ΟΙΚΟΝΟΜΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ

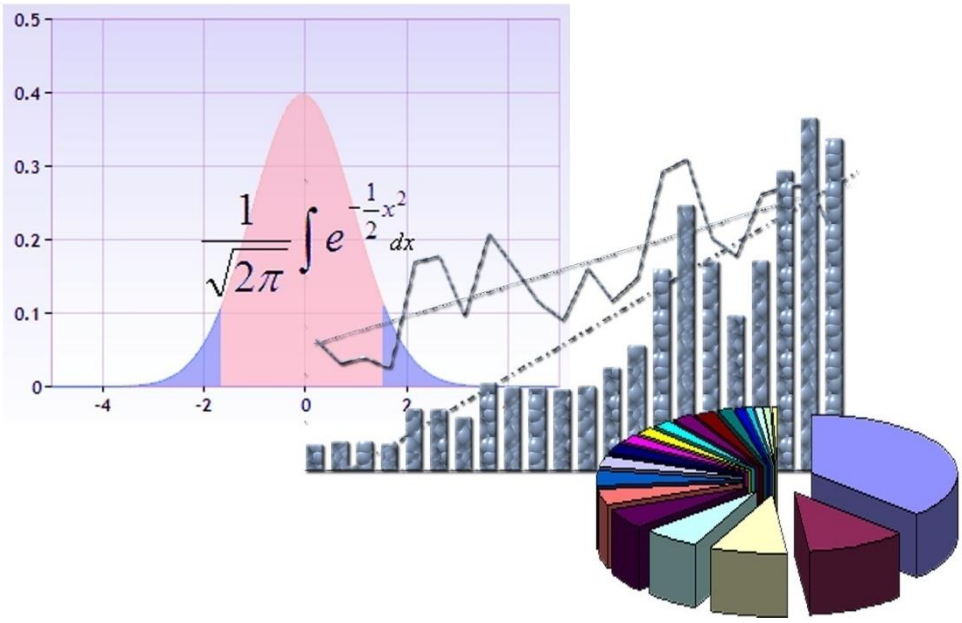
ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS

SCHOOL OF INFORMATION SCIENCES AND TECHNOLOGY

DEPARTMENT OF STATISTICS

UNDERGRADUATE STUDIES GUIDE

2022-2023



ATHENS, SEPTEMBER 2022

Athens University of Economics and Business Academic Authorities

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Vice Rector for Academic Affairs: Professor Vasileios Vasdekis
Vice Rector of Research and Lifelong Learning: Associate Professor Georgios Lekakos
Vice Rector for Economic Affairs: Professor Konstantinos Drakos
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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, Research and Religious Affairs.

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 a rich history of significant scientific achievements that characterize 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. It was renamed as the Grand School of Economic and Commerce Studies (Ανωτάτη Σχολή Οικονομικών και Εμπορικών Επιστημών (Α.Σ.Ο.Ε.Ε.)) in 1926. Until 1955, the school was operating with a single-class, three-year curriculum. In 1955 the school converted to a four-year curriculum, with the fourth year's student body being divided in two departments, the Department of Economic Studies and the Department of Commercial Studies. In 1970 the division of the student body started to take place in the second year. 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 initiated by the Department of Business Organization and Administration in 1985.

The Athens University of Economics and Business (AUEB) has been historically established in the collective consciousness of the academic community - Greek students and society - as a leading University in its core areas of expertise. Its reputation reflects, on one side, the high quality of its scientific personnel, the quality of its research and teaching activities, and its modern programs of studies, and, on the other hand, its outstanding graduates that are professionally active in Greece as well as abroad.

2. Academic Authorities and Services

The organization and operation of AUEB follows applicable law, notably Law N.4957/2022 (ΦΕΚ 141/21.07.2022 τ. Α΄).

ADMINISTRATIVE BODIES:
a) 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 is comprised of eleven (11) members, of which six (6) are internal and five (5) are external.
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SENATE
THE Senate is comprised of:

I. The Rector,
II. The School Deans
III. The School's Presidents
IV. One representative per staff category (ΕΕΠ, ΕΔΙΠ, ΕΤΕΠ, and administrative staff)
V. Students representatives, at a 10% rate of the total Senate members of above cases I to III.

SCHOOLS

The Athens University of Economics and Business comprised of **three Schools**:

1. **SCHOOL OF ECONOMICS:** Oversees and coordinates the operation of the Department of International and European Economic Studies and the Department of Economics.
2. **SCHOOL OF BUSINESS:** Oversees and coordinates the operation of the Department of Management Science and Technology, the Department of Business Administration, the Department of Accounting and Finance and the Department of Marketing and Communication.
3. **SCHOOL OF INFORMATION SCIENCES AND TECHNOLOGY:** Oversees and coordinates the operation of the Department of Informatics and the Department of Statistics.

DEPARTMENTS
Departments are the primary educational and academic units of the University. They are tasked with advancing science and technology in their respective fields and administer a curriculum that continuously keeps up with the latest developments. The Department consists of members of Academic Staff, members of the Special Educational Staff (Ειδικό ΕκπαιδευτικόΠροσωπικό-ΕΕΠ), members of the Laboratory Teaching Staff (Εργαστηριακό Διδακτικό Προσωπικό-Ε.ΔΙ.Π.) and members of the Special Technical Laboratory Staff (Ειδικό Τεχνικό Προσωπικό–ΕΤΕΠ).
The Departments of AUEB are the following:

1. Department of International and European Economic Studies
2. Department of Economics
3. Department of Management Science and Technology
4. Department of Business Administration
5. Department of Accounting and Finance
6. Department of Marketing and Communication
7. Department of Informatics
8. **Department of Statistics**

3. List of degree programs offered

Each department at the Athens University of Economics and Business offers a corresponding curriculum, with includes a number of focus areas that provide specialization, as follows:

A/A	DEPARTMENT CURRICULUM	SPECIALIZATIONS/ CYCLES(*)

1.	Department of International and European Economic Studies	1. International Economics and Finance 2. International and European Political Economy
2.	Economics	1. Economic Theory and Policy 2. Business Economics and Finance 3. International and European Economics
3.	Management Science and Technology	1. Operations Research and Business Analytics 2. Operations and Supply Chain Management 3. Software and Data Analysis Technologies 4. Information Systems and Electronic Business 5. Strategy, Entrepreneurship and Human Resources
4.	Business Administration	1. Business Administration 2. Information Systems Administration 3. Accounting and Finance Administration 4. Marketing
5.	Accounting and Finance	1. Accounting 2. Finance
6.	Marketing and Communication	1. International Management, Innovation and Entrepreneurship 2. Human Resource Management 3. Business Analytics 4. Digital Marketing
7.	Informatics (*)	1. Theoretical Computer Science 2. Computer Systems and Networks 3. Information Systems and Information Security 4. Databases and Knowledge Management 5. Operational Research and Economics of Information Technology 6. Computational Mathematics and Scientific Calculations
8.	Statistics	1. Data Science 2. Operational Research 3. Applied Mathematics

(*) The Department of Statistics does not offer specific directions in studies, but the above mentioned cycles. Likewise, the Informatics Department offers, instead of directions, the above mentioned cycles, of which the students must choose two.

More detailed information on the curriculums provided at the corresponding course guides and the departments' websites.

4. Studies Structure

Undergraduate studies in the departments of AUEB are organized in a system of semester-long courses, according to the Undergraduate Curriculum drawn up by the Department Assembly of each department. The academic year starts on the 1stof September and ends on the 31st of the following August. Academic activities are organized in two semesters, the winter semester and the spring semester. The duration of undergraduate studies is four years (eight semesters).

Semesters last 13 weeks and are interrupted by the Christmas and Easter breaks. At the end of each semester there is an examination period lasting 4 weeks.

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

On the last week of August begins the September examination period (repetitive), which lasts 4 weeks and is followed by the beginning of classes for the winter semester.

Precise dates for the start and end of semesters and examination periods are drafted by the Studies Unit, ratified by the Senate, and announced in the academic calendar of the university.

5. Enrollment

Entrance in the Department is achieved primarily though the Panhellenic examinations. The enrollment of the persons succeeded in these examinations, takes place each September through the electronic enrollment information system of the Ministry of Education, Research, and Religious Affairs.

6. Basic Regulations (including procedures of academic recognition)

A small sample of the Institutions Basic Regulations:

- ✓ The internal regulation for the operations of AUEB
- ✓ The regulation of administrative services
- ✓ The Postgraduate Programs and PhD Operation Regulation
- ✓ The Internal Regulation for the Conduction of Post-Doc Research
- ✓ The Regulation on the Administration of Examinations

7. Personnel

The University staff is comprised by the following categories:

- **TEACHING STAFF:**
  - Faculty members that are divided in (a) Professors, (b) Associate Professors, (c) Assistant Professors.
  - Special Teaching Staff (Ειδικό Εκπαιδευτικό Προσωπικό-Ε.Ε.Π.) and
  - Laboratory Teaching Staff (Εργαστηριακό Διδακτικό Προσωπικό-Ε.ΔΙ.Π.).
  - Special Technical Laboratory Staff (Ειδικό Τεχνικό Προσωπικό–ΕΤΕΠ).
  - Assisting Teaching Staff (Επικουρικό Διδακτικό Προσωπικό-Ε.Δ.Π.)
  - University and Academic Scholars
  - Teachers by secondment
- **ADMINISTRATIVE STAFF**

8. Services

The Athens University of Economics and Business provides both administrative and other services (catering, housing, library, sports, etc.) to cater its students as well as the administrative and teaching

staff. More information on the organization and operation of the University's services can be found at the 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 compliance of the University with the principles and rules of the European Credit Transfer and Accumulation System (ECTS), oversees the adherence to and application of these principles and rules, and is responsible for ensuring the smooth process of ECTS unit transfer and accumulation.

10. Academic Year/ Semester Important Dates *

- Winter Semester: October 3RD 2022 to January 13th 2023
- Christmas Holidays: December 23rd 2022 to January 8 2023
- Fall Semester Exams Period: January 16st 2023 until February 10th 2023
- Spring Semester: February 13th 2023 until May 26, 2023
- Easter Holidays: April 8th 2023 until April 23rd 2023
- Spring Semester Exams Period: May 29th 2023 until June 23rd 2023

** According to the 2022-23 Academic Calendar*

11. Official Holidays

- ✓ October 28th 2022 (28th of October National Celebration)
- ✓ November 17th 2022 (The Anniversary of Polytechneio)
- ✓ January 6th 2023 (Epiphany)
- ✓ January 30th 2023 (Three Hierarchs)
- ✓ February 27th 2023 (Clean Monday)
- ✓ March 25th 2023 (Greek Independence Day)
- ✓ May 1st 2023
- ✓ June 5th 2023 (Pentecost Monday)

PART TWO
DEPARTMENT OF STATISTICS

The Hellenic Authority for Higher Education (HAHE) **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), for the level of studies 6 of the National and European Qualifications Framework. The accreditation is valid for four years, from 29.05.2020 until 28.05.2024. The accreditation report is available at the following link: https://www.aueb.gr/en/node/20747.

A. GENERAL DESCRIPTION

A1. Establishment and Operation

Under the 377/1989 PD, according to which ASOEE is renamed to Athens University of Economics and Business (AUEB), the Statistics Department is founded in June of 1989. It was preceded by the establishment of the joint Department of Statistics and Informatics (PD 313/1984), while Statistics initially already appeared in the first ever AUEB Yearbook (1927-1928) as a curriculum course.

