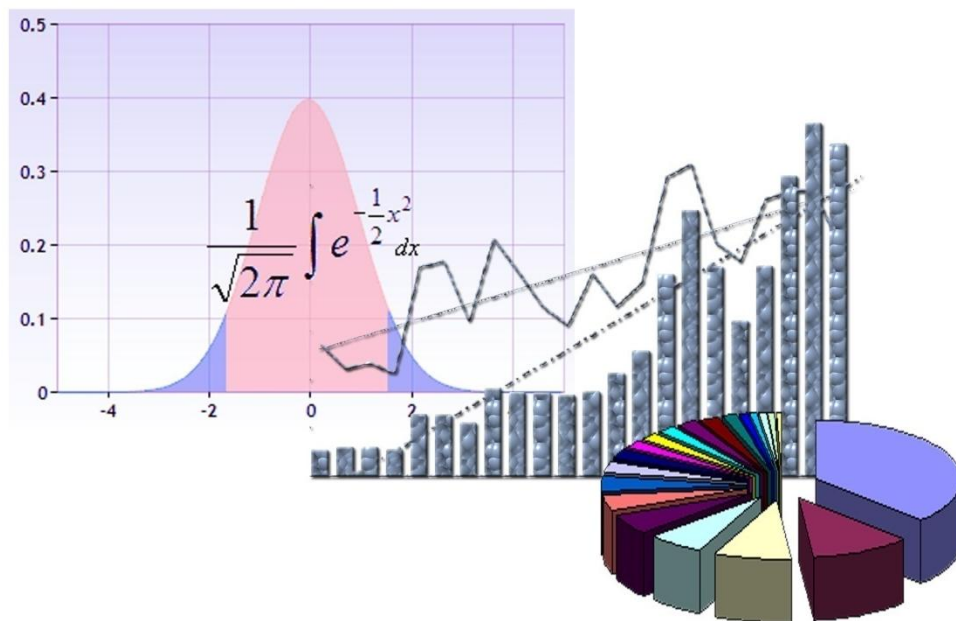**ΟΙΚΟΝΟΜΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ**

ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS

SCHOOL OF INFORMATION SCIENCES AND TECHNOLOGY
DEPARTMENT OF STATISTICS

UNDERGRADUATE STUDIES
GUIDE 2019-2020

$$\frac{1}{\sqrt{2\pi}} \int e^{-\frac{1}{2}x^2} dx$$

ATHENS, SEPTEMBER 2019

Athens University of Economics and Business Academic Authorities

Rector: Professor Emmanouil Giakoumakis
Deputy Rector for Academic Affairs: Professor Dimitrios Bourantonis
DeputyRector forEconomic Affairs: Professor Dimitrios Gkritzalis
DeputyRector for Financial Planning and Development: Associate Professor George Xylomenos

School of Information Sciences and Technology

Dean: Professor George Stamoulis

Department of Statistics

Head of the Department: Professor Vasileios Vasdekis

Vice Chairman: Professor Dimitrios Karlis

Communication Information

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Secretary e-mail: stat@aueb.gr

University: Athens University of Economics and Business (A.U.E.B)
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PART 3: GENERAL INFORMATION FOR THE STUDENTS

PART 1
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. At an international level, the University's unwavering strategic goal is to actively participate in the global academic environment, to develop high-profile international collaborations, and to generally enhance its international impact and recognition through excellence in research and education.

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 4485/2017 (Greek Government Gazette 114/4-8-2017, Part A). The Athens University of Economics and Business is overseen by the Ministry of Education, Research and Religious Affairs.

SENATE
The **Senate** is the supreme governing body of the University and it comprised of the:
- ➢ Rector,
- ➢ Deputy Rectors,

- ➢ Deans of the three Schools ,
- ➢ Heads of the Departments,
- ➢ One representative of the undergraduate students, one of the postgraduate students and one of the doctoral candidates,
- ➢ One representative per staff category, EEP, EDIP, ETEP and Administrative staff

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.

According to Greek Law 4485/2017 (Government Gazette 114/4-8-2017, Part A), each school's administration is conducted by a) the School Assembly, b) the Dean's Council, and c) the Dean

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

According to Greek Law 4485/2017 (Government Gazette 114/4-8-2017, Part A),each department's administration is conducted by: a) the Department Assembly, b) the Department Directing Council and c) the Head of the Department.

3. Curricula and focus areas

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:

Department	Focus areas
Department of International and European Economic Studies	1. International Economics and Finance 2. International and European Political Economy
Department of Economics	1. Economic Theory and Policy 2. Business Economics and Finance 3. International and European Economics
Department of 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
Department of Business Administration	1. Business Administration 2. Information Systems Administration 3. Accounting and Finance Administration 4. Marketing
Department of Accounting and Finance	1. Accounting 2. Finance
Department of Marketing and Communication	1. International Management, Innovation and Entrepreneurship 2. Human Resource Management 3. Business Analytics 4. Digital Marketing
Department of 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
Department of Statistics	

The Department of Statistics does not offer specific directions in studies. The Department of Informatics offers six modules of which students select two.

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

4. Structure of Studies

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 1st of 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 each, 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.

There is also a summer examination period, starting at the last week of August and finishing right before the start of 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 entrance examinations. The enrollment of persons that have succeeded in these examinations takes place each September through the electronic enrollment information system of the Ministry of Education, Research, and Religious Affairs.

6. Primary Regulations

The operations of AUEB are governed by a number of regulations, the most important of which are:

➢ The Regulation for the Operations of AUEB (Εσωτερικός Κανονισμός Λειτουργίας)
➢ The Regulation for Administrative Operations (Οργανισμός Διοικητικών Υπηρεσιών)
➢ The Postgraduate Studies Guide (Κανονισμός Λειτουργίας Προγραμμάτων Μεταπτυχιακών και Διδακτορικών Σπουδών)
➢ The Postdoctoral Studies Guide (Εσωτερικός Κανονισμός για την Πραγματοποίηση Μεταδιδακτορικής Έρευνας)
➢ The Regulation on the Administration of Examinations (Οδηγός Διεξαγωγής Εξετάσεων)

7. Personnel

AUEB personnel is divided in academic personnel and administrative personnel.

