WiFi): Using their personal credentials, students have access to the wireless network throughout the premises of AUEB. More information can be found at the WiFi intructions.

- Virtual Private Network (VPN): To access services such as library resources (books/journals), students need to connect their computer to the AUEB VPN service. Instructions can be found at https://www.aueb.gr/content/vpn-service.
- "EUDOXUS" Program: Using their personal credentials, students have access to the "ΕΥΔΟΞΟΣ" system, which automates the selection and distribution of textbooks for all universities. Through the Integrated Management System for Textbooks and Other Aids, students can select the textbooks they need for each course and be informed about the pickup location and time.
- Communication – Information – Connection with the AUEB Community:
  - Official AUEB channels, available at https://www.aueb.gr/el/content/social-media-aueb, provide updates on university news and activities.
  - "AUEB Cast" includes webcasts and podcasts on topics such as entrepreneurship, innovation, technology, and social responsibility. Shows can be found at https://www.aueb.gr/el/content/aueb-cast.
  - AUEB introduces the "3D Virtual Tour Application" offering a unique guided tour experience of its premises, enhancing accessibility. Explore the Virtual Walkthrough at https://www.aueb.gr/el/content/egkatastaseis.\
  - Visit the "ΟΠΑ News" newspaper at https://www.aueb.gr/el/opanews, published regularly, with special features and articles on contemporary and interesting topics.
- "myAUEB" Application: This undergraduate studies application, linked to university information systems and external information systems, provides students with information on a wide range of services and capabilities, including digital communication with the Department's Secretariat for submitting requests, connection to e-class and e-Secretariat, and linking to AUEB's Social Media, etc. More information is available at https://www.myauebapp.gr/.

C3. MEDICAL SERVICES, INSURANCE, HEALTHCARE

Undergraduate and postgraduate students as well as doctoral candidates of the University who do not have other health and hospital care coverage are entitled to full medical and hospital care under the National Health System (NHS) with expenses covered by the National Organization for Healthcare Services Provision (EOPYY). The University also operates a Mental Health Counseling Service, staffed by a psychiatrist specializing in the psychodynamic treatment of mental health issues (https://www.aueb.gr/el/content/ypiresia-symvoulou-psyhikis-ygeias). For more information, please visit the website: https://www.aueb.gr/el/content/medicalservices.

C4. SERVICES FOR STUDENTS WITH DISABILITIES

AUEB facilitates students with special needs by designing, implementing, and applying accessibility adaptations to ensure access to university buildings. Specifically, the main building is equipped with specially designed elevators, ramps, and lifts. Additionally, there are specific regulations for conducting exams for students with special needs. At AUEB, a Committee for Equal Access of Persons with Disabilities and Persons with Special Educational Needs has been established. The Committee serves as an advisory body and its mission is to submit recommendations to the relevant authorities for the development and implementation of policies ensuring equal access for persons with disabilities and those with special educational needs. Furthermore, the University provides a special vehicle to serve the daily needs of students facing mobility challenges, picking them up from their residences, and transporting them to AUEB's facilities to attend lectures in amphitheaters, just like their fellow students. This pioneering

initiative is expected to launch in the new academic year, starting in September 2024. Moreover, through the services of the AUEB Library, students with print disabilities can access the recommended Greek bibliography for their courses in electronic format. Within this framework, the Association of Greek Academic Libraries (HEAL-Link) has developed a multi-topic electronic library named AMELib. For more information, please visit the website: https://www.aueb.gr/el/lib/content/αμεα-άτομα-με-ιδιαίτερες-ανάγκες.

C5. FACULTY ADVISORS

The Faculty Advisors are available to assist students with questions and provide guidance regarding the educational process during office hours, which are announced outside the professors' or consultants' office. The faculty advisor is responsible for informing students, engaging in discussions with them, and providing advice on the following topics:

- The structure of the curriculum and the course content, so that students are up-to-date regarding topics such as prerequisite courses and, more generally, the background needed to attend courses.
- Participating in recitations, labs and intermediate exams, in order to improve the understanding of the course material and ensure success in the examinations.
- The content of the elective courses, so that students elect those courses that are the closest to their academic and personal interests.
- Exam results.
- Choosing a senior thesis topic.
- Continuing their studies at the postgraduate level, either in Greece or abroad.
- Professional prospects and entering the job market during their studies (through the practical training program) and after their graduation.
- Any other topic or issue that the student will bring up that directly or indirectly pertains to their studies.

C6. CLASSROOMS - STUDY HALLS – LIBRARIES

The Library and Information Center (LIC) of AUEB was established in 1920 and operates in the first and the second floor of the main building of the University. It participates in the Hellenic Academic Libraries Link (Heal-LINK), the Europe Direct network of the European Documentation Center, and the Hellenic Economic Library Network (H.E.LI.N.). Within the Library, three (3) Documentation Centers are in operation:

- The European Documentation Center (EDC), since 1992,
- The Organization for Economic Co-operation and Development (OECD) Center, since 1997,
- The Heritage Center of publications of the World Tourism Organization (UNWTO), since 2004.