With the 78/2013 PD "Establishment – Foundation of Schools in the Athens University of Economics and Business", the School of Information Sciences and Technology was founded, in which the Departments of Statistics and Informatics are included. Following a contemporary trend of convergence that appears in some of the larger US and European Universities, the School brings these two Departments together in order to promote their interaction and synergy, and to offer the greatest possible benefits to students and a dynamic research environment. School activities aim at three scopes: education, research and contribution to society. In terms of education, the objective is to create Statistics and Informatics executives with a complete professional sufficiency and training, such that it enables them to closely follow the rapid technology advances. The undergraduate programs combine acquiring a full cognitive background with personalized expertise. Postgraduate programs offer specialization in specific areas of high demand. Renewing the programs every two or three years ensures that the offered scientific knowledge is always up to date, while the selection of the general thematic areas with the criteria of timelessness and the methodological depth gives the offered degrees the necessary durability. Our graduates are rapidly absorbed in the labor market, both in Greece and abroad, and are often distinguished as high-ranking executives in companies, banks and organizations, while many of them have created their own businesses. Dynamism in education is linked to the cutting-edge research in the School, with extensive international collaborations, competitive funding, and a high degree of international recognition, awards, distinctions and patents. By constantly seeking to participate in international developments and the academic staff's, students and graduate's distinctions, the School of Information Sciences and Technology aims at a multidimensional excellence that contributes substantially to the general progress.

The Statistics Department of the Athens University of Economics and Business is historically the first, and still remains the only, exclusively Statistics department in any Greek University. The degree offered by the Department is awarded from the School of Information Sciences and Technology and bears the name of the Department.

Academic Title offered:

Degree in Statistics

Admission Requirements

Students are admitted by the Department through the Pan-Hellenic Exam system and the rules defined regarding special student categories. Registration takes place each September through the obligatory electronic registration system, in accordance to instructions provided by the Ministry of Education. There are no departments similar to the Department of Statistics, thus it does not accept student transfers (ΦΕΚ 3599/08.07.2022, τ.Β').

Educational and Professional aims

The aim of the Department is to promote and transmit knowledge in the field of statistical science and its related subjects, theoretical and applied, through research and education, by preparing graduate scientists with the ability to implement appropriate methods of statistical analysis in various fields of activity (eg. economic, social, business, administrative, research, educational, etc.).

Access to further studies

Department graduates have access to postgraduate studies in a wide range of programs, both in Greece and abroad, with a comparative advantage being, their solid mathematical and statistical background of quantitative and computational analysis methods, which, combined with the ability to choose courses from other departments, gives them access to a wide range of subjects and their orientation in their postgraduate studies.

A2. Facilities

Department of Statistics Labs

In order to support the operation of the undergraduate and postgraduate programs of the Department of Statistics as well as promoting research, there are three (3) research labs equipped with computers with a total capacity of 57 computers and one (1) educational lab of a total capacity of 51 computers.

More analytically, the Statistics department laboratories are the following:

Research Labs:

i. **Laboratory of Statistical Methodology**, which is located at the 2nd floor of the Evelpidon 47A and Lefkados 33 building and is available to the postgraduate students of the Department. The lab has one central computer and a local network of 27 pcs with a windows OS and internet connection, **1 pc for the instructor, 4 additional workstations and one server (a total of 32 pc's), 1 interactive table, 4 projectors and 4 laptops**.
ii. **Stochastic Modelling and Applications Laboratory**, which is located at 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 at the 2nd floor of the Troias 2 and Kimolou str. building, room 208 (co-housed with the Stochastic Modeling and Applications Laboratory). **They are equipped with 38 computers**.

Educational Lab:

i. **Laboratory of Applied Statistics, Probability and Data Analysis,** which includes two separate spaces. The main space is located at the 3rd floor of the Antoniadou wing of the main AUEB building

(room A35). Undergraduate students, PhD candidates and temporary teaching staff can work here. The laboratories equipment includes 4 servers SUN workstations, 2 UPS, 1 DELL server with a local network consisting of 40 PC's, 1 PC for the professor, 2 printers, 1 scanner, 1 overhead projector and projector connected to the PC. In a separate area of the lab, there are 10 workstations for the PhD candidates (a total of 51 PC's).

The second space is located on the 4th floor of the Antoniadou wing (room A45) and is in common use with the Educational Lab of the Informatics Department (it is not being used yet).

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 are based on a stack of servers with sufficient and continuously increasing capacity. These servers, among other things, perform user authentication for controlled access to CE resources, are used as file servers for users to, they contribute to automated software reinstallation on the computers of the CE laboratories and finally, they control and prevent the invasion of malicious programs (viruses) on the above computers. All servers are connected to a high-speed network and are accessible from anywhere in the University.

There are three teaching and practice rooms available to all students and all departments. These computers operate in a Windows environment with centralized management of users' accounts and resources. These computers have access to all applications installed in the central systems of the CE.

All members of the academic community, i.e. undergraduate and postgraduate students, the faculty and the university staff, can obtain access to CE's resources. Those interested are registered to the e-services of the CE and the University via the URegister service.

Students can request to be reminded of their password electronically, without being physically present in the CE. In addition to the direct access to the CE through the teaching and practice rooms which operate throughout the day, users can utilize central systems and email for 24 hours a day.

Network Operating Centre

AUEB's Network Operating Centre (NOC) is responsible for the network infrastructure of the entire institution, both in voice (ie telephony) and in data. NOC monitors, maintains and coordinates all University networks. It also hosts the servers of most of the University's services (websites, e-class, secretariats, etc.), except for the Computer Center, and network protection systems against attacks on the Internet.

A backbone fiber optic network of Gigabit Ethernet technology operates in all University buildings. The main buildings of the University are connected to the backbone through the University's fiber optic ring while some auxiliary buildings are connected either by wireless laser or microwave link. In all buildings of the University there is a horizontal (in-floor) and vertical (between floors) structured voice and data wiring that connects offices and workshops with the backbone network at 100 or 1000 Mbps. The University provides wireless broadband access to the network from the classrooms and public areas of all buildings.

The University is connected to the Internet through the Greek Research and Technology Network (GNSS) with a Gigabit Ethernet optical fiber. Therefore, through access networks and the backbone

network, all users have access to the Internet at extremely high speeds. Finally, through the Eduroam international system, all University users can connect to the wireless networks of hundreds of educational and research institutions around the world, and vice versa, users of these universities can connect to AUEB's wireless network.

E-class

In AUEB operates a complete Course Management System that supports Asynchronous eLearning Services via a simple web browser (https://eclass.aueb.gr). Through e-Class, lecturers distribute to student's material related to their lessons, such as notes, presentations, exercises and announcements, while students can submit their work in electronic form. The e-Class is used in all courses of the Statistics Department to facilitate communication between students and teachers.

B. STATISTICS DEPARTMENT PERSONNEL

B1. Faculty Members (Δ.Ε.Π.)

Professors

Vasdekis Vasileios, holds a degree in Mathematics from the University of Athens (1988), MSc in Applied Statistics from Oxford University (1989) and a Ph.D in Statistics from Oxford University (1993). His research interests are focused on a) repeated and longitudinal measurements, b) models of latent variables, c) statistical inference with the use of composite likelihoods. URL: http://stat-athens.aueb.gr/~vasdekis/

Yannakopoulos Athanassios (University of Athens 1989, Ph.D. Warwick, 1993). His research interests focus on Stochastic Analysis and Applications, Stochastic Differential Equations and Mathematical Modeling with the use of Random and Deterministic Dynamical Systems with applications in Insurance, Finance and Modern Technologies. URL: http://www2.stat-athens.aueb.gr/~yanath/

Dellaportas Petros, holds a Ph.D. from the University of Plymouth, MSc from the university of Sheffield, and a degree in Mathematics from the University of Athens. His research interests are focused on MCMC theory, Bayesian Model Determination, Inference and Simulation methods for Stochastic Differential Equations, Time Series Forecasting, Financial Statistics, Sparsity. URL: http://stat-athens.aueb.gr/~ptd/

Zazanis Michail, He obtained the Engineering Diploma from the National Technical University of Athens (1982), the M.Sc. in Applied Mathematics from the Division of Applied Sciences, Harvard University (1983), and the Ph.D. in Applied Mathematics from Harvard University (1986). His research interests focus on Applied Probability Theory. URL: http://stat-athens.aueb.gr/~mzazanis/

Karlis Dimitrios BSc. in Statistics from Department of Statistics, AUEB in 1992 and a Ph.D. in Statistics from the same department in 1999. His research interest refers to mixture models, computational statistics and especially stochastic algorithms, multivariate count data analysis, models for statistical analysis for sports data and modeling dependent data via copulas. URL: http://www.stat-athens.aueb.gr/~karlis

Kyriakidis Epameinondas, B.Sc. in Mathematics (1985) University of Athens, M. Sc. in Statistics (1986) Imperial College, Ph.D. in Stochastic Operational Research (1990) Birkbeck College**.** His research interests focus on a) stochastic dynamic programming theory and applications, b) issues of population and epidemic processes control, c) problems of optimal preventive and corrective maintenance of production systems and d) problems of optimal vehicle routing. URL: https://www.aueb.gr/sites/default/files/cv/gr/1379.pdf

Ntzoufras Ioannis, Graduate of the Department of Statistics and Insurance Science (1994), University of Piraeus. He received his M.Sc. in Statistics with Application in Medicine (with distinction) from the University of Southampton (1995) and his Ph.D. from the Department of Statistics at Athens University of Economics and Business (1999). His research interests focus on topics of Bayesian and computational statistics, categorical data analysis, statistical modeling, model and variable selection methodology. He is also highly motivated by applications of sophisticated models in problems related with Medical research, Psychometrics, and sport analytics.URL: http://stat-athens.aueb.gr/~jbn/

Fragkos Nikolaos, holds a degree in Mathematics from the University of Athens, M.Sc. in Mathematics and Ph.D. in Probabilities, Stochastic Processes from Ohio State University. Research Interests:

Statistics, Probability, Stochastic Analysis and Modeling, Actuarial Science, Pension Funds Evaluation. URL: http://www.stat-athens.aueb.gr/~frangos/

Psarakis Stylianos, holds a degree in Mathematics from the University of Crete (1986) and a Ph.D. from the Department of Statistics at AUEB (1993). His research interests focus on: a) Statistical Quality Control, b) Distribution Theory and c) Multivariate Statistical Analysis. URL:http://www.stat-athens.aueb.gr/~psarakis/

Associate Professors

Vrontos Ioannis, He has studied at the Athens University of Economics and Business, from where he obtained his B.Sc. in Statistics (1995), his M.Sc. in Statistics (1997) and his Ph.D. is Statistics (2001). His research interests include Bayesian Methodology, Time Series Modeling, Issues of applied finance, Optimal Asset Portfolio Allocation and alternative forms of investing high risk assets.URL: http://stat-athens.aueb.gr/~vrontos/

Livada Alexandra, graduated from AUEB where she finished M.A studies in Economic Theory and Policy. She holds a Ph.D. degree in Economics from Essex University-UK**.** Her main research interests are in Quantitative Economics and Business Analysis, Applied Econometrics, Applied Time Series Analysis and Forecasting Techniques, Income distribution-Inequality Measurement, Applied Financial Econometrics, Business Cycles Analysis, Index Numbers and Official Statistics URL: http://stat-athens.aueb.gr/~alivada/

Merkouris Panagiotis, holds a BSc degree in Mathematics from the National and Kapodistrian University of Athens, an M.Sc. degree in Statistics from McGill University, and a Ph.D. degree in Statistics from the University of Waterloo. His research interests include sampling surveys statistics, official statistics, estimating functions and stochastic processes inference.URL: https://www.aueb.gr/sites/default/files/ cv/gr/1132.pdf

Besbeas Panagiotis, holds a degree in Mathematics with a specialization in Statistics with honors from University of Kent (1994). He graduated with distinctions from the University of Kent (1995) and obtained Ph.D. in Statistics (1999) from the same university. His research interests include: a) Applied Statistics, b) Statistical Computing and c) Ecological Statistics. URL: http://www.aueb.gr/pages_en/faculty/faculty_en_short.php?facid=1133

Pavlopoulos Charalampos, received his B.Sc. degree in Mathematics from the University of Patras, Greece (1985), and subsequently his M.A. (1988) and Ph.D. (1991) degrees 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, spatial and environmental statistics. URL: http://www.stat-athens.aueb.gr/~hgp/

Papageorgiou Ioulia, has a B.Sc. in Mathematics (2.1) from University of Ioannina, Department of Mathematics with major in Statistics and Ph.D. in Statistics, University of Ioannina, and Department of Mathematics. Her research interests are in the field of Sampling Theory, Model Based Clustering, Mixture Models, Applications to Archaeometry. URL: http://stat-athens.aueb.gr/~ioulia/

Tsiamyrtzis Panagiotis, holds a degree in Mathematics from the Aristotle University of Thessaloniki (1994), an M.Sc (1997) and a Ph.D. (2000) in Statistics from the Statistics department of 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/sites/default/files/cv/ gr/1275.pdf

Assistant Professors

Bakoyannis Georgios (under appointment), obtained his degree in Public Health from the Technological Educational Institute of Athens (2004), Postgraduate degree in Biostatistics from National and Kapodistrian University of Athens (2007) and his Ph.D. in Biostatistics from National and Kapodistrian University of Athens (2014). His research interests focus on Survival analysis with competing risks, statistical inference for stochastic processes, causal inference, precision medicine (estimation of optimal personalized treatment rules).