The **academic personnel** is comprised of the following categories:

- Faculty members (Μέλη Διδακτικού και Ερευνητικού Προσωπικού-Δ.Ε.Π), which have the main responsibility for coordinating the teaching and research activities of the University, and are divided in (a) Professors, (b) Associate Professors, (c) Assistant Professors, and (d) Lecturers.
- Special Teaching Staff (Ειδικό Εκπαιδευτικό Προσωπικό-Ε.Ε.Π.) and Assisting Teaching Staff (Επικουρικό Διδακτικό Προσωπικό-Ε.Δ.Π.), which support the teaching activities of departments.
- Laboratory Teaching Staff (Εργαστηριακό Διδακτικό Προσωπικό-Ε.ΔΙ.Π.), which have applied laboratory teaching responsibilities primarily consisting of supervising (laboratory) exercises.
- Special Technical Laboratory Staff (Ειδικό Τεχνικό Προσωπικό–ΕΤΕΠ), which oversee the operation of the departmental infrastructure, providing specialized, technical laboratory work that ensures that the academic and applied work of the department is adequately completed.
- Teaching staff with fixed-term appointments supported by EU and related funding, which support some of the teaching activities of departments.
- Secondary education personnel under a temporary posting at AUEB, which support the teaching as well as research activities of departments.

- Ph.D. candidates working as teaching assistants as part of their duties towards their departments.

The **administrative personnel** supports the faculty and the students by providing administrative support to students and the rest of the personnel as well as a variety of services (housing, library and sports facilities, etc.)

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, exofficio, 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*

- ➢ Fall Semester: September 30th 2019 until January 10th 2020
- ➢ Christmas Vacations: December 21 2019 until January 6th 2020
- ➢ Fall Semester Exams Period: January 13th 2020 until February 7th 2020
- ➢ Spring Semester: February 10th 2020 until May 22nd 2020
- ➢ Easter Holidays: April 11th 2020 until April 26th 2020
- ➢ Spring Semester Exams Period: May 25th 2020 until June 19th 2020

According to the 2019-20 Academic Calendar

11. Official Holidays

- ✓ January 6th (Epiphany)
- ✓ January 30th(The Three Patron Saints of Education Day)
- ✓ March 2nd (Clean Monday)
- ✓ March 25th (Greek Independence Day)
- ✓ May 1st (Labor Day)
- ✓ June 8th (Pentecost Monday)
- ✓ October 28th (28th of October National Celebration)

PART 2
DEPARTMENT OF STATISTICS

A. GENERAL DESCRIPTION

1. 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 ~~very~~ 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 graduates 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. The Department does not have any similar department, thus does not accept students transfers (ΦΕΚ 2520/29.06.2018, 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 their solid mathematical and statistical background of quantitative and computational methods of analysis, 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.

2. 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 promotion of research, there are three (3) research labs equipped with computers with a total capacity of 57 computers and one (1) educational lab at the Department of Statistics of a total capacity of 51 computers.

More analytically, the Statistics department laboratories are the following:

Research Laboratories:

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 pc's 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 Modeling 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 Laboratory:

i. **Educational 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 include 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.

Computer Centre

AUEB's Computer Center (**CE**) is responsible for providing computer infrastructure to the University 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, ie 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 a reminder 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 students 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 almost all courses of the Statistics Department to facilitate communication between students and teachers.

B. Personnel

1. Faculty Members (ΔΕΠ)

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 Modelling 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 PhD 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 PhD in Statistics from the same department in 1999. His research interest refer 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

Kostaki Anastasia obtained a basic degree in Mathematics, Statistics and Computer Science from the University of Lund, Sweden. She then received MSc, PhL and PhD in Statistics from the same University. Her research interests focus on the development of statistical techniques for population analysis and modeling of mortality and birth rates as well as on the methodology of analysis of demographic, social and biomedical data URL: http://stat-athens.aueb.gr/~akostaki/

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 PhD 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 PhD 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 MSc degree in Statistics from McGill University, and a PhD 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 a Doctoral Degree in Statistics (1999) from the same university. His research interests include: a) Applied Statistics, b) Statistical Computing και c) Ecological Statistics. URL: http://www.aueb.gr/pages_en/faculty/faculty_en_short.php?facid=1133

Pavlopoulos Charalampos, Recieved 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

Demiris Nikolaos, studied Mathematics in the University of Patras and received his MsC in AUEB and his PhD 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 (PhD) 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/

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

B2. Scientific Associates

Aifanti Maria received her B.Sc. in Economic Sciences from National and Kapodistrian University of Athens (1977). She has participated as co-author in various academic books related to Statistics. Her academic research interests mainly focus on Economic topics.

B3. 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.

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

B4. Special Technical Laboratorial Staff (E.T.E.P.)

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

B5. 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
Program Studies

C1. Learning Outcomes

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

- To demonstrate understanding of the basics of probability theory and the mathematical foundations of statistics, statistical reasoning and inferential methods.
- To understand the notion of uncertainty and how statistics, probability and modern data science can improve decisions when faced with uncertainty.
- To design, collect and analyze real data and draw appropriate conclusions knowing the limitations of the analysis.
- To interpret and communicate the results of a statistical analysis.
- To develop data-analyzing skills using statistical computing tools and software.
- To demonstrate knowledge of ways to avoid misuse of statistical methods and wrong interpretation of the results.
- To understand how research questions are translated into a form that can be addressed with statistical methods.
- To read 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 ofEuropean 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 ECTSreferred 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.

C3.Course's Categories

1. The program's courses are divided into 2 basic categories:
   a) **14 compulsory courses** which must be attended by all of the Department's students
   b) **Elective courses** which are of two categories:
      - Courses offered by the Statistics Department
      - 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 establishes the necessary background in order to make his following choices.

3. In the last two semesters, no compulsory courses are offered. In 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 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 4th semester, the student may enroll in courses with a **maximum of 40 ECTS credits per semester.**

6. From the 5th to the 6th semester, the student may enroll in courses with a **maximum of 38 ECTS credits per semester.**

7. In the 7th and 8th semesters the student may enroll in courses with a **maximum of 46 ECTS credits per semester.** There can be excess only for the course "Practical Training".

8. After the 4th year of study, the student may enrol 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	38 ECTS	38 ECTS
4th	46 ECTS + Practical Training	46 ECTS + Practical Training
5th and 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.

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 Departments of the University.

