ΟΙΚΟΝΟΜΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ

ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS

SCHOOL OF INFORMATION SCIENCES AND TECHNOLOGY

DEPARTMENT OF INFORMATICS

UNDERGRADUATE STUDIES GUIDE
2017-2018

ATHENS, SEPTEMBER 2017

Contact information

Department of Informatics

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AUEB

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AUEB administration

Rector: Professor Emmanouil Giakoumakis

Deputy Rector for Academic Affairs: Professor Dimitrios Bourantonis

Deputy Rector for Economic Affairs: Professor Dimitrios Gritzalis

Deputy Rector for Financial Planning and Development: Associate Professor George Xylomenos

Department of Informatics administration

Department Chair: Professor George D. Stamoulis

Director of Computer Systems and Communications Division: Associate Professor Vasileios Siris

Director of Information Systems and Database Systems Division: Associate Professor Ioannis Kotidis

Director of Applied Mathematics, Information System Economics and Operations Research Division: Professor Panayiotis Katerinis

Department Secretary: Christos Sakellariou

Academic calendar

- **Winter semester:** 2 October 2017 to 12 January 2018
- **Christmas break:** 23 December 2017 to 7 January 2018
- **Winter semester examination period:** 15 January 2018 to 9 February 2018
- **Spring semester:** 12 February 2018 to 25 May 2018
- **Easter break:** 2 April 2018 to 15 April 2018
- **Spring semester examination period:** 29 May 2018 to 22 June 2018

Official holidays

- 17 November (Anniversary of the NTUA uprising)
- 30 January (Three Holy Hierarchs Holiday)
- 19 February (Orthodox Ash Monday)
- 1 May (Labor Day)
- 28 May (Holy Spirit Monday, i.e., Orthodox Pentecost Monday)

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I. ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS

The Athens University of Economics and Business (AUEB), as with all Greek higher education institutions, is a public entity overseen by the Ministry of Education, Research, and Religious Affairs. The organization and operation of AUEB follows applicable law, notably Law 4485/2017 (Greek Government Gazette 114/4-8-2017, Part A).

AUEB is the third oldest Greek university, and the first in the areas of economics and business administration. It was established 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 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 school was divided in 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 was inaugurated, in Economic Studies, while a corresponding program was initiated by the Department of Business Organization and Administration in 1985.

AUEB in a center of excellence in academic research and teaching and is being consistently ranked at the top, nationwide, and very highly, globally, in the areas it is active. 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.

Senate

The AUEB Senate is comprised of

- the Rector,
- the Vice Rectors (until the elections for Vice Rectors, the Deputy Rectors do not sit in the Senate),
- the Deans of the three Schools,
- the Department Chairs,
- one representative of the undergraduate students, one representative of the M.Sc. students, and one representative of the Ph.D. candidates,
- three representatives of the technical staff and one representative of the administrative staff.

Schools

AUEB is comprised of three schools:

- The School of Economics, which supervises and coordinates the operation of the Department of International & European Economic Studies and the Department of Economics,
- The School of Business, which supervises 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.
- The School of Information Sciences and Technology, which supervises 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. Department personnel comprises the faculty, the Special Teaching Staff (Ειδικό Εκπαιδευτικό Προσωπικό - ΕΕΠ), the Laboratory Teaching Staff (Εργαστηριακό Διδακτικό Προσωπικό - Ε.ΔΙ.Π.), and the Special Technical Laboratory Staff (Ειδικό Τεχνικό Προσωπικό – ΕΤΕΠ).

The Departments of AUEB are the following:

- Department of International & European Economic Studies

- Department of Economics
- Department of Management Science and Technology
- Department of Business Administration
- Department of Accounting and Finance
- Department of Marketing and Communication
- Department of Informatics
- 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 Department Assembly, b) the Directing Council, and c) the Chairman.