Stavros Vakeroudis obtained his degree in Applied Mathematics from the School of Applied Mathematical and Physical Sciences of the National Technical University of Athens (2004). He continued with postgraduate studies in Paris, where he obtained an M.Sc. in Probabilities and Applications from the Pierre et Marie Curie-Paris VI University (2006). He got his PhD from the same university in the Science of Mathematics (2011). His research interests focus on stochastic analysis, stochastic processes, stochastic modeling, actuarial mathematics, risk theory, financial mathematics and the actuarial science and his Ph.D. in Nottingham. His research interests mainly concern Bayesian Statistics and its applications in Biostatistics, health economics and epidemic patterns. URL: http://www.aueb.gr/users/nikos/

Zympidis Alexandros, received a first-class honors degree in Mathematics from the University of Athens, Master of Science (MSc) with distinction and Doctor of Philosophy (Ph.D.) in Actuarial Science from the City University of London. His basic research interests include a) stochastic modeling of insurance and pension systems and b) applications of the fractional brownian motion and H∞ optimal control. URL: http://www.stat-athens.aueb.gr/~zimb/

Ioannidis Evangelos obtained in 1987 his degree in Mathematics from the University of Heidelberg, Germany, with a diploma-thesis in non-parametric Statistics. In 1993 he obtained his Ph.D. in Mathematics from the same University. His thesis concerned spectral analysis of time series. His current research interests concern co-integration methods, application of bootstrap to Unit-root-testing and Multivariate Spectral Analysis and their application to the analysis of economic data, as well as Official Statistics, and, in particular, survey sampling.URL: http://stat-athens.aueb.gr/~eioannid/

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

Penteli Xanthi-Xanthipi, Graduate of the Department of Statistics at Athens University of Economics and Business (2003). She received her M.Sc. in Biostatistics from the University of Athens (2006) and her Ph.D. from the Department of Statistics at Athens University of Economics and Business (2011). Her research interests are focused on statistical modeling and inference for time series, discrete data and biostatistics. URL: https://www.aueb.gr/el/faculty_page/penteli-xanthi-xanthipi

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Panagiotis Merkouris	Troias & Kimolou str., 5th floor	210-8203**941**	merkouris@aueb.gr
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ASSISTANT PROFESSORS			
Bakoyannis Georgios (under appointment)			
Vakeroudis Stavros	12 Kodrigtonos str, 2nd floor	210-8203**225**	svak@aueb.gr
Nikolaos Demiris	12 Derigni str, 2nd floor	210-8203**569**	nikos@aueb.gr

FACULTY MEMBER	OFFICE	TELEPHONE NUMBER	email
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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

Tsompanaki Evgenia, holds a BSc in Mathematics with major field in Statistics and Operational Research, Department of Mathematics, University of Patras, an M.Sc. in Statistics, Department of Statistics, Athens University of Economics and Business and also a PhD in Statistics, Department of Statistics, Athens University of Economics and Business**.** Her main research interests are in the areas of 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**

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

URL1: http://www.cs.aueb.gr/el/content/mamaloykas-xristos and
URL2:*http://scholar.google.co.in/citations?user=fZuGhmQAAAAJ&hl=en&cstart=0&pagesize=20*

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

Mihou Tatiana holds a degree in Statistics, 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 B.Sc. in Statistics, Department of Statistics, Athens University of Economics and Business (1995), and M.Sc. in Statistics, Department of Statistics, Athens University of Economics and Business (2011).
- **Anastasiou Sofia,** Graduate of the School of Physical Education and Sport Science (2000), Democritus University of Thrace.
- **Spyropoulou Aliki,** graduate of ATEI of Halkida in Business Management (2000), postgraduate degree from the Greek Open University in Business Management (2010).

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

- **Smyrnaki Argyro**, holds a degree in Statistics, Department of Statistics, Athens University of Economics and Business (1996), MSc in Human Resources Management (2016), Department of Marketing & Communication and Management of Science and Technology of Athens University of Economics& Business.
- **Chrysanthopoulou Maro,** holds a degree in Statistics, Department of Statistics, Athens University of Economics and Business (2004), MSc in Statistics, 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, the graduates will be able:

- To understand the basics of probability theory and the mathematical foundations of statistics, statistical reasoning and inference.
- To understand the notion of uncertainty and how statistics, probability and modern data science can improve decision making in an uncertain environment.
- To design, collect and analyze statistical data and draw appropriate conclusions knowing the limitations that exist in every step of this procedure.
- To interpret and communicate the results of a statistical analysis.
- To analyze data using statistical packages and other computational tools.
- To demonstrate knowledge of ways to avoid misuse of statistical methods and wrong interpretation of the results.
- To understand how research assumptions are translated into a form that can be addressed with statistical methods.
- To study publications that use statistical methods and to evaluate the validity of the statistical arguments.

C2. Studies Regulation

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

1. The program is in accordance with the philosophy of the curricula of European Universities with which the Department cooperates, since it is based on the European Credit Transfer System (ECTS). The basis of this system is the Credit Unit (ECTS). Each course corresponds to a number of ECTS referred to the program.
2. To determine each course's ECTS, the total demands of the course are taken into consideration (lectures, assignments, required preparation, etc)
3. The student completes his/ her studies and is awarded a degree when he/ she has successfully attended courses corresponding to, at least, 240 ECTS credits. Courses can be passed either by examination, or by exemption, or by equivalence under the Erasmus program.
4. According to the Department's indicative curriculum, each academic year includes educational activities corresponding to 60 academic ECTS credits.
5. The program offers 14 compulsory courses.

Since the academic year 2021-22 the Statistics Department, in collaboration with the Informatics Department, introduces courses cycles which consist of specific courses from both departments that are related to specific subjects. The cycle subjects are:

- Data Science
- Operational Research
- Applied Mathematics

The cycles are not compulsory, but they offer the students flexibility to acquire additional knowledge in their subject.

C3. Courses Categories

1. The program's courses are divided into 2 basic categories:
    1. **14 compulsory courses** which must be attended by all students
    2. **Elective courses** which are of two categories:
        1. Courses offered by the Statistics Department
        2. Courses offered by other Departments
2. Compulsory courses are offered during the first 6 semesters (8 in the first year, 4 in the second year and 2 in the third year), so the student has the necessary background to make his choices in the future.
3. In the last two semesters, no compulsory courses are offered. This way the student has the flexibility to form a study program, which will cover the basic knowledge in Statistics (as provided by the compulsory Statistics courses), while at the same time he is given the chance to develop a program that meets his/her individual interests.
4. During the **first two semesters** the student may enroll in courses with a **maximum of 30 ECTS credits**.
5. From the 3rd to the 4thsemester, the student may enroll in courses with a **maximum of 40 ECTS credits per semester.**
6. From the 5th to the 6thsemester, the student may enroll in courses with a **maximum of 40 ECTS credits per semester.**
7. In the 7th and 8thsemesters the student may enroll in courses with a **maximum of 48 ECTS credits per semester.** There can be excess only for the course "Practical Training".
8. After the 4th year of study, the student may enroll in courses with a **maximum of 48 ECTS credits per semester**. There can be excess only for the course "Practical Training".

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 the student chooses courses to attend each semester**, the obligatory courses of previous semesters which the student has not passed and are offered in the specific semester must precede all other courses.**
10. There are **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 as well as "Data Analysis" of the 6th Semester. It should be noted that the courses "Estimation – Hypothesis Testing" and "Linear Models" are repeated in the 4th and 5the semester respectively.
11. Apart from the 14 compulsory courses that amount to 108 ECTS, the student must accumulate **at least** 72 ECTS from elective courses offered by the Department of Statistics. The remaining 60

ECTS credits, necessary for the degree, can be obtained either from elective courses offered by the Department of Statistics, or by courses offered by other University Departments.

12. The list of the offered courses is announced each year and depends on the availability of the teaching personnel. Some elective courses may not be offered if there is no available instructor.
13. By getting the degree, the student can obtain a computer certificate equivalent to ECDL in the public sector, if during his/her studies has 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
DATABASES	DET OR INF
COMMUNICATION NETWORKS	INF
COMPUTER NETWORKS	INF
DATA MANAGEMENT & ANALYSIS SYSTEMS (old title: DATABASE DESIGN)	INF
ARTIFICIAL INTELLIGENCE	INF
MACHINE LEARNING	INF
DATA MINING	INF
INFORMATION RETRIEVAL SYSTEMS	INF

14. Students can enroll in the Teacher Education Program. More information can be found here: https://www.dept.aueb.gr/en/tep.
15. Lastly, students are given the chance to attend one semester in a similar Department in a University abroad through the ERASMUS+ program. The courses that are successfully completed by the student are corresponded to courses of the Department and are included in the student's transcript of records. For more information about student mobility you can visit the link: https://www.aueb.gr/en/erasmus.

MODULE COURSES

Since the academic year 2021-22 the Statistics Department, in collaboration with the Informatics Department, introduces courses modules which consist of specific courses from both departments that are related to specific subjects. The modules subjects are:

- Data Science Module
- Operational Research Module
- Applied Mathematics Module

Each module's courses offer the students flexibility to obtain additional knowledge in their subject.

Module Completion: In order for a student to complete a module, he/ she has to succeed in **at least 5 module courses** (these courses must not have been taken in any other modules), **at least 2 of those** has to be either from the Informatics Department either from the Management of Science and Technology Department.

Non – Compulsoriness: The modules are not compulsory, and the students are free to take courses of all modules. If a student does complete a module this is noted in the **Diploma's annex**.

The courses titles and the way they are distributed in modules is displayed 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) *(old title: Data Mining g 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

Cod.	Course	Data Science	Operational Research	Applied Mathematics	Semester	ECTS
8143	Combinatorial Optimization (DET)		✓	✓	7th	6
6124	Probabilities II (STAT)			✓	2nd	7,5
6082	Linear Algebra II (STAT)			✓	2nd	7,5
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 *(old title: 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's for courses provided either by the Statistics Department or other Departments could be modified.