12. The list of the offered courses is announced each year and depends on the availability of the corresponding 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:

COURSES WHICH PROVES KNOWLEDGE OF INFORMATICS

Course Title	Department
INTRODUCTION TO PROGRAMMING WITH R	STATISTICS
INTRODUCTION TO PROBABILITY AND STATISTICS WITH R	STATISTICS
DATA ANALYSIS	STATISTICS
SIMULATION	STATISTICS
DATABASES	MANAGEMENT SCIENCE AND TECHNOLOGY
COMMUNICATION NETWORKS	INFORMATICS
COMPUTER NETWORKS	INFORMATICS
DATABASE DESIGN	INFORMATICS

14. Students can enroll in the Teacher Education Program. More information can be found here:https://www.dept.aueb.gr/tep

14. At last, 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/el/content/πρόγραμμα-έρασμος.

C4. Educational Support

1. Courses offered by the Department of Statistics, mostly compulsory ones, part of the teaching time is dedicated to the students practicing on statistical packages. There is a lab functioning in the Department, for the undergraduate students to prepare their assignments, and for researching and collecting information and bibliography related to the assignments. For this reason, there are many statistical packages installed, and many other applications, such as word processor software, graphics packages, databases etc. In the lab, there are also available copies of the Practical Training assignments undertaken by the students, as well as copies of the Department's pre-publications. The lab also occasionally hosts seminars relative to the Department's subjects, as well as courses of the undergraduate program.

2. Educational support (tutorials) is offered, when necessary, in the courses offered by the Department of Statistics. Time and place of the tutorials is announced on the Department's announcement board and on the University's website (www.aueb.gr).

C5. General Rules

1. There are no "directions" in the study program. Each student can form his own "direction" and specialization according to his/her particular interests.

2. Each student can extend his knowledge to other scientific subjects offered by the University (economics, management, marketing, informatics etc.) by choosing suitable elective courses. Selection is done in collaboration with theirFaculty Advisor.

3. Regarding the elective courses, semesters are indicative.

4. The minimum number of students enrolled in a course, in order for it to be offered, is 8.

5. Within the framework of the ECTS transfer system, students of the Department may also enroll in courses offered by Departments of other Universities in Greece and abroad (in addition to those with which the Department cooperates as part of the Erasmus program). In order to be recognized the attendance and the performance to these courses, there must be an agreement with the course's instructor, the Faculty Advisor and the Head of the Department. The number of ECTS corresponding to these courses is determined by the Curriculum Committee and approved by the Department's Assembly.

6. The overall Grade Point Average (GPA) upon graduation is the weighted average of all passed courses with ECTS credits of each course used as weighting factors.

7. The Department's announcements are posted to the Department's website (https://www.dept.aueb.gr/stat).

8. Each instructoris obliged to have an updated page on the University's e-class.

9. Exam grades are (optionally) posted in the Department's website and/or in the e-class. Official announcement of the grades is on e-Grammateia.

10. The Study Program includes compulsory and elective courses, their syllabus and the weekly teaching hours.

11. The above provisions are part of the Internal Regulation of the Department of Statistics. These provisions are communicated to the students through the Undergraduate Course Guide, which is made available at the beginning of each academic year. In this guide it is recorded the Study Program's courses, the semesters on which they are offered, their characterization and the respective ECTS credits.

12. **Bachelor Dissertation**: It can take place only on the 4th year of study (or later). In order for a student to be enrolled, he/she must have completed successfully all compulsory courses and holds an average of at least 7 grade in these courses. Bachelor Dissertation has a duration of one semester. A supervisor is assigned and alsoother two faculty members as examiners. The dissertation is presented on a predefined date and time defined for all dissertations, during or just before the exam period. For more details, see the corresponding section of this Study Guide.

13. **Practical Training:** It can take place only once and refers to the application of statistical methods in a workplace of the Public or Private Sector. To start with the practical training, everyone who is interested should obtain the approval of an instructor from the Department who will supervise him/her, and the approval of the Department's Practical Training Coordinator, and then fill in the forms which are available on the Department's website. The start of the Practical training can take place after the 6th Semester, in the summer or later. The student must have accumulate at least 80 ECTS credits and have passed a minimum of 8 compulsory courses. Depending on the scientific subject and its duration, it can be graded/attributed from 6 to 14 ECTS credits. The number of ECTS is determined by the Department's Practical Training Coordinator after the suggestion of the supervisor. Prior to

any practical training period, preparatory seminars are conducted. URL: http://internship.aueb.gr/.

For more details, see the corresponding section of this Study Guide.

14. Updating of the Study Program takes place each April, according to the legislation.

C6. Attending, Course enrollment and examination

- **Course enrollment**: In order students to attend lectures and be gradedin courses, they must complete an online course enrollment, which they must submit to the Department's Electronic Secretariat (e-Grammateia) at the link: (https://aueb.gr/el/content/e-grammateia-0). Course enrollment is <u>mandatory</u> and must be completed at the dates and times announced by the University at the beginning of each semester. <u>In case of non-enrollmentin courses, student isnot permitted to sit in the exams.</u>

- The final enrollment to the coursesmust be **saved**.

- **Textbook Selection:**Students can submit an electronic textbook selection through the Eudoxus platform (https://eudoxus.gr/). **It must be emphasized that the course enrollment and the textbook selection does not substitute each other.** There are penalties in case of receiving a textbook for a course that the student is not enrolled in.

- The teaching hours of the Department's courses, of the same semester, are not coinciding.

- Each courseis taught for 13 weeks, with 4 lecture hours per week. Most courses include tutorials where exercisesare solved and questions are discussed.

- The grade in each course is expressed on the scale 0-10, and can include half integers (0.5). The passing grade is five (5). The overall Grade Point Average (GPA) upon graduation is the weighted average of all passed courses with ECTS credits of each course used as weighting factors.The GPA is accompanied by a qualitative rating: grades from 8.51 to 10 receive the rating "Excellent", grades from 6.51 to 8.50 receive the rating "Very Good", and grades from 5.00 to 6.50 receive the rating "Good".

- The examination of courses in the winter semester takes place from January to early February. The examination of courses in the spring semester takes place in June. Finally, a second examination for courses of both semesters takes place in September. If a student fails in a course that he enrolled in during the winter or spring semester, he may repeat the examination of the course during the September examination period.

- **Grade cancelation**: Students who have received a passing grade in a course but wish to be re-examined in they must submit an application to the Department's Secretariat following a relevant announcement by the Rectorate. The following restrictions apply:

  – The maximum number of times a student can request a re-examination is equal to the 10% of the courses required to obtain a degree (i.e., 4, in the case of the Department of Statistics).

  – The application must be submitted in the interval between the examination period the student obtained the passing grade and the immediately following period where the course will be examined. The student can participate in the course's examination anytime in the future.

C7. Scholarships and Awards

In order to support undergraduate students, as well as to recognize and encourage excellence, the Department of Statistics and AUEB's Career Office, offers **scholarships** in collaboration with other organizations, foundations and businesses. These scholarships are announced at the University's (https://www.aueb.gr/el/news_archive/23) and the Department's (https://www.dept.aueb.gr/el/stat/content/γενικές-υποτροφίες) website.