Curricula and Focus Areas

Each department offers a corresponding curriculum, with includes a number of focus areas that provide specialization, as follows:

Department	**Focus Areas**
International and European Economic Studies	1) International Economics and Finance 2) International and European Political Economy
Economics	1) Economic Theory and Policy 2) Business Economics and Finance 3) International and European Economics
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
Business Administration	1) Business Administration 2) Information Systems Administration 3) Accounting and Finance Administration 4) Marketing
Accounting and Finance	1) Accounting 2) Finance
Marketing and Communication	1) International Management, Innovation and Entrepreneurship 2) Human Resource Management 3) Business Analytics 4) Digital Marketing
Informatics	1) Theoretical Computer Science 2) Computer Systems and Networks 3) Information Systems and Information Security 4) Databases and Knowledge Management 5) Operations Research and Economics of Information Technology 6) Computational Mathematics και Scientific Calculations

Note that the Department of Statistics offers no focus areas, whereas the Department of Informatics offers six modules of which students select two. Detailed information on the curricula are offered in the department study guides and webpages.

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 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.)

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.

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.

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)

ECTS Coordinator

The ECTS Coordinator of the University is, ex officio, the chair 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.

II. DEPARTMENT OF INFORMATICS

Informatics, or Computer Science, is the science of information processing via the use of computers. The Department of Informatics is one of the most dynamic departments within Greece, and offers a four-year program of study covering the full spectrum of Informatics, according to the standards set by international scientific associations of Informatics, as well as its applications and extensions in Economics and Business Administration. For this reason, the Department trains scientists capable of contributing substantially and having leadership roles (as shown also by the track record of our graduates) in the development of Information and Communication Technologies and their applications in various sectors of economic and social activity.

Information technologies are already applied extensively to economic and commercial activities, to the successful operation of banks, industries, transportation, mobile communications, medicine, education, to the creation and distribution of films, video games, and other services via the Web, and to various other technology areas. Immediately after completing their studies, our graduates face several opportunities for a successful career, including, among others, in the Greek and international IT industry, in the IT departments of corporations, in consulting firms, in the management and finance sectors, in education, etc. Finally, our graduates often pursue postgraduate or doctoral studies in Greece or abroad, followed by a research or academic career.

The Department of Informatics places emphasis, on the one hand, on teaching the fundamentals, so that students will able to follow the rapid technological and scientific developments of the field, and, on the other hand, on familiarizing students with the cutting edge of the various applied fields of Informatics. In addition, through the coursework and the intensive practice through assignments and lab sessions, the students develop practical skills and the ability to cope with complex problems on a real scale. The curriculum, which is being updated on a permanent basis, includes five groups of courses:

- Courses on the core of Informatics, with basic courses that cover all its major areas (programming, algorithms, computer organization, databases, networks, software Engineering, etc).
- Courses on mathematical background.
- Courses on economics and management science..
- Specialization courses on areas of intense scientific activity, and of high value in the job market, organized in six modules
    - Theoretical Computer Science
    - Computer Systems and Networks
    - Databases and Knowledge Management
    - Information Systems and Information Security
    - Operations Research and Economics of Information Technology
    - Applied Mathematics and Scientific Computing
- Electives from other departments of the university.

Additionally, part of the degree requirements is the knowledge of a foreign language at an excellent level. Apart from the courses, the curriculum also includes optionally carrying out a senior thesis, as well as an internship in a relevant company or organization. Therefore, each student has the opportunity to create a personalized, to a certain extent, course profile.

The Department of Informatics owes its dynamism and prestige to the capabilities, scientific standing and international recognition of its faculty, many of whom have worked as professors or researchers at universities and research centers in the US and Europe. The department forms a center of research activity with significant contributions, according to international standards, in many scientific areas. Numerous funded research projects, as well as developmental project and projects aimed at the transfer of expertise, are being run, resulting in large numbers of scientific publications. These activities involve, in an active and decisive role, the Ph.D. candidates of the department.

Finally, the department offers 4 M.Sc. programs of high demand in cutting-edge sectors: the M.Sc. program in Information Systems, the M.Sc. program in Computer Science, the M.Sc. program in Data Science and the M.Sc. program (jointly with the National and Kapodistrian University of Athens) in Business Mathematics.

With these features, the Department of Informatics at AUEB is one of the best choices for studies within the dynamically evolving field of information sciences and technology.

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III. INFRASTRUCTURE AND SERVICES

Computer Center

The Computer Center of AUEB is responsible for providing infrastructure computing across the university for educational and research purposes.