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) *(old title: Data Mining g 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)	--------

TITLE	PREREQUISITES
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 Procedures 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 Procedures 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 *(old title: Applied Numerical Analysis)* (INF)	Calculus II (STAT) **and** Computational Mathematics (INF) **or** Numerical Methods in Statistics

C4. Educational Support

1. In the courses offered by the Statistics Department (apart from the theoretical ones), and mainly in the compulsory ones, part of the time is dedicated to the students practicing statistical packages suitable for the subject. There is a lab operating in the department which is used by undergraduate students to complete assignments, and to search and collect data and bibliography to help them complete these assignments. For this reason, there are installed many statistical packages as well as other applications such as word processors, graphical packages, databases, etc. In the lab are also available copies of the Practical Training reports prepared by students and copies of the Departments pre-publications. The lab also occasionally holds seminars on the subjects of the Department, as well as undergraduate courses, after communication with the lab supervisor.

2. When deemed necessary, tutoring is offered. Tutoring hours and the room in which they are held are announced in the University's website (https://www.aueb.gr/en). During tutoring hours, students can ask for help to solve exercises, ask questions or help to understand concepts.

C5. General Rules

Maximum study duration and part time study

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

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

Other Rules

1. In the studies program, there are no directions, in the strict sense. Each student though, can form their direction and desired specialization by choosing a specific Course Module.
2. Each student can also expand his or her knowledge in other academic fields of the University (i.e. Economics, Administration, Marketing, Informatics etc) by choosing appropriate elective courses. This selection happens in collaboration with their Studies Advisor. This way of designing one's studies provides them with freedom of choices.
3. For the elective courses, the semesters are only indicative. Students of greater semesters can also enroll in these courses.
4. The elective courses of the Statistics Department are offered in accordance to the program's needs, faculty availability and the student's interest in attending them.
5. Minimum number of students necessary in order for a course to be taught is 8. It is possible, in exceptional cases, for a course to be taught with fewer students, only following a decision from the Department's Assembly.

6. Other than the courses offered in the Department's curriculum, the students can also choose other courses offered by other departments from a list of offered courses.
7. Within the system of ECTS transfer, students can enroll in courses offered by departments in other Greek or foreign universities (beyond those already in agreement with the department within the Erasmus program). In order for the attendance and the performance in those courses to be recognized, the consent of the course instructor, the Studies Consultant and the department's President must have preceded. The ECTS corresponding are determined by the Studies Program Committee and approved by the Department's Assembly.
8. The degree's grade is the weighted average of the grades of the individual courses, and the weighting coefficients are each courses ECTS.
9. All of the department's announcements are uploaded at the department's website (https://www.dept.aueb.gr/en/stat-0).
10. Faculty members must keep an updated page of the courses they teach in the University's eclass.
11. Optionally, grades can be announced in the department's website and/ or in the courses eclass. **Official announcement of the grades is in 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. In the guide there are listed the courses of the program, the semesters in which these courses are offered, their characterization and the corresponding ECTS's. This information is advisory in nature.
14. **Bachelor Dissertation**: The Dissertation can take place only on the 4th year (or later). For a student to be able to write it, he/ she must have passed all compulsory courses and hold an average grade to these courses, of 7 or larger. The dissertation has the duration of one semester. A supervisor is appointed, plus two other professors as examiners. The dissertation is presented at a specific date and time set for all dissertations, during or a little before the respective exams period. More information is available at the studies guide.
15. **Practical Training**: Students can participate only once in it, and it refers to applying statistical methods in a working environment, either of the public or the private sector. For the training to begin, the student interested must obtain the consent of the Supervisor and the approval of the Practical Training Coordinator appointed by the Department and then fill in the relevant forms available on the Department's website. The training can begin after the completion of the 6th semester, after the summer. The student must have collected at leats 80 ECTS and must have passed at least 8 compulsory courses. Depending on its subject and duration, it can yield from 6 to 14 ECTS. The number of ECTS is determined by the Practical Training Coordinator, after a proposal made from the student's supervisor. Preparatory seminars are held before each period. URL: https://www.aueb.gr/en/internship. More info can be found at the relevant section of the Studies Guide.
16. According to the applicable law, the guides review occurs every April.

C6. Courses Attendance, Selection and Examination

- **Course Selection**: To be able to participate in the courses exams, the students must complete an electronic course statement, which they submit to the Electronic Secretariat of the University (**e-Γραμματεία)** (https://aueb.gr/el/content/e-grammateia-0). The submission takes place at dates

announced by the University at the beginning of each semester and is **compulsory**. If the student fails to submit the form, even if he/ she successfully passes the courses exams, it is canceled.

- For the definite submission of the form to the electronic secretariat, the form must be **saved**.
- **Text Book Selection**: In a similar way, the students must submit electronically their textbook selection via the EUDOXUS platform (https://eudoxus.gr/). **It must be noted that Course Selection and Textbook Selection do not substitute each other.** There are penalties in the case that a student chooses and receives a textbook from a course he has not selected.
- It is looked after that teaching hours from courses of the same semester do not overlap.
- Each course is taught for 13 weeks, in 4 lecture hours per week. Most courses also include labs, that are for exercises and answering student's questions.
- The courses grades range from 0-10, with the use of the half grade (0,5). Basis is the grade five (5). The degree's grade is the weighted average of the grades of the individual courses, and the weighting coefficients are each courses ECTS. More analytically:

  Excellent: 8,51 – 10

  Very Good: 6,51 - 8,5

  Good: 5 - 6,5

  Passing grade is 5 and more.

- For courses taught in the winter semester the exams take place from the end of January to the beginning of February. For courses taught in the spring semester, the exams take place in June and July. Finally, courses from both semesters are examined again in September. If a student fails at the exams of course he/ she has taken during the Winter or Spring Semester, he/ she can retake the exams in September.
- **Course Re-examination**: Students that have passed a specific course, but desire to be re-examined, can apply in the Department's Secretariat, following the Dean's relative announcement. With this application, their grade is cancelled. Following restrictions apply:
  - Each student has the right to use this feature 4 times (for 4 courses), during his studies.
  - The application must be submitted in the period between the interval between the examination period that the student passed the course, and the exams period in which the course will be examined. Obviously, the student can be examined in this course at any time in the future.

C7. Scholarships and Awards

The Statistics Department and the University's Career Office, in order to support undergraduate students, but also to acknowledge and encourage excellence, would like to inform interested parties for scholarships derived from collaborations with other organizations, institutions and businesses. These scholarships are announced at the university's website (https://www.aueb.gr/el/news_archive/23) and at the Department's website (https://www.dept.aueb.gr/en/stat/content/scholarships).

Also, the AUEB Property Management & Development S.A. manages the bequests from the foundations "Georgia Nikolakopoulou" and "Faidonas G. Chatzigeorgiou", through which scholarships are granted 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 that belong 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 Statistics Department introduced a Rewards Program for Undergraduate Students with EXCELLENT PERFORMANCE, as well as a Rewards Program for Undergraduate Students with a GOOD PERFORMANCE. In particular:

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

- Beneficiary for the scholarship/ reward are the **best three (3) undergraduate students** with and 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, fir 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.
- From the 2021-22 academic year and beyond, the **three (3) best graduates** will be rewarded - unless there is a private funding to reward more students. **7,50 (seven and a half)** is set as the minimum grade for the reward.
- For graduating students, the length of the studies is not taken into account, but only the average grade is. If a graduating student is also entitled to the reward as a 4th year student with excellent performance, then he will receive the reward twice, as it is for different reasons (excellent performance during the 4th year of studies and best degree grade).
- 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 they can be replaced or modified depending on possible sponsorships available.
- With the REWARD there is also a AWARD OF ACADEMIC PERFORMANCE which will be signed only from the department's president and will contain 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 can be modified.
- The students REWARD will be mentioned in the section "6.1 Additional Information" of the Diploma (both in the Greek and the English version).

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

- 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 average grade for the undergraduate students 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, fir 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 President of the Department of Statistics and will contain the details of the award. The rewards amount is a contribution of the Department and can be modified in relation to the departments financial availability or can be replaced or modified depending on possible private sponsorships/ donations. The possibility not to give a sum of money as a scholarship/ reward, but to give, for example, a book or a USB or other, similar, symbolic reward gift, will be explored.
- 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 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 can be modified.
- The students REWARD will be mentioned in the section "6.1 Additional Information" of the Diploma (both in the Greek and the English version).

With the commencement of the above programs, the "Performance Award" program is terminated. The program was about the two (2) best students of the Department that had successfully attended all courses of the previous academic year (at least eight (8)), as described in the Studies Guide, and held an average grade of at least eight (8). In the case of a tie, the reward was given to all tying students, while those already holding a Higher Education degree were exempted from this process.

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

Each graduant student of the Department that completes his/ her 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 Statistics Department for the next three (3) years from the year he/ she graduated, following the request of the interested party (after he/ she is selected for the program).

C8. 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, administrative staff, etc.).

The procedure concerns all complaints that have to do with 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 at the department's website (https://www.dept.aueb.gr/sites/default/files/stat/entypa/Aitisi_paraponon.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 data which are processed and taken into consideration in any reform of the program studies.

C9. Bachelor Dissertation

Within the framework of the educational process, students, on their 4th year (or more) of study, are able to 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 and thus ensuring the studies standards and the departments reliability.

General Rules for Applying

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

Special Teaching Staff (E.DI.P) that hold a Ph.D. or are currently in the conclusive rank, are eligible to supervise a dissertation with support from 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. The students can contact the professor for further information. The department's Assembly then is informed about the assignment of the dissertation and is appointing 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 information 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 his 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 departments secretariat. Members of the academic community can attend the presentation. At the end of the presentation the student answers questions of the Evaluation Committee and the audience. The presentation should last less than 20 minutes, and 15 minutes are given for the questions.

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 fills out the relevant proceedings which is 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.

C10. 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, those interested can participate in the self-funded "AUEB STUDENTS PRACTICAL TRAINING 2016-2020" program. This program is funded entirely by the Company, which has to 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).

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, the students are able to utilize their academic knowledge and to practically apply them in the workplace.

Exposing students to real working conditions contributes to their better integration into the productive system, of both the Greek and the international markets. It is intended to create a two-way channel of transmitting information between the Statistics Department and the production, about its needs in statistics and the department's capability to cover them, as well as the perspective statistics can offer.

Through this channel, the Department of Statistics draws significant information and is thus able to continuously adapt the Department's curriculum to the needs of the market.

The 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 into 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 the interested companies after completion of the practical training period.

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

Briefly, the following are mentioned:

Terms and Conditions

The "Practical Training" program refers to students that have completed the ***6th semester*** (3rd year). Students can apply **only once**. Applying for practical training in the e-secretariat takes place at the 4th year of studies or after. Conditions for participating in the program are that the student has obtained at least 80 ECTS's, has successfully completed at least 8 compulsory courses and has participated in the relative informative meeting/ seminar organized by the Practical Training Office. [the above minimum academic requirements are an exclusion criterion (on-off) from the selection process in the Internship Program].

Within the framework of the sound financial management of the cofounded acts, and in order to ensure transparency and equal treatment of the applicants, there are several evaluation criteria, which are common for all departments in the University.

Evaluation Criteria: After the exclusion criterion is checked begins the evaluation process, which is based on the following criteria that are graded from 0-100:

- Average grade of the courses that students have passed up until the previous exams period. The average is then multiplied by 10. This result has a weight of 80%.
- Total ECTS that the student has accumulated so far, in relation to the number required to obtain the degree. This criterion has a weight of 10%.
- The student's year. For the 3rd or 4 th year, the students get 100 points, and for each year after the 4th the student loses 10 points. This criterion has a weight of 10%.

In case of a tie the applicants will be evaluated based on the average grade they were holding until the previous examination period.

A committee of three members evaluates the students application, and the results (temporary and definite) are announced on the AUEB internship website (https://www.aueb.gr/en/internship) and in the department's website.