Additionally, AUEB's Property, Management & Development Company, manages the bequests of the Foundations of "Georgia Nikolakopoulou" and "Faidonas Hatzigeorgiou". Inthese foundations, scholarships are granted to students with limited financial resources, based on their academic performance.

The **State Scholarships Foundation (Ίδρυμα Κρατικών Υποτροφιών - ΙΚΥ**) grants scholarships to diligent students and aims to ensure equal participation in higher education of those who have low incomes and belong to vulnerable social groups. The project is co-funded by Greece and the European Union (European Social Fund) through the Operational Program "Human Resources Development, Education and Lifelong Learning 2014-2020".

Finally, from the academic year 2018-2019, the Department of Statistics implemented a procedure of granting scholarships and performance awards to undergraduate students based on academic criteria and using its own resources. More particularly:

(a) For the first 4 years of studies, a PERFORMANCE AWARD is granted to the best two students of each academic year, who have successfully attended and passed all courses of the previous academic year and have an average grade of at least "eight" (8). To calculate the weighted average of the previous academic year, grades of all three exam periods (January, June and September) are taken into consideration. The performance award is signed by the Head of the Department, is published in November of each year, and is included in the Diploma Supplement. Students already holding an academic degree are exempted from this procedure.

(b) Each graduate who completes his/her studies in 4 years and holds an average grade(GPA) of 8.51 or more, can receive a full scholarship (in the form of 100% exemption of student fees) to attend one of the postgraduate programs of the Department of Statistics for the next three academic years following his/ her graduation, upon acceptance.

C8. Complaint Management Procedure

In recognition that, on occasion, there will be legitimate complaints which individuals wish to raise, the Department is committed to maintaining an effective complaint procedure. The Department recognises that reasonable complaints, sometimes improve the quality and effectiveness of its services and boost the student-centric educational procedure. Complaints will be recorded, along with any action taken in regard to the specific complaint.

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.

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 Procedure
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
Work progress is regularly monitored in cooperation with the supervisor.

Writing Procedure
The dissertation must contain the following:
- Review of bibliography
- Description of the 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/el/stat/content/διπλωματική-εργασία-0

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 ~~respective~~ exam period.
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, the Committee meets in order to evaluate the dissertation and grant the final grade. The final grade is recorded to the Department's Electronic Secretariat (e-Grammateia) at the current examination period.

DissertationSubmission
The student submits the dissertation in a hard copy and electronically to the department's secretariat, after incorporating any observations may occurred at 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" 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 adapting 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.

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.

This meeting is devoted to all interested students 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 3 times a year (Winter Semester, Spring Semester and during the summer) in specific dates announced by the Central Office for the Practical Training.

To start the Practical Training each student must obtain an agreement from a professor that will supervise him/ her, as well as approval from the Practical Training coordinator. Then, he/ she has to fill the forms available at the Statistics Department website and the Central Office for the Practical Training website (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, which 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 decision making in order to solve specific problems. Supervising the student from the designated faculty member is about designing the respective sampling research and the methodological dealing with the problem, 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 participating in the Practical Training, 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 with the student, 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:
- Fill in the electronic application at the Practical Training website:https://www.dasta-is.aueb.gr/.
- Choose an available position for Practical Training, in cooperation with the central office manager (Ms A.Panagiotidou) and the Scientific Supervisor.
- Submit the Statement of the Student's Personal Data to the Central Office for Practical Training (Ms A.Panagiotidou). The form is available at the https://www.dasta-is.aueb.gr/ link, under the ΔΗΛΩΣΕΙΣ menu.
- Statement of the Beginning of the Practical Training. It is filedin at the Central Office for Practical Training (Ms A.Panagiotidou) before the beginning of the training or shortly after.
- Statement of Practical Training takes place at e-Grammateia (https://aueb.gr/el/content/e-grammateia-0) during the course enrollment period.
- Before beginning Practical Training, the students must submitto the Central Office for Practical Training (Ms A.Panagiotidou) the Certificate of the Employment Agency received by the organization.
- A contract (Private agreement - three original copies) is signed for the implementation of the Practical Training (received by the employment agency), and is submitted to the Central Office of Practical Training (Ms. Angeliki Panagiotidou).
- Completion Report from the Agency's Supervisor, submitted to the Central Office of Practical Training (Ms. Angeliki Panagiotidou) after the ending of the Training.

- Completion Report from the Department's assigned Supervisor, submitted to the Central Office of Practical Training (Ms. Angeliki Panagiotidou) after the ending of the Training.
- Report and Grading (of the Statistics Department Coordinator) submitted to the Department's secretariat after the ending of the Training.
- The student writes the aforementioned report – essay about the Practical Training and submits it in printed and electronic format (two cd's) to the Central Office of Practical Training (Ms. Angeliki Panagiotidou).

Forms
- Statement for the beginning of the Training
- Completion Report from the Agency's Supervisor
- Completion Report from the Department's assigned Supervisor
- Report and Grading of the Statistics Department Coordinator
- Cover
- Student's Personal Data Statement
- Certificate of the Employment Agency
- Private Contract with the company/ organization
- Questionnaire for the employment agencies
- Questionnaire for the students
- Certificate of Completion of the Practical Training (from the agency)

Communication – Information: Aggeliki Panagiotidou, M.Sc.
Central Office for Practical Training
Athens University of Economics and Business
13 Elpidos str., 104 34, (3rd floor), Tel.: 210 8203 825
E-mail: apan@aueb.gr

The Central Office for Practical Training is open for students from Monday to Friday, 11:00 – 15:00

C11. General Structure of the ProgramStudies

The general structure of the program is presented in the table below:

A' Semester	B' Semester
• Probability I (C) • Calculus I (C) • Linear Algebra I (C) • Introduction to Programming with R (C)	• Probability II (C) • Calculus II (C) • Linear Algebra II (C) • Introduction to Probability and Statistics with R (C)
C' Semester	**D' Semester**
• Estimation and Hypothesis Testing (C) • Stochastic Processes I (C) • Introduction to Mathematical Analysis • Demographic Statistics • Introduction to Economic Theory • Introduction to Computerized Accounting and Finance	• Linear Models (C) • Time Series Analysis (C) • Sampling • Mathematical Methods • Actuarial Science I
E' Semester	**F' Semester**
• Generalized Linear Models (C) • Applied Linear Models • Bayesian Statistics • Statistical Quality Control • Theoretical Statistics • Introduction to Operational Research	• Data Analysis (C) • Simulation • Multivariate Statistical Analysis • Biostatistics I • Probability Theory • Official Statistics
G' Semester	**H' Semester**
• Statistical Learning • Biostatistics II • Econometrics • Stochastic Processes II • Actuarial Science II • Research Methodology* • Special Topics in Probability and Statistics - • Bachelor Dissertation • Practical Training	• Categorical Data Analysis • Advanced Sampling Methods • Statistical Methods for the Environment and Ecology • Numerical Methods in Statistics • Non Parametric Statistics • Bayesian Inference Methods • Special Topics in Probability and Statistics – Decision Theory • Bachelor Dissertation • Practical Training

(C): compulsory courses

Notes:

- Courses which aren't offered on the academic year 2019-2020 are denoted with *.
- Elective courses are offered only if there is an available instructor.
- There are tutorials for all compulsory courses. Tutorials will also take placeto elective courses, according to availability.
- 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.