The main information systems of the Computer Center are based on a cluster of servers with hard disks of sufficient and continuously increasing capacity. These servers, among other things, perform user identification, so as to ensure controlled access to the resources of the Center, are used as file servers for users to store their files, help in the automated reinstallation of software on the computers of the Center's Laboratories, and also control and prevent infestation with malware. All servers are connected to a high-speed network and are accessible from anywhere in the University.

The Computer Center has three classrooms for teaching and practice purposes, available to all students from all departments. These computers work in a Windows environment with a centralized management of users' accounts and resources. The computers have access to the main systems of the computer center, the university's e-mail system, and the Internet. To cater to the students' printing needs, the Computer Center has two main high-speed laser printers, as well as three more laser printers (one in each room).

All members of the academic community of the university, i.e., undergraduate and graduate students, faculty members, and university employees, can have access to the resources of the Computer Center. Interested parties are enrolled electronically in the services of the Computer Center and the University via the URegister service. Students can request password reminders electronically without having physical access to the Computer Center. For students who have a laptop and are located close to the Computer Center, access is possible via the private wireless network hosted by the Center. In addition to the direct access to the resources of the Computer Center, through the classrooms, it is also possible to use the central systems and the e-mail service via the Internet, 24 hours a day.

Network Operations Center

The Network Operations Center (NOC) of AUEB is responsible for the network infrastructure of the entire university, regarding both voice and data services. NOC monitors, maintains, and coordinates all university networks. It also hosts the servers of most university services and the network security software.

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 network through the university's fiber optic ring, while some auxiliary buildings are connected via a wireless link. In all university buildings, there is horizontal (in-floor) and vertical (inter-floor) structured voice and data cabling that connects offices and Laboratories with the backbone network at speeds of 100 or 1000 Mbps. The University provides wireless broadband access to the network from the classrooms and common areas of all buildings.

The university is connected to the Internet through the Greek Research Network with Gigabit Ethernet optical fibers. Through the access and backbone network, all users have access to the Internet at extremely high speeds.

Finally, through the international Eduroam system, all university users can connect to the wireless networks of hundreds of educational and research institutions around the world. Vice versa, users from these institutions can connect to the university's wireless network.

Informatics Training Laboratories

Apart from the computing support provided by the Computing Center and the Network Operation Center to the entire University, the Department of Informatics provides additional computing infrastructure to its members, due to their increased needs in teaching, practical training, and research. The Department has four Informatics Training Laboratories: CSLAB I, on the second floor of the Derigny wing, CSLAB II, on the third floor of the Derigny wing, CSLAB III, on the fourth floor of the Antoniadou wing, and GradCSLAB, on the second floor of the Evelpidon building. Access to CSLAB I and II is restricted to the undergraduate students, instructors, and laboratory staff of the Department of Informatics. CSLAB III is also used by the corresponding personnel of the Department of Statistics. GradCSLAB is used by the students and instructors of the MSc programs of the Department of Informatics.

CSLaboratories I, II and III provide 57, 43 and 15 workstations, respectively, while GradCSLAB provides 24 workstations. The workstations are supported by a cluster of servers with multiple processors, and disks in RAID arrays. The servers provide central file storage, printing services, access to software development applications and database management systems, as well as centralized management of accounts and resources. The servers and workstations run Windows and/or Linux. They are connected to each other and with the University’s backbone via a Gigabit Ethernet network. All the Laboratories are equipped with laser printers for the use of the Department’s students.

The users of the Informatics Training Laboratories have access to all the services provided by the University, as well as to the more specialized services provided locally by the servers of the Laboratories. To gain access to the Laboratories, students simply need to confirm their identities and their affiliations with the Department of Informatics. The same credentials are used to access all the workstations and servers of the Informatics Training Laboratories.

Research Laboratories of the Department of Informatics

Apart from the Informatics Training Laboratories, the Department of Informatics also has the following five Research Laboratories, which support the Department's research:

- Computer and Communications Systems Laboratory,
- Information Systems and Databases Laboratory,
- Theory, Economics and Systems Laboratory,
- Information Processing Laboratory,
- Mobile Multimedia Laboratory.