After posting the temporary results, students have the right to submit a written objection to the department's secretariat within 5 working days since the announcement of the results. Objection are examined by the three-member committee appointed by the department.

The informative is addressed to all the students that are interested and aims at informing them about the procedure and the scope of Practical Training. It also aims to draw attention into useful details during the interview. In this meeting the program's coordinator, Professor D.Karlis, informs the student about the academic part and the Practical Training office manager, Ms A.Panagiotidou informs them about the administrative part.

Depending on the subject and its duration, Practical Training can yield **from 6 to 14 ECTS**, provided that the student, after completing the Practical Training, devises the written report, in consultation with his/ hers supervising Professor. The report is filed at the Central Office for the Practical Training, up to 3 months after the ending of the contract.

Alternatively, students can participate in the Practical Training program without a written report. In this case, the Practical Training does not yield grade or ECTS's and is only presented in the student's diploma.

Students can apply two (2) times a year (Winter Semester, Spring Semester and/ or during the summer) in specific dates announced by the Central Office for the Practical Training. For the Winter period the announcement is published in September and for the Spring and/ or Summer period it is published on January.

The duration of the Practical Training is set at 3 months of full-time employment or 6 months of part time employment (full time amounts to 40 hours per week and part time amounts to 20 hours per week).

In order to start the training, each student must obtain the consent of a faculty member of the department, that will also be his/ her supervisor, as well as the consent of the Practical Training coordinator. The student then must fill out the relevant forms available at the department's website and the website of the Practical Training Office (https://www.dasta-is.aueb.gr/).

The student that participates in the Practical Training practices the role that the market expects from a Statistical Scientist: the role of an expert Statistician that can deal with specific problems in different areas of the working environment. It is an exercise in collecting and methodologically analyzing data related to specific problems of specific areas of the labor market, in drawing conclusions, in forecasting and making decisions in order to solve specific problems. The student's supervision from the designated faculty member is about designing the relevant sampling research and dealing with the problem methodologically, as well as the relative inference and proposals for decision making and specific actions.

The student's academic performance is important in the final selection for his participation in the Practical Training Program, because it is indicative of how well trained he is. Naturally, the student's special interests are essential in him/ her being chosen to participate in the program. The organization in which the student will carry the training is chosen after discussing it with him/ her, so that the Practical Training will be relevant to his/ her interests.

Grading the Practical Training is decided from the Departments coordinator, after the supervisor's proposal. The student submits an essay in which he/ she describes in detail the problem and the implemented methodology to analyze the corresponding data. A copy of the essay is kept at the Educational Laboratory of Applied Statistics, Probability and Data Analysis of the Department.

It should be noted that, in the case that the funding comes from NSRF funds, a Bilateral Committee consisting of the Project's Scientific Coordinator and a faculty member designated by the Convention of the Department is set. The committee evaluates the applications and validates the final results in order to ensure the transparency and equal treatment of applicant students.

Procedure

Each student who is interested in participating to the "Practical Training" Program must follow the below procedure:

The student must:

- Check if he/ she has an Insurance Registration Number/ EFKA (ΕΦΚΑ). If not, the student must do what is necessary to obtain one.
- Ensure that he/ she has an IBAN account, as a beneficiary or co-beneficiary, in any Greek bank (Foreign Bank Accounts are not accepted).

After the student has accumulated the above, he/ she must fill in the Personal Data Statement at the dasta AUEB website, before beginning the practical training, within time limits specified by the practical training office.

After the student's application has been approved, the job offers are now visible in the «ΘΕΣΕΙΣ» menu at the dasta AUEB website. The student can choose as many positions as he/ she is interested in, by choosing «Εκδήλωση Ενδιαφέροντος». This way, the students cv is now visible at the employment agency, and in case there is interest, the agency will communicate with the student. It is recommended that the students' express interest in at least 10-15 different positions, and to conduct as many interviews as possible in order to have a complete view of the what the positions are about.

The student now can check the progress of his/ her request at the «Παρακολούθηση» menu:

Step 1: The student can see which employment agencies accepted him/ her at the «Έγκριση Εταιρείας» column.

Step 2: The student chooses «αποδοχή» at the «Έγκριση Φοιτητή/τριας» column, in order to accept the offered position (only one). The position is now secured, and the placement process is completed.

Note: the student cannot carry out his/ her Practical Training with a relative with first degree of kinship (father, mother, siblings).

Step 3: The student informs the Department's Practical Training Coordinator about the pre-agreed duration of the training. The exact date is set by the Practical Training Office.

As soon as the practical training is agreed upon, students must then find a supervising faculty member with an object similar to that of the training. The student must name the supervisor one week prior to the beginning of the training, provided that the faculty member has agreed.

Documents for the beginning of the Training

- Employment agency certificate * & Private Agreement: they are automatically produced by DASTA OPA and the companies are obligated to sign / seal them. Delivered by students to the Office within specific deadlines set by the Office
- Personal Information Statement: The student submits the application electronically to DASTA OPA and then delivers it signed to the Practical Training Office.
- Inventory Entry Card*: It is electronically submitted to DASTA AUEB and then a signed copy must be delivered to the Practical Training Office. Filling this card is obligatory. Failure to complete it may result in termination of the contract and the Practical Training.
- Course Registration: Students must register to the course "Practical Training" for the semester that the training will take place.

- Statement for the beginning of the Training: This form is submitted to the Office in printed or electronic form with the student's signature, the supervisors' signature and the signature of the supervisor of the employment agency. Finally, it has to be signed from the Department's President,

** Only for the program implemented through ESPA*

Forms for the completion of the Practical Training

- Certificate of the completion of the Training, which is submitted in an original form within a specific time frame since the date of the completion defined by the Practical Training Office.
- Evaluation Questionnaires (Employment Supervisor and Student) are electronically filled at DASTA AUEB.
- Delivery of the written report electronically in the Practical Training Office within three (3) months since the completion of the Training. In case the report does not receive a passing grade, the student can submit it again the next exams period. The report must be submitted and must receive a passing grade for the Practical Training to be completed successfully and the student to be compensated.
- If the student wants to do his Practical Training in the summer, he must register to the course in the Spring Semester.
- Inventory Exit Card*: It is electronically submitted to DASTA AUEB and then a signed copy must be delivered to the Practical Training Office. Filling this card is obligatory. Failure to complete it may result non completion the Practical Training – no compensation.

** Only for the program implemented through ESPA*

Communication - Information

Eleftheria Nifli 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 is accepting students Monday to Friday, 11:00 – 15:00.

C11. General Structure of the Studies Program

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

1st Semester	2nd Semester
• Probabilities I (C) • Calculus I (C) • Linear Algebra I (C) • Introduction to Programming using R (C) • Statistics I: Probabilities and Estimation*	• Probabilities II (C) • Calculus II (C) • Linear Algebra II (C) • Introduction to Probabilities 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	• Linear Models (C) • Time Series Analysis (C) • Demographic Statistics • Sampling • Mathematical Methods • Actuarial Science I
5th Semester	**6th Semester**
• Generalized Linear Models (C) • Applied Linear Models • 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
7th Semester	**8th Semester**
• Methods of Statistical and Machine Learning • Biostatistics II • Econometrics • Stochastic Procedures II • Actuarial Science II • Bayesian Inference Methods • 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 not offered at the academic year 2022-23 are noted with an asterisk (*)
- "Statistics I: Probabilities and Estimation" and "Statistics II: Inference and Regression" will be offered only to Erasmus students, during the academic year 2022-23.
- Elective courses are offered only if there is an available professor.
- Tutoring courses are provided for all compulsory courses. Tutoring will also be done, depending on availability, in elective courses.
- All courses are taught 4 hours weekly, plus 2 hours' tutorials (where applicable).
- Each course examination is determined by the instructor and may involve assignments, exercises, intermediate exams, etc.

- The student can also choose from a list of elective courses offered by other departments

Beginning from the academic year 2021-22 and onwards, the Statistics Department launched a seminar cycle to **connect theory with the practical applications of the statistical methods**, addressed at first year students. The scope of the **seminar** is to motivate the interest of the first year students for the statistical science, its applications and its professional prospects. More specifically:

- Each seminar lasts for 45 to 60 minutes and takes place once a month, or more frequently, depending on lecturer's availability.
- There will be no final exams and attendance is optional.
- The seminar is open to all undergraduate students of the department, not only the freshmen.
- The following are presented at a level comprehensible to first year students (not with the approach of a research seminar):
  - ✓ Statistical applications with a significant social impact (COVID pandemic, clinical trials, sports, economics, Enigma, market research, psychometry etc)
  - ✓ Interesting statistical problems from publications on relevant topics in international journals (eg Significance)
  - ✓ Areas of current state-of-the-art statistical research and applications (eg Statistical learning, Big data)
  - ✓ Statistical applications in business (insurance, banks, pharmaceutical companies etc)

In addition, beginning in the academic year 2021-22 and onwards, the Statistics Department implements lab seminars in Microsoft **Excel**, for the first year of studies, for teaching specialized tools and learning to create databases, statistical tables and graphic representation of statistical results.

- The Microsoft Excel lab is **optional**
- The lab has a short duration (eg 2 hours/ week for 6 weeks) and can be done twice a year.
- Successful attendance, proven via exams or exemption exercise, will not yield credit units and will not be accounted for the degree acquisition.
- Successful attendance is listed only on the diploma's annex received during the Graduation Ceremony
- At the request of the interested party, a "Certificate of Successful Attendance" is given (without grade indication) which is signed by the President of the Department.
- There is a limit to the number of participants depending on the workstations available in the Lab used for the seminar. Selection criteria are defined by the faculty member in charge.

C.12 Elective Courses offered by other departments for the academic year 2022-23

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	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
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 * *(old tile: 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* *(is not offered during the 2022-23 academic year)*	INFORMATICS
H	3644	6	E.E.	INFORMATION RETRIEVAL SYSTEMS*	INFORMATICS
H	3743	6	E.E.	DATA MINING* *(old title: 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 to the "Teacher Education Program" are eligible to enroll to 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 in the repetitive exam period in September. The Department does not support any extra exam periods.

Exams and Evaluation/ Grading Rules

As defined by the University regulations.

Department's ECTS Coordinator

The Department's ECTS Coordinators are: Professor D. Karlis and deputy coordinator is Associate Professor A. Livada.

D. COURSE DESCRIPTION

1ο YEAR

A' Semester

Probabilities I (code: 6001)

Course Type: Compulsory

Course level: First cycle

Instructor: E. Kyriakidis, Professor (1ο Class) and St. Vakeroudis, Assistant Professor, (2ο Class), Department of Statistics

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

Desired Learning Outcomes: Upon successful completion of the course, the students should be able to: Understand the way probabilities correspond to events, to solve problems using probabilities laws, review probabilities using the Bayes rule, choose the correct probabilistic model for their problem.

Prerequisites: none

Syllabus: Discrete probability spaces, elementary combinational analysis. Probabilities 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 and hypergeometric distributions, Poisson distribution. Uniform, binomial, geometric and hypergeometric distributions, 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. independency. Random variables simulation using the method of inverse transformation.

Recommended Reading

- Κούτρας Μ., Εισαγωγή στη Θεωρία Πιθανοτήτων και Εφαρμογές, Εκδόσεις ΤΣΟΤΡΑΣ ΑΝ ΑΘΑΝΑΣΙΟΣ, 2016.
- Feller, W. (1968). An Introduction to Probability Theory and its Applications. Wiley, N.Y.
- Hoel P., Port S., Stone C., 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: Written exam at the end of the semester.