C12. Elective Courses offered by other Departments for the academic year 2019-20

Winter Semester

CODE	ECTS	COURSE TITLE	DEPARTMENT
1131	6	GENERAL ECONOMIC HISTORY	Economics
1193	6	PRINCIPALS OF SOCIOLOGY	Economics
1311	6	MACROECONOMIC THEORY I	Economics
1313	6	MICROECONOMIC THEORY I	Economics
1550	6	PUBLIC FINANCE I	Economics
2612	6	COST ACCOUNTING	Business Administration
3070	6	TEACHER TRAINING INTERNSHIP I	Informatics
3074	6	INTRODUCTION TO PEDAGOGY	Informatics
3075	6	ORGANIZATION AND MANAGEMENT OF EDUCATION AND EDUCATIONAL INSTITUTIONS	Informatics
3076	6	INTRODUCTION TO METHODOLOGY OF TEACHING - ANALYTICAL PROGRAMMS	Informatics
3078	6	EDUCATIONAL EVALUATION	Informatics
3117	6	DISCRETE MATHEMATICS	Informatics
3125	6	INTRODUCTION TO PROGRAMMING	Informatics
3230	8	COMPUTATIONAL MATHEMATICS	Informatics
3321	8	COMPUTER PROGRAMMING WITH C++	Informatics
3335	7	DATA STRUCTURES	Informatics
3515	7	LOGIC	Informatics
3531	7	ARTIFICIAL INTELLIGENCE	Informatics
3541	8	SOFTWARE ANALYSIS AND DESIGN	Informatics
3571	8	COMMUNICATION NETWORKS	Informatics
3743	6	DATA MINING FROM LARGE DATABASES AND THE WORLD WIDE WEB	Informatics
4107	6	FINANCIAL LAW	International & European Economic Studies
4137	6	PORTFOLIO MANAGEMENT	International & European Economic Studies
4110	6	INTRODUCTION TO POLITICS AND INTERNATIONAL RELATIONS	International & European Economic Studies
5634	6	MARKETING RESEARCH	Marketing& Communication
5636	6	MARKETING	Marketing& Communication
5411	6	INTRODUCTION TO BUSINESS ADMINISTRATION	Marketing& Communication
5622	6	INTRODUCTION TO MARKETING	Marketing& Communication
8117	6	DATABASES	Management Science and Technology
8123	6	OPTIMIZATION METHODS IN MANAGEMENT SCIENCE	Management Science and Technology
8137	6	BUSINESS INTELIGENCE AND BIG DATA ANALYSIS (prerequisite is 8117 – Databases)	Management Science and Technology

| 8143 | 6 | COMBINATIONAL OPTIMIZATION | Management Science and Technology |
| 8154 | 6 | ENTREPRENEURSHIP | Management Science and Technology |

Spring Semester

CODE	ECTS	COURSE TITLE	DEPARTMENT
1402	6	MICROECONOMIC THEORY II	Economics
1412	6	MACROECONOMIC THEORY II	Economics
2410	6	ADVANCED FINANCIAL ACCOUNTING	Business Administration
2416	6	FINANCIAL MANAGEMENT I	Business Administration
2610	6	OPERATIONAL POLICY AND STRATEGY	Business Administration
2622	6	INVESTMENT MANAGEMENT	Business Administration
3080	6	TEACHER TRAINING INTERNSHIP II	Informatics
3084	6	GENERAL AND EVOLUTIONARY PSYCHOLOGY	Informatics
3085	6	QUALITY IN EDUCATION AND TEACHING	Informatics
3086	6	INTRODUCTION TO COMPUTERS - EDUCATIONAL APPLICATIONS	Informatics
3087	6	SPECIAL EDUCATION METHODOLOGY - TEACHING ECONOMIC COURSES	Informatics
3222	6	COMPUTER PROGRAMMING USING JAVA	Informatics
3432	7	ALGORITHMS	Informatics
3513	7	APPLIED NUMERICAL ANALYSIS	Informatics
3543	7	DATABASE DESIGN	Informatics
3672	7	NETWORKS	Informatics
3644	6	INFORMATION RETRIEVING SYSTEMS	Informatics
3612	6	SPECIAL TOPICS OF DISCRETE MATHEMATICS	Informatics
3713	6	GAME AND DECISION THEORY	Informatics
3814	6	INFORMATION THEORY *(will not be offered in the academic year 2019-20)*	Informatics
3745	6	MECHANICAL LEARNING	Informatics
5414	6	HUMAN RESOURCES MANAGEMENT	Marketing& Communication
5626	6	DIGITAL MARKETING	Marketing& Communication
7138	6	RISK MANAGEMENT	Accounting & Finance
8106	6	PROGRAMMING I	Management Science and Technology
8132	6	FOOD SUPPLY CHAIN MANAGEMENT	Management Science and Technology
8134	6	PRODUCTION AND OPERATIONS MANAGEMENT	Management Science and Technology

Note: A student accepted to "Teacher Education Program" is eligible to enroll in a course from the Department of Informatics titled: "*Creating and Using Digital Educational Material in Contemporary Education Methodologies*", which has 6 ECTS credits.

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 Associate Professor A. Livada.

D. COURSE DESCRIPTION

1ST SEMESTER

Probability I (code: 6001)

Course type: Compulsory

Course level: First cycle

Instructor: Professor E. Kyriakidis, Department of Statistics

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

Desired Learning Outcomes: Upon successful completion of the course the students should be able to understand the different ways to calculate probabilities of events, solve problems by using the laws of probability, revise probabilities by using Bayes' rule, use random variables with realistic applications, and choose the appropriate probability model.