The five Research Laboratories cover most of the Department's research areas that require specialized infrastructure. Access to these Laboratories is granted to graduate and undergraduate students working on research projects related to the fields of the corresponding Laboratories.

Each Research Lab is directed by a faculty member of the Department of Informatics and is staffed by faculty members, specialized technical personnel, PhD students, MSc students and undergraduates, all involved in the research of the lab. For undergraduate students, the Research Laboratories provide an opportunity to get involved in research, either in the context of advanced courses or during their senior theses. The Research Laboratories are mainly funded by Greek and international research programs they participate in.

e-Learning and Lifelong Learning

Following an initiative of the Department of Informatics, and in cooperation with the Network Operation Center, the asynchronous e-Learning system e-Class (https://eclass.aueb.gr) is in operation at the University. Using e-Class, instructors distribute to students material related to their courses, such as notes, presentations, exercises, and announcements, while students can submit their assignments in electronic form. e-Class is used in almost all of the courses of the Department of Informatics to facilitate the communication between students and instructors.

AUEB has a distant teaching and teleconferences classroom, which can be used to record and broadcast video and sound over the Internet. This functionality is being extended to other classrooms of the University, to enable recording and live broadcasting of lectures and other events via Internet.

Members of the Department of Informatics also participate in e-Learning and lifelong learning programs organized by the University's Center for Continuing Education and Lifelong Learning (see https://elearning.aueb.gr/ and http://kek.aueb.gr/).

Research Center

The Research Center of AUEB (http://www.rc.aueb.gr/), one of the oldest of its kind in Greece, promotes the University's research and connects it to the Greek and international research and professional communities. Under the scientific guidance of the University's faculty members, the Center carries out research projects, both purely scientific and applied, funded by national and international sources, such as the European Union. Graduate and undergraduate students may also participate in the Center's projects. The Center also supports the faculty's research and organizes seminars and conferences. Through the Research Center, the members of the Department of Informatics participate in numerous national and international projects, which promote the Department's research and disseminate its results.

All forms of external funding towards the University are managed by the Research Center, which is accountable to the Senate. The Research Center retains part of the cost of the projects it manages, to cover its operational costs and support the University.

Careers Office

The main goal of the Careers Office (https://www.career.aueb.gr/) is to help the students and alumni of AUEB find jobs and offer them guidance for graduate studies.

The Careers Office assists the students and alumni in their first steps towards finding jobs by (a) informing them about job openings and forwarding resumes to cooperating companies and organizations, (b) organizing Career Days, where interested students and alumni have the opportunity to meet and discuss employment opportunities with representatives of companies and other organizations,

(c) organizing seminars about the process of job interviews, as well as presentations of job market trends, (d) providing printed and electronic material with guidelines about writing resumes and cover letters, as well as advice for job interviews, (e) offering to students and alumni the opportunity to discuss with expert advisors issues related to their careers or education, and to use specialized psychometric tests.

The Office also provides extensive information about AUEB's undergraduate and graduate programs of studies, other graduate programs in Greece and abroad, scholarships and endowments, as well as companies active in Greece. It publishes informative leaflets, it organizes informative events as well as regular visits of high school students to the premises of the University, and it maintains a database with information about alumni employment and job openings, which provides a view of supply and demand in the job markets. The Office also cooperates with AUEB's Center for Entrepreneurship and Innovation (https://acein.aueb.gr/).

Innovation and Entrepreneurship Unit

The mission of the Innovation and Entrepreneurship Unit (http://www.mke.aueb.gr/) is to encourage innovative thinking and foster entrepreneurship in AUEB as well as to support the University students, and the wider public, interested in understanding the requirements for organizing new innovative business efforts. For that reason:

- The Unit's website provides direct and continuous access to relevant information, knowledge and practical tools in order to encourage creativity and provide the means for managing innovation and organizing successful business efforts.
- The Unit's Helpdesk offers direct personal communication aiming at providing information and resolving problems.
- Educational material is produced by the University's academic staff, providing students with suitable training and useful information regarding the newest developments in various scientific fields.
- The Unit supports the teaching of entrepreneurship courses, providing modern material and tools to the instructors.
- The Unit organizes open events, such as seminars and visits to external courses, that give the opportunity to students to interact with successful entrepreneurs and prominent executives. This helps the students increase their understanding regarding the implementation of their ideas.
- The Unit works closely with its Advisory Steering Committee, enabling the enhancement of educational activities and the provision of practical knowledge to students, with the assistance of specialized teachers and executives.
- The Unit also provides support for the start-up of new business teams through the services of the ACEin Center (Athens Center for Entrepreneurship, https://acein.aueb.gr), such as support related to marketing, prototyping, and legal issues, as well as the necessary networking for the development of new products/services and/or innovative new businesses.