Teaching Language: Greek

Calculus I (code: 6041)

Course Type: Compulsory

Course level: First cycle

Instructor: H. Pavlopoulos, Assistant Professor, Department of Statistics (1st class, A – L) and Al. Zymbidis, Assistant Professor, Department of Statistics (2nd class, M – Omega)

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

Desired Learning Outcomes: After the successful completion of the course, the students will have adequately understood elementary concepts and techniques of Infinite Calculus and will be able to use them in solving 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. Derivative of a function, calculus of derivatives and derivatives of higher order, theorems of Rolle, Mean-Value and L'Hospital, local extremes. 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 of convergence, Bolzano-Weierstrass theorem, theorems of sequence convergence. Series of real numbers, series with positive terms, criteria of convergence 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: 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, Assistant 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 the students are able to answer questions demonstrating this understanding, obtaining a geometric insight in 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 Rn, lines and planes in Rn. Matrices and matrix multiplication, Elementary matrices. Linear systems: The Gauss algorithm and the factorization PA=LDU. Inverse and transposed matrices, the algorithm Gauss-Jordan. 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 Rn and matrices. Orthogonal subspaces, and orthogonal complement of a subspace. Projections and least squares approximations. Projections.

Recommended Reading

- Gilbert Strang (1999), Γραμμική Άλγεβρα και Εφαρμογές, Πανεπιστημιακές Εκδόσεις Κρήτης.
- Lipschutz, S., LipsonMarcLars, Γραμμική Άλγεβρα, $5_η$ Έκδοση, Εκδόσεις Τζιόλα, 2013.
- 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: 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, I. Vrontos, Associate Professors, Department of Statistics

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

Desired Learning Outcomes: Upon successful completion of the course students should be able to manage and import data to 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., Εισαγωγή στον Προγραμματισμό και στη Στατιστική Ανάλυση με R, Εκδόσεις Ελληνικά Ακαδημαϊκά Συγγράμματα και Βοηθήματα-Αποθετήριο "Κάλλιπος", 2016.
- 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. Tutorial. Εργασία.

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

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

Teaching Language: Greek.

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 a fuller and deeper understanding of the concepts learned in the introductory probability course. In addition, they

will have the prerequisite knowledge for courses based on multi-dimensional distributions and joint studies, such as multivariate analysis, multivariate techniques and modeling.

Prerequisites: Introduction to Probability

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. χ2, t, and F distributions. Multivariate distributions. The Multivariate Normal Distribution. Convergence in distribution. The Central Limit Theorem.

Recommended Reading

- Ross, S., Βασικές Αρχές θεωρίας πιθανοτήτων, Εκδόσεις Κλειδαριθμός ΕΠΕ, 2011.
- Κούτρας Μ., Εισαγωγή στη θεωρία Πιθανοτήτων και Εφαρμογές, Εκδόσεις Τσότρας, 2016.
- Παπαΐωάννου Τ., Θεωρία Πιθανοτήτων και Στατιστικής, Εκδόσεις Σταμούλης Α.Ε., 1997.
- Feller, W. (1968). An Introduction to Probability Theory and its Applications. Wiley, N.Y.
- Hoel P., Port S., Stone C., «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.
- 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 use basic concepts related (a) series of functions and (b) function of more than one variables (partial derivatives, optimization with or without constraints, including techniques such as Lagrange multipliers or the Kuhn-Tucker conditions, multiple integrals, etc.). The course emphasizes on

future application of these concepts to statistics, probability, computer science and various fields of study related to economic or 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. Optimization, Lagrange multipliers and applications.

Recommended Reading

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

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

Desired Learning Outcomes: In-depth understanding of the concepts of the course so that students be able to answer questions demonstrating this understanding. The acquisition of a geometric oversight of concepts such as projection, determinant, eigenvalues and eigenvectors. Finally, applying this knowledge to solving exercises, such as calculating a projection matrix, solving a function interpolation problem with least squares, matrix diagonalization, calculating the square type contour lines.

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, unitary.

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 – Assistant Professor X. Penteli, Department of Statistics

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

Desired Learning Outcomes: The student will be able to know and understand basic concepts about Statistics, to understand basic concepts of Probabilities, to be familiarized basic characteristics of Statistics and Probability through simulation, to have sufficient R knowledge in order to implement basic programs to solve basic statistical methodologies, to create and understand basic descriptive graphs, to be able to satisfactorily manage his data in order to extract from large volumes of data what is useful to him, to be able to understand in real data their basic characteristics..

Prerequisites: none

Syllabus: This course aims to introduce students to basic principles of statistics and probability using R. These tasks 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 probability results. Introduction and comparison of distributions. Basic principles of descriptive statistics. Describing data using the appropriate graphs and measures. Tabulating and presenting the data. Introduction to linear regression. Statistical terminology and the media, probabilities, inference. Case studies. Examples from everyday life.

Recommended Reading

- Αγγελής Β., Δημάκη Α., Στατιστική Τόμος Α, Εκδόσεις "σοφία", 2010.
- Δαμιανού Χ., Κούτρας Μ., Εισαγωγή στη Στατιστική Μέρος Ι, Εκδόσεις Συμμετρία, 2003.
- VerzaniJ., Εισαγωγή στη Στατιστική με την R, Εκδόσεις Κλειδάριθμος ΕΠΕ, 2016.

- 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. Tutorial. Assignments. Self-Study.

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

Teaching Language: Greek.

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: After successfully completing the course, students will be able to estimate unknown parameters using the appropriate methodology, to build confidence intervals that contain the unknown parameters with the desired probability and to carry out statistical tests regarding the 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. 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., Στατιστική Τόμος Α, Εκδόσεις “σοφία”, 2012.
- Δαμιανού Χ., Κούτρας Μ., Εισαγωγή στη Στατιστική ΜΕΡΟΣ Ι, Εκδόσεις Συμμετρία, 2003.
- 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. Tutorial. 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: Professor M. Zazanis, Department of Statistics

E.C.T.S.: 8

Desired Learning Outcomes: Upon successful completion of the course, students should 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, know the basic properties of a simple random walk process on the integers, Poisson and Wiener processes in continuous time, Markov chains in discrete time, 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., Στοιχεία θεωρίας στοχαστικών ανελίξεων, Εκδόσεις Ζήτη, 1991.

- 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. Tutorial. 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: After successfully completing the course students will be familiar and able to use in concrete applications the basic concepts of mathematical analysis focusing on the future applications of these concepts in statistics, probability, and computer science as well as their applications in various fields of study related to economic sciences.

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, Beginning Functional Analysis, Springer Series on Undergraduate Mathematics, 2002
- A.N. Yannacopoulos, Introduction to Mathematical Analysis, Lecture Notes (2016)
- 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. Tutorial. 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: After 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 the Bayesian with the classic (frequentist) approach to statistics. During this course are taught: 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 and MINIMAX. Point estimate, 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. Tutorial. 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: Academic Scholar

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 focused on micro and macro analysis, as well as economic policy tools.

Prerequisites: none

Syllabus: Introductory knowledge regarding the way microeconomics and macroeconomics operate, as well as the main problems they face. Also, introductory knowledge regarding basic concepts and scales of the economy and how to measure and define them. Introduction: the Circular flow of income. The Scarcity problem. Institutional Framework.

Microeconomics theory: Supply and Demand, Balance and elasticity. Consumer behavior theory. Utility method and Indifference curves. Production and cost theory. Market structures forms: Perfect competition, Monopoly, Monopolistic competition, Oligopoly, other forms. General Economic Balance and Economics of Prosperity.

Macroeconomics theory: National product and National income. Consumption. Saving. Investment. Multiplier. Production. Employment, Salaries. Defining income and employment. Money markets. Fiscal and Monetary policy. International trade and macroeconomics. About inflation and unemployment. Economic growth. The State's role in solving macroeconomic problems.

Recommended Reading

- Mankiw N., Taylor P. Mark, Οικονομική 3η Έκδοση, Εκδόσεις Τζιόλα, 2016.
- McConell C., Flynn S., Brue S., Εισαγωγή στην Οικονομική Επιστήμη, Εκδοτικός Οίκος Rosili, 2016.
- G. Mankiw, M. Taylor (2011) «Αρχές Οικονομικής Θεωρίας» - Gutenberg Γιώργος & Κώστας Δαρδανός
- D. Begg, S. Fischer, R. Dornbusch (2006) "Εισαγωγή στην Οικονομική" Εκδόσεις Κριτική
- Δημέλη Σ. (2010) «Μακροοικονομικά Μεγέθη και ανάπτυξη της Ελληνικής Οικονομίας»

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.

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: correlation coefficient, simple and multiple linear regression, statistical inference in linear regression, hypothesis testing and diagnostic tests, transformations, general linear model, algorithmic methods for choosing the optimal (sub)model, multicollinearity and dummy variables.

Prerequisites: Estimation and hypothesis testing (code: 6012)

Syllabus: Introduction to simple linear regression, model coefficients 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.

Introduction to multivariate normal distribution. Multiple regression, design matrix, introduction to pseudo variables, general form of linear model, LS estimates and properties. Unbiased estimate of data variance. Maximum likelihood estimation. Multiple correlation coefficient, model ANOVA, partial F-tests. Simple residuals, standardized and studentized residuals, normality test, Q-Q plots, residual plots, added variable plots. 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. Tutorial. Assignments.

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

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: After the successful completion of the course, students should 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., Εφαρμοσμένη Στατιστική, Εκδόσεις Ζήτη, 1990.
- Zivot, Eric.Wang, Jiahui, Modeling Financial Time Series with S-PLUS, Springer Science and Business Media Inc., 2006.
- Shumway, Robert H., Stoffer, David S., Time Series Analysis and its Applications, Springer Science and Business Media LLC, 2006.
- Gilgen, Hans, Univariate Time Series in Geosciences, Springer-Verlag Berlin Heidelberg, 2006.
- Kirchgassner, Gebhard, Wolters, Jurgen, Introduction to Modern time Series Analysis, Springer-Verlag Berlin Heidelberg, 2007.
- Δαμιανού Χαράλαμπος Χ., ΜΕΘΟΔΟΛΟΓΙΑ ΔΕΙΓΜΑΤΟΛΗΨΙΑΣ, Εκδόσεις “σοφία”, 2007.
- 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. Tutorial. 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: After successfully completing the course, students will be able to estimate unknown parameters using the appropriate methodology, to build confidence intervals that contain the unknown parameters with the desired probability and to carry out statistical tests regarding the specific problems.

Prerequisites: none

Syllabus: Point estimation, properties of point estimators (consistency, unbiasdness, 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, comparing parameters in two different samples, statistical significance level, p-value, power of a test, sample size calculation.

Recommended Reading

- Αγγελής Β., Δημάκη Α., Στατιστική Τόμος Α, Εκδόσεις “σοφία”, 2012.
- Δαμιανού Χ., Κούτρας Μ., Εισαγωγή στη Στατιστική ΜΕΡΟΣ Ι, Εκδόσεις Συμμετρία, 2003.
- 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. Tutorial. 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., Δημογραφική Ανάλυση-Αρχές, μέθοδοι, υποδείγματα, Εκδόσεις Σταμούλη Α.Ε., 2004.
- 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. Tutorial. 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 to combine these methods to collect a sample from a finite population. To choose the most effective and appropriate plan, depending on the population, among alternatives. To find estimators, their typical errors, confidence intervals and in general, statistical inference based on the sampling method used to collect the data. To be aware of sampling and non-

sampling errors entering a survey and how to minimize them, and finally to compile 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 a 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., Θεωρία Δειγματοληψίας, 2016.
- 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. Tutorial. 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: M. Zazanis, Professor, Department of Statistics

E.C.T.S.: 7

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

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

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, 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. Tutorial. 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 are 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

Applied Linear Models (code: 6225)

Course Type: Elective

Course level: First cycle

Instructor: P. Tziamyrtzis, Associate Professor, Department of Statistics

E.C.T.S.: 8

Desired Learning Outcomes: Students are expected to know the fundamental theory behind the simple and multiple linear regression models and weighted regression. It is also expected to understand the linear models' applications in experimental design and be able to design an experiment exploiting its basic principles.