Prerequisites: none

Syllabus: Sample space, events, Definition of Probability, elementary combinational analysis. Properties of probabilities, independent events, Conditional Probabilities, Law of Total Probability, Bayes theorem. Discrete random variables, Joint distribution of random variables. Independence. Mean value, Variance, Markov and Chebyshev inequalities. Uniform, binomial, geometric and hypergeometric distributions, Poisson distribution.

Continuous distributions. Distribution function and probability density function. Mean, variance. Uniform, exponential and normal distribution. Gamma and Beta distributions. Moment generating functions.

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) Probability 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: Assistant Professor Al. Zympidis, Department of Statistics

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

DesiredLearningOutcomes: 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: Contracted Instructor

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

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. Orthogonal matrices.

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 with R (code: 6122)

Course type: Compulsory

Course level: First cycle

Instructor: Professor I. Ntzoufras, Department of Statistics

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

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 and figures, multiple graphs.

Objects and object types. Loop Commands and Syntax (for, while, repeat). Creating Scripts and Programs. Simple Functions & Functions with multiple output. Lists of results. Special functions and commands.

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 Broken Hill.
- 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 exercises. Tutorial. Assignments.
Student Assessment Method: Written exam at the end of the semester (80%). Written assignments (20%). Lab exercises (extra small bonus).
Teaching Language: Greek

2nd Semester

Probability II (code: 6142)

Course type: Compulsory

Course level: First cycle

Instructors: Professor M. Zazanis – Associate Professor I. Papageorgiou, Department of Statistics

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

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. They will have understood the basic concepts underlying multidimensional probability distributions and obtained the necessary mathematical skills in order to use them in the context of statistical problems.

Prerequisites: Introduction to Probability.

Syllabus: Joint distributions of discrete random variables, marginal and conditional distributions. The multinomial and the multi-hypergeometric distribution. Joint distributions of continuous random variables. Joint, marginal, and conditional densities. Transformations of multidimensional random variables. The χ^2, t, and F distributions. Order Statistics. The multivariate normal distribution. Convergence in distribution. The Central Limit Theorem.

Recommended Reading
- Ross, S., Βασικές Αρχές θεωρίας πιθανοτήτων, Εκδόσεις Κλειδάριθμός ΕΠΕ, 2011.
- Κούτρας Μ., Εισαγωγή στη θεωρία Πιθανοτήτων και Εφαρμογές, Εκδόσεις Τσότρας, 2016.
- Παπαϊωάννου 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», ITE 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 studies cycle

Instructor: Professor A. Yannacopoulos, 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 variables. 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

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

Instructors: Professor N. Fragkos, Department of Statistics

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

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. Applications of eigenvalues/eigenvectors also include an introduction to the Principal Component Analysis method and Dynamical systems.

Prerequisites: none

Syllabus: Rectangular matrices, the Gramm-Schmidt rectangularization and A = QR factorization. Determinants. Eigenvalues and characteristic polynomial, eigenvectors and eigen spaces. The minimal polynomial. 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. The Jordan canonical form. The Principal Component Analysis (PCA). The Singular values decomposition SVD). The Polar decomposition. Complex and hermitian matrices. The generalized inverse (Moore-Penrose inverse) and its applications in linear regression and projection matrices.

Recommended Reading

- Gilbert Strang (1999), *Γραμμική Άλγεβρα και Εφαρμογές*, Πανεπιστημιακές Εκδόσεις Κρήτης.
- Ε. Ξεκαλάκη & Ι. Πανάρετος (1993), *Γραμμική Άλγεβρα για Στατιστικές Εφαρμογές*, Αθήνα.
- Η. Φλυτζάνης (1999), *Γραμμική Άλγεβρα & Εφαρμογές, Τεύχος Α: Γραμμική Άλγεβρα*, Το Οικονομικό.
- Γ. Δονάτος-Μ. Αδάμ (2008), *Γραμμική Άλγεβρα Θεωρία και Εφαρμογές*, Gutenberg.
- D. C. Lay, (2012), *Linear Algebra and Applications, Addison-Wesley.*
- 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.
Student Assessment Method: Written exam at the end of the semester.
Teaching Language: Greek.

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

Course type: Compulsory

Course level: First cycle

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

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

Desired Learning Outcomes: The student will be able to understand and make use of basic concepts about statistics and probability. They will be able to have sufficient knowledge of R program, as to be capable to implement basic programs in order to perform basic statistical methods, to create and understand basic descriptive visualization, to manage data of certain complexity and to extract them from large datasets. They will be also able to comprehend basic characteristics of real data and communicate them efficiently
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 I, 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 studying and analyzing. Tutorial. Assignments. Self Study.
Student Assessment Method: Written exam at the end of the semester. Home assignment. Written exam (Project).
Teaching Language: Greek.

2ND YEAR

3rd Semester

Estimation and Hypothesis Testing (code: 6012)

Course type: Compulsory

Course level: First cycle

Instructors: Professor St. Psarakis, Department of Statistics

E.C.T.S.: 8 credits

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

- Robert V. Hogg, Elliot Tanis, Dale Zimmerman, Probability and Statistical Inference, 9th edition.
- G. A. Young ,R. L. Smith. Essentials of Statistical Inference. Cambridge Series in Statistical and Probabilistic Mathematics.
- Tore Schweder and Nils Lid Hjort. Confidence, Likelihood, Probability: Statistical Inference with Confidence Distributions. Cambridge Series in Statistical and Probabilistic Mathematics.

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.

Stochastic Processes I(code: 6126)

Course type: Compulsory

Course level: First cycle

Instructor: Associate Professor H. Pavlopoulos, Department of Statistics

E.C.T.S.: 8 credits

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 credits

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.

Demographic Statistics (code: 6134)

Course type: elective

Course level: First cycle

Instructor: Professor A. Kostaki, Department of Statistics

E.C.T.S.: 7 credits

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.

Recommended Reading
- 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.
- Shiva S. Halli, K. Vaninadha Rao (1992). Advanced Techniques of Population Analysis, Plenum Pub Corp.

Teaching Method: Face to Face.
Teaching includes: Class lectures. Tutorial. Self Study and assignment.
Student Assessment Method: Written exam (70% of the final grade) and assignment using the presented techniques (30% of the final grade).
Teaching Language: Greek.