The Library contributes decisively in both meeting the needs of scientific information of the university community and supporting the educational and research work. This objective is achieved through the uniform organization of the collections and the coordination of the provided services. The Library offers access to:

- printed collections of books and scientific journals,
- the textbooks taught in the courses,
- a collection of electronic scientific journals,
- a collection of electronic books,
- the postgraduate dissertations and PhD theses completed at AUEB and archived in digital format in the Institutional Repository PYXIDA,
- sectoral studies,
- statistical series from national and international organizations,

- audiovisual material,
- information material (encyclopedias, dictionaries),
- collections of the official governmental publications of the European Union, the OECD, and the UNWTO,
- databases of issues cultivated at the University,
- printed collection of other academic libraries.

The Library operates as a lending library for its members with regard to all printed collections, except for the collection of journals and statistical series, in accordance with its internal operating rules. The Library and Information Center (LIC) of AUEB features a study hall, workstations with PCs for guests, photocopying and printing equipment, while also providing students with the option to borrow books and journal articles from other academic libraries that are members of the networks the library participates in (https://www.aueb.gr/el/library).

C7. STUDENT SUPPORT UNIT

The unit operates the following offices:

a. Internships and Career Integration Office: This Office is aimed at undergraduate and graduate students and graduates of the institution's programs. Its mission is to promote the best possible connection between theory and practice and to facilitate the transition of students from academic to professional life. Internships are an integral part of education at AUEB, as all Departments have institutionalized and included them in their curriculum.
b. Support for International Students and Mobility Office: This Office addresses international students enrolled in undergraduate, graduate, and postgraduate programs, as well as students interested in participating in mobility programs.

C8. INCUBATION & ACCELERATION CENTER OF AUEB

In the incubation and acceleration center (https://acein.aueb.gr/) function the following:

a) Transfer Unit
b) Incubation center

The purpose of the Technology Transfer and Innovation Unit is to strengthen the research capacity of the Foundation, its connection with industry, the transfer of the knowledge produced to society and the cultivation of the idea of entrepreneurship within the academic community.

C9. STUDENT ASSOCIATIONS

Within the university community of AUEB various Organizations and Student Associations are active and continuously developing. For more information, you can visit the main webpage of AUEB: https://www.aueb.gr/el/content/σύλλογοι-φοιτητών.

C10. ALUMNI NETWORK

Continuing its long-standing tradition of promoting top executives in the economic, social, and political life of the country, AUEB takes pride in the fact that thousands of its graduates hold leadership positions in universities in Greece and abroad, international research institutes and organizations, as well as major

public and private sector companies. Recognizing the importance of developing and strengthening bonds with its Alumni, AUEB has created its Alumni Network, a platform https://alumni.aueb.gr/ where all university graduates can register. The main objectives of the Network are to reconnect graduates with their colleagues and former classmates, while keeping them informed about all activities, services, and events relevant to them. For additional information, please visit: https://www.aueb.gr/el/content/οργανώσεις-και-σύλλογοι-φοιτητών-και-αποφοίτων.

C11. VOLUNTEERING PROGRAMME

As part of its strategy for Social Contribution, AUEB has launched the "AUEB Volunteers" Program. The program aims to foster a culture of volunteering, both as a significant learning experience and as a responsibility of every responsible citizen. The objectives of "AUEB Volunteers" include: (a) volunteer actions in collaboration with NGOs or independently, (b) awareness-raising activities on volunteering and citizen engagement, and (c) improvement actions for university infrastructures and services (https://www.aueb.gr/el/volunteers).

C12. QUALITY ASSURANCE UNIT

AUEB implements a quality assurance policy aimed at continuously improving the quality of its study programs, research activities, and administrative services, enhancing academic and administrative work, and improving overall university operation. The Quality Assurance Unit (MOQI) coordinates and supports evaluation processes. Specifically, quality assurance in educational activities is achieved through the use of questionnaires for evaluating: (a) courses/teaching of undergraduate and postgraduate study programs, (b) educational laboratories of the institution, (c) research of postgraduate students, and (d) research of first-year students, which are completed by students (https://www.aueb.gr/el/modip).

C13. CENTER OF CONTINUING EDUCATION AND LIFELONG LEARNING

The Center for Continuing Education and Lifelong Learning is a unit of AUEB ensuring coordination and interdisciplinary collaboration in the development of vocational programs, continuing education, training, and general lifelong learning. These programs complement, modernize, or upgrade knowledge, skills, and abilities acquired through formal education systems, vocational training, initial professional training, or professional experience, facilitating integration or reintegration into the labor market, ensuring employment, and promoting professional and personal development (https://www.aueb.gr/el/content/dia-vioy-mathisi-kedivim-opa).

C14. COMPLAINS & APPEALS

With the aim of continuously improving the quality of educational and administrative services offered by the University, a process for managing complaints and appeals of students has been established to ensure their immediate and comprehensive handling, with a focus on effectiveness and confidentiality. The complaints and appeals form can be found at the following link: https://www.aueb.gr/el/complaints-form.

C15. GENDER EQUALITY

Promoting Gender Equality at all levels of operation and all aspects of academic life at AUEB is a significant aspect of the University's Social Responsibility. AUEB's actions and structures for Gender Equality aim to raise awareness within the academic community about its critical importance and to fully integrate Gender Equality into all aspects of the university's operations. Through these structures and actions, AUEB seeks to instill a culture of equality and fairness within the Institution. More information is available at https://isotita.aueb.gr/.