Prerequisites: Linear Algebra, Linear Models.

Syllabus: Normal linear model through matrices. Statistical inference, LRT, general linear hypothesis. Quadratic forms and distributions, mean value, independence between quadratic forms. Weighted regression, variance modeling. Sensitivity analysis. Basic principles of design of experiments. Factorial experiments with one factor. Analysis of variance with one factor. Sum-to-zero parameterization, corner point parameterization, design matrix, estimated parameters, model ANOVA. Contrasts and multiple comparisons. Two factors analysis of variance, interaction, estimated parameters, model ANOVA. The case of more than two factors. Analysis through linear model. Multiple comparisons in factorial experiments, ANCOVA methods. Incomplete blocks experiments. Blocking and confounding. Fractional factorial experiments. Random effects models, split-plot experiments.

Recommended Reading

- Chatterjee, S. and Hadi, A.S. (2012). Regression analysis by example, Wiley.
- Draper N.R. and Smith, H. (1997). Εφαρμοσμένη Ανάλυση Παλινδρόμησης, Παπαζήσης
- Montgomery, D.C., Peck, E.A. and Vining, G.G. (2012). Introduction to Linear Regression Analysis, Wiley.
- Montgomery, D.C. (2012). Design and analysis of experiments, Wiley.
- Ryan, T.P. (2008). Modern regression methods, Wiley.

- Weisberg, S. (2014). Applied Linear Regression, Wiley

Teaching Method: Face to Face.

Teaching includes: Class lectures. Lab exercise. Assignments.

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

Teaching Language: Greek.

Generalized Linear Models (code: 6176)

Course Type: Compulsory

Course level: First cycle

Instructors: Associate Professor I. Vrontos – 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 and interpreting the results, and in some depth understanding of the theoretical issues that arise.

Prerequisites: Linear Algebra, Estimation – Hypothesis Testing, Linear models.

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. Tutorial. 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 and Assistant Professor X. Pendeli, Department of Statistics

E.C.T.S.: 8

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

Prerequisites: Estimation and hypothesis testing (code: 6012)

Syllabus: Introduction to regression, straight line fitting, model coefficients 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. Tutorial. 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: After the course the student will have the skills needed to deal with improving the quality of products or services using statistical methods.

Prerequisites: Estimation – Hypothesis Testing

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 and St. Vakeroudis, Assistant Professor, Department of Statistics

E.C.T.S.: 8

Desired Learning Outcomes: After completing the course the 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., Μαθηματική Στατιστική, Εκδόσεις Ζήτη, 1998.
- Φουσκάκης Δ., Ανάλυση Δεδομένων με τη Χρήση της R., Εκδόσεις Τσότρας, 2013.
- CrawleyM.J., Στατιστική Ανάλυση με το R., BrokenHillPublishers, 2013.
- 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, the 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, «Εισαγωγή στην Επιχειρησιακή Έρευνα», Εκδόσεις Συμμετρία, 2003.
- HillierF., S., LiebermanG.J., Εισαγωγή στην Επιχειρησιακή Έρευνα, Τόμος Α΄, Τεύχος Α΄, Εκδόσεις Παπαζήσης, 1985.
- F. S. Hillier, G. J. Lieberman, "Introduction to Operations Research", McGraw-Hill, 2005.

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.

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: After successful completion of the course, the students should 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: 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 real data sets 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., Εισαγωγή στον Προγραμματισμό και στη Στατιστική Ανάλυση με R, Εκδόσεις Ελληνικά Ακαδημαϊκά Ηλεκτρονικά Συγγράμματα και Βοηθήματα-Αποθετήριο "Κάλλιπος'', 2016.
- Φουσκάκης Δ. (2013). Ανάλυση Δεδομένων με Χρήση της R. Εκδόσεις Τσότρας. Αθήνα.
- Marques de Sa, Joaquim P., Applied Statistics Using SPSS, STATISTICA, MATLAB and R, Editions Springer-Verlag, 2008.
- 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: After successfully completing the course, the students will be able to understand elements of stochastic simulation and implement it 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. Tutorial. 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

E.C.T.S.: 8

Desired Learning Outcomes: Upon completion of the course, the student will be able to: produce graphs and comprehend relations in his 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., Μέθοδοι Πολυμεταβλητής Στατιστικής Ανάλυσης, Εκδόσεις Σταμούλη Α.Ε., 2005.
- Everitt, Sidney B., Casella, Fienberg G., Olkin S., Ingram, An R and S-PLUS Companion to Multivariate Analysis, Springer-Verlag London Limited, 2005.
- 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. Tutorial. 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: Probability I, Probability II, Calculus I, Calculus II, Introduction to Mathematical Analysis.

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., Measure Thery and Probability Thery, Springer Science and Business Media, LLC, 2006.

- Billingsley, P. (1995): Probability and Measure, 3rd Edition, John Wiley & Sons.
- Bhattacharya, Rabi. Waymire, Edward C., A Basic Course on Probability Theory, Springer Science and Business Media, Inc., 2007.
- 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., Basic Principles and Applications of Probability Theory, Springer-Verlag Berlin Heidelberg, 2005.
- SpringerLink (Online service), Gut A., Probability: A graduate Course, Springer Science and Business Media, Inc., 2005.
- 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 the student 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. Tutorial. 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: Associate Professor A. Livada, Department of Statistics

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 the student should 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. Tutoring.

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

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: Regression and Introduction to economic analysis

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., Οικονομετρικές Μέθοδοι, Εκδόσεις Κλειδάριθμος ΕΠΕ, 2005.
- 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 public presentation. Practical exercises.

Teaching Language: Greek.

Stochastic Processes II (code: 6057)

Course Type: Elective

Course level: First cycle

Instructors: Professors E. Kyriakidis, - M. Zazanis, 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), 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., Θεωρία Μέτρου, Εκδόσεις Συμμετρία, 2005.
- 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: Assistant Professor X. Penteli, Department of Statistics

E.C.T.S.: 8

Desired Learning Outcomes: Upon completion of the course the 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, the student will be able to construct graphs and understand relationships between data, identify observation clusters in the data, be able to build classification rules.

Prerequisites: Understanding subject 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., Ανάλυση Πολυμεταβλητών Τεχνικών στις Κοινωνικές Επιστήμες, Εκδόσεις Κλειδάριθμος ΕΠΕ, 2011.
- Ιωαννίδης Δ., Αθανασιάδης Ι., Στατιστική και Μηχανική Μάθηση με την R, Εκδόσεις Τζιόλα, 2017.
- Rajaraman A., Ullman D.J., Εξόρυξη από Μεγάλα Σύνολα Δεδομένων, Εκδόσεις Νέων Τεχνολογιών, 2014.
- Sidney B., Everitt, Casella G., Fienberg, S., Ingram O., An R and S-PLUS Companion to Multivariate Analysis, Springer-Verlag London Limited, 2005.
- 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, the students will: Know and understand Survival Analysis. Have acquired knowledge about theory and methods. Practical skills for survival data analysis. 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., Εφαρμοσμένη Στατιστική με έμφαση στις Επιστήμες Υγείας, Εκδόσεις Τζιόλα, 2016.
- Μπερσίμης Σ., Σαχλάς Α., Εφαρμοσμένη Στατιστική με χρήση του IBM SPSSStatistics 23, Εκδόσεις Τζιόλα, 2016.
- PetrieA., SabinC., Ιατρική Στατιστική με μια ματιά, Εκδόσεις Παρισιάνου Α.Ε., 2015.
- PaganoM., GauvreauK., Αρχές Βιοστατιστικής, Εκδόσεις Έλλην, 2002.
- Ιωαννίδης Ι., Αρχές Αποδεικτικής Ιατρικής, Ιατρικές Εκδόσεις Λίτσας, 2000.
- 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 can 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, 2013
- 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 the students should be able to:

- Understand the differences between classic and 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 algorithms MCMC 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.

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

Course Type: Elective

Course level: First cycle

Instructor: Academic Scholar, Department of Statistics

E.C.T.S.: 7

Desired Learning Outcomes: Upon successful completion of the course, the student 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 the 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 the table of financial outcomes with added information and find the optimal decision.
- Construct the 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, Παίγνια και Αποφάσεις, Εκδόσεις Κριτική, 2012.
- Κ. Μηλολιδάκης, Θεωρία Παιγνίων, Εκδόσεις Σοφία, 2009.
- J. Q. Smith, Decision Analysis: A Bayesian Approach, Chapman and Hall, 1988.
- F. S. Hillier and G. J. Lieberman: Introduction to Operations Research, Mc GrawHill, 2005.

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.

H' Semester

Categorical Data Analysis (code: 6108)

Course Type: Elective

Course level: First cycle

Instructor: Academic Scholar, Department of Statistics

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: Associate Professor P. Merkouris, Department of Statistics

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

Syllabus: Statistical theory of finite populations: populations, sub-populations, variables, parameters. Random sampling, probabilities of selection of units. Sampling with unequal probabilities, sampling weights, selfweighting and nonselfweighiting 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: Probability I, Probability II, Stochastic Procedures I

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: Assistant Professor E. Ioannidis, Department of Statistics

E.C.T.S.: 8

Desired Learning Outcomes: At the end of the course the student 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. Jacknife 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. Measure theory and probability theory. Springer Science & Business Media, 2006.
- 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, the students should be able to:

- Read scientific announcements and understand the results as well as their validity
- Be able to find information about data and methodologies needed for their analyses
- Accurately designing surveys and all their individual features
- Understand survey's validity and reliability
- Be able to distinguish problematic from accurately designed surveys
- Be able to correctly choose and apply statistical methodologies to address a research problem
- To be aware of morality issues in research.

Prerequisites: none

Syllabus: Data collecting methods: contemporary methods, advantages and disadvantages. Error types. Questionnaire design. Building scales, scale types. Reliability indices. Examples of misuse of statistics, discussions on specific publications, building a questionnaire, research issues (introducing bias, etc), report writing and presenting.

Recommended Reading

- Norman M. Bradburn, Seymour Sudman, Brian Wansink (2004) Asking Questions: The Definitive Guide to Questionnaire Design.
- Paul P. Biemer (2004) Measurement Errors in Surveys. Wiley.

Teaching Method: Face to Face.

Teaching includes: Class lectures.

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

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

Instructor: N. Frangos, Professor, Department of Statistics

E.C.T.S.: 7

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

- Comprehend various types of pension schemes.
- Understand the contributions - benefits relationship, the effect of financial and biometric assumptions on the evaluation of pension schemes.
- Check the sufficiency of the pensions reserves as well as their viability

Prerequisites: none

Syllabus: Structures, systems and financing resources of the Pension Funds, Benefits programs design, setting the technical basis, Demographic and Economic assumptions, Composite actuarial interest rate functions based on multiple cost matrix, population models, Actuarial measures of liabilities evaluation, Standard and additional financing costs, actuarial profit/ damage, actuarial balance, categorization and criteria for evaluating financing methods

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

Υπεύθυνος: Assistant Professor E. Ioannidis, Department of Statistics

E.C.T.S.: 8

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

Prerequisites:

Syllabus: It can only take place in the 4th year of studies, or later. In order for a student to be able to conduct a dissertation he/ she must have passed all compulsory courses and hold an average grade of at least 7. The work lasts one Semester. A supervising Professor is assigned, as well as two other faculty members as examiners. The dissertation is presented on a specific day and time specified for all these within (or shortly before) the corresponding exam. The dissertation corresponds to 8 PM. (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 the student will be able to:

- Know how they can deal with a statistical problem with real data
- Be able to understand, explore and formulate a real problem of statistical content in the sense of statistical analysis.
- Know the role of a statistician in a company and the way of interacting with colleagues and function within a group.
- Understand time allocation when working on a project.
- Learn to handle various types of data, coming from different sources.
- Learn how to compile reports on the results of statistical analyses.
- Transfer theoretical knowledge to practical aspects
- Acquire work experience and work skills while discovering the working environment.
- Learn how to write a CV and choose prospective employers/ work environment

Prerequisites:

Student must have

- Completed the 5^{th} semester
- Not have participated again in practical training
- Have accumulated at least 80 ECTS's
- Have successfully completed at least 8 compulsory courses
- Participate in a relevant informative session/ seminar of the Practical Training office.