Introduction to Economic Theory (code: 6112)

Course type: elective

Course level: First cycle

Instructor: Associate Professor A. Leivada, Department of Statistics

E.C.T.S.: 7 credits

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
- MankiwN., TaylorP. Mark, Οικονομική 3^η Έκδοση, Εκδόσεις Τζιόλα, 2016.
- McConellC., FlynnS., BrueS., Εισαγωγή στην Οικονομική Επιστήμη, Εκδοτικός Οίκος Rosili, 2016.
- G. Mankiw, M. Taylor (2011) «Αρχες Οικονομικης Θεωριας» - Gutenberg Γιώργος & Κώστας Δαρδανός
- D. Begg, S. Fischer, R. Dornbusch (2006) "Εισαγωγη Στην Οικονομικη" Εκδοσεις Κριτικη
- 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 Computerized Accounting and Finance (code: 6163)

Course type: elective

Course level: First cycle

Instructor: Academic Scholar

E.C.T.S.: 7 credits

Desired Learning Outcomes: Introducing the basic framework of Financial Accounting and Reporting. Analyzing the components of an Accounting Information System (AIS).

Prerequisites: none

Syllabus: Introducing the basic 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, accrual accounting concepts, the accounting equation, posting journal entries, adjustment entries, closing entries. Introduction to an accounting information system (AIS).

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. Devising a study.
Student Assessment Method: Written exam at the end of the semester. Written exam (Project).
Teaching Language: Greek.

4th Semester

Linear Models (code: 6023)

Course type: Compulsory

Course level: First cycle

Instructor: Professor A. Kostaki, Department of Statistics

E.C.T.S.: 8 credits

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 of choosing the optimal (sub)model, multilinearity and dummy variables.

Prerequisites: Estimation and hypothesis testing (code: 6012)

Syllabus: Introduction to regression, straight line fitting, coefficients estimators. Coefficient estimators properties, mean value, variance, confidence intervals, hypothesis testing, estimating data variance. Predicted values, straight line ANOVA, R^2, F test. Introduction to multivariate normal distribution. Multiple Regression, examples. LS estimations, Estimator properties. Expected and predicted dependent variables values estimation. Error estimation. Partial correlation coefficient, model ANOVA, partial F-tests, consecutive F-tests. Dummy variables, Simple residuals, standardized residuals, studentized residuals, normality test, basic hypothesis testing plots. Transformations, the concept of multilinearity, diagnostic tests. Stepwise regression, forward, backward, stepwise methods, all possible regressions.

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. Homeassignment.
Teaching Language: Greek.

Time Series Analysis (code: 6145)

Course type: Compulsory

Course level: First cycle

Instructor: Academic Scholar

E.C.T.S.: 8 credits

Desired Learning Outcomes: After the succesfull 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., Μωυσυάδης 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) <u>RECURSIVE</u>

Course type: Compulsory

Course level: First cycle

Instructor: Academic Scholar

E.C.T.S.: 8 credits

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.

Sampling (code: 6033)

Course type: elective

Course level: First cycle

Instructor: Associate Professor I. Papageorgiou, Department of Statistics

E.C.T.S.: 7 credits

Desired Learning Outcomes: After the completion of the course the students should ideally be able to:
- Implement the standard sampling designs and a combination of these, from the sampling theory to select the sample from a finite population.
- Choose the appropriate method depending on the target population, in order to achieve best performance for the derived estimates.
- Find estimates and their standard errors, confidence intervals, and general statistical inference that is in accordance with the sampling procedure that has been followed.
- Identify the sampling and non-sampling errors that may occur in a sampling survey and implement techniques that can minimize them.
- Construct a 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: Professor M. Zazanis, Department of Statistics

E.C.T.S.: 7 credits

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

- Lipschutz S., Lipson Marc Lars, Γραμμική Άλγεβρα, $5^η$ 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 I (code: 6135)

Course type: elective

Course level: First cycle

Instructor: Assistant Professor A. Zympidis, Department of Statistics

E.C.T.S.: 7 credits

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: Individual and collective risk models, 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, 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 Bornhuetter-Ferguson method, separate frequency and severity modeling, parametric methods (use of damage functions).Reinsurance schemes: Quota Share, Excess of Loss, Stop Loss, Markov chains and Bonus-Malus insurance systems.

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.

3rd YEAR

5th Semester

Applied Linear Models (code: 6225)

Course type: elective
Course level: First cycle
Instructor: Professor V. Vasdekis, Department of Statistics
E.C.T.S.: 8 credits

Desired Learning Outcomes: Students are expected to know the fundamental theory behind the simple and multiple linear regression models, weighted regression, non-linear regression, random effects models and to become familiar with their practical applications. The students study the conditions for applications and the use for analysis under different data types.

Prerequisites: Linear Algebra, Linear Models

Syllabus: Linear models for normal data using matrices. Statistical inference. Maximum likelihood and least squares. Quadratic forms. Confidence interval construction and prediction. Goodness-of-fit, plots. ANCOVA and their applications, weighted regression, variance modeling, sensitivity analysis, non-linear regression with independent data. Design of experiments. Factorial experiments with one, two or more factors. Applications of multiple comparisons. Blocking and confounding in factorial experiments. Fractional factorial experiments. Random effects models and 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 N. Demiris, Department of Statistics

E.C.T.S.: 8 credits

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. These models include in particular logistic models for binary data as well as Poisson-log-linear models for contingency tables, including the interpretation of their results, and in some depth understanding of the theoretical issues that arise. In addition, the ability to construct design matrices with different parameterizations and to identify the presence of interactions from diagrams of the fitted values of a model.

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 Method: Face to Face.
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.

Bayesian Statistics (code: 6106)

Course type: elective

Course level: First cycle

Instructor: Assistant Professor N. Demiris, Department of Statistics

E.C.T.S.: 7 credits

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.

Statistical Quality Control (code: 6123)

Course type: elective

Course level: First cycle

Instructor: Professor St. Psarakis, Department of Statistics

E.C.T.S.: 7 credits

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

E.C.T.S.: 8 credits

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, $2^η$ 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 I - Εκτιμητική, $2^η$ Έκδοση, Εκδόσεις Ζήτη, Θεσσαλονίκη.
- Ρούσσας Γ. (1994) Στατιστική Συμπερασματολογία, Τόμος II – Έλεγχοι Υποθέσεων, $2^η$ 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 Operations Research (code: 6153)

Course type: elective

Course level: First cycle

Instructor: Professor E. Kyriakidis, Department of Statistics

E.C.T.S.: 7 credits

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, realistic 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. An introduction to inventory control.

Recommended Reading
- Δ. Φακίνος, Α. Οικονόμου, «Εισαγωγή στην Επιχειρησιακή Έρευνα», Εκδόσεις Συμμετρία, 2003.
- Hillier F., S., Lieberman G.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.

Linear Models (code: 6023) <u>RECURSIVE</u>

Course type: Compulsory

Course level: First cycle

Instructor: Professor A. Kostaki, Assistant Professor X. Penteli, Department of Statistics

E.C.T.S.: 8 credits

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 of choosing the optimal (sub)model, multilinearity and dummy variables.

Prerequisites: Estimation and hypothesis testing (code: 6012)

SyllabusIntroduction to regression, straight line fitting, coefficients estimators. Coefficient estimators properties, mean value, variance, confidence intervals, estimating data variance. Predicted values, straight line ANOVA, R^2, F test. Introduction to multivariate normal distribution. Multiple regression model. LS estimators. Estimating expected and predicted values of a dependent variable, error estimation, Partial correlation coefficient, model ANOVA, partial F-tests, consecutive F-tests. Dummy variables. Simple, standardized and studentized residuals, normality test, basic model hypothesis testing graphs, model hypothesis testing. Transformations, the concept of multilinearity, diagnostic tests, forward, backward, stepwise methods, all possible regressions

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. Studying and analyzing bibliography. Tutorial. Assignments.
Student Assessment Method: Written exam at the end of the semester. Home assignment.
Teaching Language: Greek.

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 credits

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.

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 credits

Desired Learning Outcomes: The students after successfully completing the course 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 credits

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
- Bartholomew David J., Steele F., Moustaki I., Galbraithe J.I., Ανάλυση Πολυμεταβλητών Τεχνικών στις Κοινωνικές Επιστήμες, Εκδόσεις ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ, 2011.
- 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) Αναλυση 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 H. Pavlopoulos, Department of Statistics

E.C.T.S.: 8 credits

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 credits

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). FundamentalsofBiostatistics. 7thInternationaledition, Brooks/Cole – Νέα έκδοση προσεχώς.
- DiekmannO., Heesterbeek, J.A.P. andBritton, T. (2012). Mathematicaltoolsforunderstandinginfectiousdiseasedynamics. 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 credits

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.

4th YEAR

7th Semester

Econometrics (code: 6175)

Course type: elective

Course level: First cycle

Instructor: Associate Professor A. Livada – Associate Professor I. Vrontos, Department of Statistics

E.C.T.S.: 8 credits

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 economical 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.

Statistical Learning (code: 6127)

Course type: elective

Course level: First cycle

Instructor: Assistant Professor X. Penteli, Department of Statistics

E.C.T.S.: 8 credits

Desired Learning Outcomes: Upon completion of the course the students will be able to: apply contemporary statistical methods using the R software to analyze big 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: None.

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.
- RajaramanA., UllmanD.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. Oralexam .Writtenexam (Project).
TeachingLanguage: 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 credits

Desired Learning Outcomes:

Upon successful completion of the course, the students will: Know and understand Survival Analysis. Acquire 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). Non parametric 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 pg.).
- 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.

Stochastic ProceduresII (code: 6057)

Course type: elective

Course level: First cycle

Instructor: Professor M. Zazanis - Professor A. Yannacopoulos, Department of Statistics

E.C.T.S.: 8 credits

Desired Learning Outcomes: After successfully completing the course, students will be

familiar with the basic concepts of stochastic processes in continuous time and continuous state space including their simulation focusing on applications in probability, statistics, computer science and finance.

Prerequisites: none

Syllabus: Martingales in discrete time, stopping times, filtrations (intuitive). Optional Stopping Theorem. Applications of martingales in statistics, statistical learning and finance. Stochastic processes in continuous time. Brownian motion and its properties. Geometric Brown motion and the Ornstein-Uhlenbeck process. Gaussian processes. Introduction to the stochastic integral.

Simulation of stochastic processes. Applications of Brownian motion and stochastic integration in finance.

Recommended Reading

- 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.

Actuarial II (code: 6124)

Course type: elective

Course level: First cycle

Instructor: Assistant Professor A. Zympidis, Department of Statistics

E.C.T.S.: 7 credits

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.

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

Course type: elective

Course level: First cycle

Instructor: - Professor A. Yannacopoulos, Professor N. Fragkos, Department of Statistics

E.C.T.S.: 7 credits

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 mechanical 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)

* This courseis not offered during the academic year 2019-20

Course type: elective

Course level: First cycle

E.C.T.S.: 7 credits

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
- Be able to grasp 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.

8th Semester

Categorical Data Analysis (code: 6108)

Course type: elective

Course level: First cycle

Instructors: Academic Scholar

E.C.T.S.: 8 credits

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. χ^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 credits

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: none

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

Numerical Methods in Statistics (code: 6115)

Course type: elective

Course level: First cycle

Instructor: Academic Scholar

E.C.T.S.: 7 credits

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 non linear 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.
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 credits

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: Academic Scholar

E.C.T.S.: 8 credits

Desired Learning Outcomes: At the end of the course the student will be able to: a) Understand the non parametric methods described and their properties: Bootstrap, non parametric density estimation, non parametric regression, generalized additive models and rank tests. b) Implement these methods in real data analysis and correctly interpret the results.

Prerequisites: Linear algebra, Estimation and testing statistical hypothesis, Linear models.

Syllabus: Non parametric density estimation, histograms, Nadaraya-Watson estimator: bias, variance, tradeoff between them and bandwidth choice: plug in and cross-validation methods. Non parametric 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. Non parametric 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 Ration : 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 anδ 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 exam (Project).
Teaching Language: Greek.

Methods of Bayesian Inference (code: 6168)

Course type: elective

Course level: First cycle

Instructor: Academic Scholar

E.C.T.S.: 7 credits

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.

Bachelor Dissertation(code: 6907)

Course type: elective

Course level: First cycle

Coordinator: Associate Professor N. Demiris, Department of Statistics

E.C.T.S.: 8 credits

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

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 theses within (or shortly before) the corresponding exam. The dissertation corresponds to 8 PM. (URL: https://www.dept.aueb.gr/el/stat/content/διπλωματική-εργασία-0)

Practical Training (code: 6801)

Course type: elective

Course level: First cycle

Coordinator: Professor D. Karlis, Department of Statistics

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

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 5th 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.

PART3
GENERAL INFORMATION FOR THE STUDENTS

The Athens University of Economics and Business provides not only high quality education but also high quality student services. With the adoption 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 is responsible for providing 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. Catering

A restaurant operates in the main building of the University. All members of the academic community can use the restaurant for free or by paying a minimum 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 who 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 particular, 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. The Faculty Advisors accept students for questions and advise with respect to the educational process during office hours announced outside the Professors - Consultants office.

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 subjects 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/content/erasmus-programme).

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 of 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-associations).

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/).