PART 3
GENERAL INFORMATION FOR THE STUDENTS

Athens University of Economics and Business provides not only high-quality education but also high quality services. With the publication of the Presidential Decree 387/83 and the Law 1404/83, the operation, organization, administration of Student Clubs at Universities is designed to improve the living conditions of the students, to entertain them and promote their social and intellectual wellbeing with initiatives to engage in socialization.

To fulfill this objective the University ensures the required infrastructure funds for housing, procurement, sports, the operation of a restaurant, canteen, reading room, library, organizes lectures, concerts, theatrical performances and excursions inland and abroad, develops international student relations, holds classes for the teaching of foreign languages, computer science and Modern Greek as a foreign language for foreign students and provides any other means needed.

1. Cost of Living

The cost of living is determined by the current housing and feeding prices. This cost is reduced if students qualify for free accommodation and meals.

2. Housing

The Student Club of the Athens University of Economics and Business provides free accommodation to students, provided that they satisfy the necessary conditions, available in the Student Club's website. At the same time, the Student Club also has a Housing Finding Office, which collects ads for renting apartments.

3. Food Services

Located inside the main building of the University is a student refectory of the AUEB University Student Club where all members of the University Community can eat meals, either free of charge or for a fee. Free meals are granted to those that meet the necessary conditions. For more information one can contact the Student Club office.

4. Medical Services, Insurance/ Healthcare

Undergraduate, postgraduate and PhD students of the University that have no other medical and hospital care are entitled to full care in the National Health System (ESY), with expenses covered by the National Health Services Provider (EOPYY). The infirmary is housed in the main building and operates on certain weekdays. The Psychiatric Counseling Service also operates at the University, where a physician specializing in the psychodynamic treatment of mental health issues is employed.

5. Services for students with special needs

The University ensures the facilitation of students with special needs through the design, implementation and application of adaptations to the university's environment for access to university buildings. In the main building there are specially designed lifts, ramps and elevators. There are also specific exam regulations for students with special needs.

Furthermore, the Library provides to students with vision impairments the possibility of electronic access to the suggested bibliography for their courses. In this context, the Link of Greek Academic Libraries (Σ. Ε. Α. Β.) has developed a multimodal electronic library named **AMELib**. To access this service, users must be authenticated and use a code and password. For more information visit the Library's webpage https://www.aueb.gr/en/library.

6. Financial Support

Undergraduate students of Higher Education Institutions and Higher Ecclesiastical Academies, Greek nationals or nationals of other European Union countries, are entitled to annual housing allowance in accordance with the terms and conditions set out in Joint Ministerial Decision 140832 / G1 / 25-8-2017 (FEK 2993 B / 31-8-2017).

Also, the State Scholarship Foundation (IKY) annually grants scholarships to students who exhibit excellent academic performance in their six-month courses and for achieving high entrance admission scores at the University. The Secretariats of the respective Departments shall notify the names of the Candidate Scholars and will set the deadlines for submitting their supporting documents.

In addition, the "George Halkiopoulos Foundation" operates at the University. It grants scholarships depending on the educational performance and the financial status of the candidates. In October of each academic year, the Foundation (Public Relations Department, ground floor building) announces the scholarship amount, as well as the manner and date of application for the interested parties.

Finally, other awards are granted occasionally by various Institutions, Organizations and Businesses. Information is provided by the Department of Education Department of Student Welfare (ground floor of the main building) and by the Secretariats of the Departments, as well as on the central AUEB website.

7. Office of Student Affairs – Faculty Advisors

At each department a faculty advisor is designated for each student, appointed by the Head of the Department, with the responsibility to guide and consult the student regarding their studies. If one of the advisors is on a leave, then a substitute is appointed by him/ her. In the case that a professor leaves the Department, the distribution of his students is the department's president responsibility.

8. Study Centers – Reading Rooms – Libraries

The Library & Information Center (BCC) of the Athens University of Economics and Business was established in 1920 and operates on the first and second floor of the University's central building. It is a part of the Hellenic Academic Libraries Association (Heal-LINK), the European Documentation Centers Europe Direct and the Economic Libraries Cooperation Network (DIOB).

Three (3) Documentation Centers operate within the library:

- The European Documentation Center (KET) since 1992,
- The Organization for Economic Cooperation and Development (OECD) Documentation Center since 1997,
- The Delegation Center of the World Tourism Organization (WHO) hosting publications since 2004.

The Library contributes decisively both to meeting the needs for scientific information of the academic community and to supporting teaching and research work. This is achieved through the unified

organization of collections and the coordination of the provided services. The Library provides access to:

- the printed collection of books and scientific journals,
- courses textbooks,
- collection of electronic scientific journals
- e-books collection
- the postgraduate theses and doctoral theses produced in AUEB and deposited in digital form at the PYXIDA institutional repository
- sectoral studies
- statistical series by national and international organizations
- audiovisual material
- information material (encyclopedias, dictionaries)
- Collection of official governmental publications of the European Union, the OECD and the WCO
- databases on the issues cultivated by the University
- printed collections of other academic libraries.

The Library lends to its members all its printed collections, except for magazines and statistical series, in accordance to its internal rule of operation. The Library has a reading room, computer workstations for visitors, photocopiers and printing machines, and provides the opportunity to interlibrary loan books and magazine articles from other academic libraries that are members of its network.

9. International programs and practical information on international student mobility

AUEB is actively involved in the Erasmus+ Program by promoting cooperation with universities, businesses and international organizations of the European Union (EU) as well as the mobility of students, teaching and administrative staff. Within the framework of this Program, the University collaborates with more than 220 European Institutions on subject's relative to its Departments. More than 7000 students have participated so far in the Erasmus Program.

Of these, approximately 4,000 OPA students have attended courses at Associate Universities in Europe and about 3,000 foreign students who have completed a period of study at AUEB ensure accreditation through the Credit Transfer and Accumulation System (ECTS).

In addition, the Foundation co-ordinates the Erasmus+ Practical Training Group with partners from the National Technical University of Athens and the Universities of Crete, Ioannina and Macedonia, offering the possibility of practical training for students and the ability of teaching/education to faculty members.

Finally, AUEB, adopting the internationalization and extroversion strategy, has been successfully participating in the International Credit Mobility Program with the aim of developing international collaborations in education and research with partner Universities in countries outside the EU via: a) student mobility; b) short-term teaching staff mobility and c) teaching and administrative staff training mobility. The Program was first implemented in the academic year 2015-2016 and to date there have been 52 students and staff members moving from and to 8 Partner Institutions in countries outside the EU. (USA, Canada, Singapore, Russia, South Korea, Armenia). More information can be found on the Foundation's homepage (https://www.aueb.gr/en/erasmus).

10. Language lessons

Knowledge of foreign languages, as a universally accepted educational value, is a necessary resource for effective individual involvement in the sophisticated social reality. The Student Club, understanding this modern educational necessity, offers the opportunity to every university and technical university

student, as well as to all those who are interested, in attending relevant seminars. Seminars are held in English, French, German, Spanish, Italian and Russian, and new language seminars are available if there is a similar interest.

11. Practical Training

The mission of the Central Office of Practical Training is to promote in the best possible way the linking of theory to practice and the smooth transition of students from academic to professional life. Practical Training is an integral component of education at the Athens University of Economics and Business, as all its Departments have instituted and included it in their curriculum. The duration is 2 to 4 months and is mainly implemented in three periods (winter semester, spring semester and summer season). Prepare seminars are carried out prior to each internship period. Information: 13 Elpidos street, 3rd floor.

12. Sports Facilities

The Athens University of Economics and Business organizes a variety of sports activities. It has a long history in sports accompanied with a multitude of distinctions, medals, trophies and prizes in national and international competitions. In order to continue to provide complete education to its students, the Athens University of Economics and Business collaborates with the City of Athens Cultural, Sports and Youth Organization and uses its sports facilities, located at 10 Pasov Street, Grava, Ano Patissia (indoor swimming pool, indoor basketball and volleyball court, open athletics course at the Ermonassis & Pityountos - Thermis junction (5x5 open soccer field) and at the Mitsakis & Polyla junction - Ano Patissia (open air tennis court).

The teaching of Physical Education courses at the Physical Education Department of AUEB follows the curriculum for the teaching of academic subjects. It begins in winter semester and ends at the end of the spring semester. It is worth noting that students have the right to attend Physical Education courses up to six months after receiving their Diploma. The Department of Physical Education of the Athens University of Economics and Business is staffed by well-trained Physical Education Teachers and by specialized temporary teaching staff.

13. Student Clubs

Various Student Organizations and Clubs operate in the academic community of the Athens University of Economics and Business. More information can be found on AUEB's website (https://www.aueb.gr/en/content/student-clubs).

14. Career Office

The Office's main task is to assist University students and graduates to join the labor market and guide them for postgraduate studies. The Career Office assists students and graduates in their first steps to find work: (a) by communicating available positions and promoting CV's to collaborating businesses and organizations, (b) organizing Occupational Orientation Days where students and graduates get the chance to meet and discuss with businesses and other organizations representatives, (c) organizing seminars concerning the job interview procedure, as well as presentations of the current trends in the job market, (d) providing printed and electronic material with directions on how to write the cv and the cover letter, as well as advises for job interviews, (e) giving the chance to students and graduates to talk with consultants for career or educational issues and to use the special psychometric tests .

The office also provides extended information for AUEB's undergraduate and postgraduate programs, other Greek and international postgraduate programs, scholarships and Greek businesses.

The Office publishes informational brochures and organizes informative events. It also runs regular visits of high school students to the University's premises. In addition, the Office maintains a database of graduate employment data and job positions to provide an insight into the labor market's supply and demand. The Office also cooperates with The Athens Center for Entrepreneurship and Innovation.

15. Unit of Innovation and Entrepreneurship

The Unit of Innovation and Entrepreneurship task is to encourage innovative thinking and foster entrepreneurship in the AUEB community, to support the students and the wider public interested in entrepreneurship, to understand requirements and organize new innovative business endeavors. For that reason:

- The Unit's website provides direct and continuous access to relevant information, knowledge and practical tools to encourage creativity and to provide the means for managing innovation and organizing successful business efforts.
- The Unit's helpdesk is available for direct personal communication, information and problem solving.
- Professors – Partners of the unit produce educational material with instructions and information on the cutting edge of developments in various scientific fields.
- The Unit supports teaching of entrepreneurship courses by providing teachers with contemporary material and relevant tools.
- The Unit organizes open events, seminars and visits to courses, thus providing the opportunity of direct contact with successful entrepreneurs and prominent executives, in order to improve students' understanding by reducing the distance between theoretical training and the practical application of their ideas.
- The Unit closely cooperates with the Advisory Steering Committee, providing the opportunity to enhance educational activities and provide practical knowledge to students, with the assistance of specialized teachers and executives

The Unit also provides support for the start-up of new business groups through the services of the ACEin Center (Athens Center for Entrepreneurship (https://acein.aueb.gr/en/).