Athens Center for Entrepreneurship and Innovation

The Athens Center for Entrepreneurship and Innovation (https://acein.aueb.gr/) aims to support innovative entrepreneurship for sustainable development and jobs. Through a variety of actions, the benefiting business organizations will be able to get training on key business issues, use support services (such as business plan, legal issues, accounting, and financial support) and finally have the opportunity to become part of an international--scale network of sponsors.

IV. DEPARTMENT PERSONNEL

IV.1. Faculty[1]

Ioannis (Ion) Androutsopoulos, Associate Professor

Diploma in Electrical Engineering, National Technical University of Athens.
MSc in Information Technology / Knowledge - Based Systems, University of Edinburgh, UK.
PhD in Artificial Intelligence, University of Edinburgh, UK.

Theodoros Apostolopoulos, Professor

Diploma in Electrical Engineering, National Technical University of Athens.
Ph.D. in Informatics, National Technical University of Athens.

Michail Vazirgiannis, Professor

B.Sc. in Physics, National and Kapodistrian University of Athens.
M.Sc. in Robotics, National and Kapodistrian University of Athens.
MSc in Knowledge Based Systems, Heriot Watt University, Edinburgh, UK.
Ph.D. in Informatics, National and Kapodistrian University of Athens.

Vasileios Vassalos, Associate Professor

Diploma in Electrical Engineering, National Technical University of Athens.
MSc in Computer Science, Stanford University, USA.
PhD in Computer Science, Stanford University, USA.

Paraskevas Vassalos, Assistant Professor

B.Sc. in Mathematics, University of Ioannina.
M.Sc. in Computational Mathematics and Informatics, University of Ioannina
Ph.D. in Mathematics, University of Ioannina.

Emmanouil Giakoumakis, Professor

Diploma in Electrical Engineering, National Technical University of Athens.
Ph.D. in Informatics, National Technical University of Athens.

Emmanouil Giannakoudakis, Professor

BSc in Computer Science in Computer Science, University of Bradford, UK.
PhD in Computer Science, University of Bradford, UK.

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[1] Acronyms:

BA: Bachelor of Arts,	BSc: Bachelor of Science
MA: Master of Arts.	MBA: Master in Business Administration
MPhil: Master of Philosophy	MSc: Master of Science
PhD: Doctor of Philosophy	ScD: Doctor of Science

Dimitrios Gritzalis, Professor

B.Sc. in Mathematics, University of Patras.
MSc in Computer Science, City University of New York, USA.
Ph.D. in Informatics, University of the Aegean.

Antonios Dimakis, Assistant Professor

B.Sc. in Computer Science, University of Crete.
MSc in Computer Science, University of Crete.
PhD in Electrical Engineering and Computer Sciences, University of California, Berkeley, USA.

Sofia Dimelis, Professor

B.Sc. in Economics, Athens University of Economics and Business.
MSc in Economics, University of Pittsburgh, USA.
PhD in Economics, University of Pittsburgh, USA.

Theodore Kalampoukis, Professor

B.Sc. in Mathematics, National and Kapodistrian University of Athens.
PhD in Computer Science, University of Glasgow, UK.

Vasiliki Kalogeraki, Associate Professor

B.Sc. in Computer Science, University of Crete.
M.Sc.in Computer Science, University of Crete.
PhD in Electrical and Computer Engineering, University of California, Santa Barbara, USA.

Panayiotis Katerinis, Professor

BSc in Mathematics, University of London, UK.
MSc in Mathematics, University of London, UK.
PhD in Mathematics, University of London, UK.

Ioannis Kontogiannis, Professor

BSc in Mathematics, Imperial College, University of London, UK.
Part III (MSc equivalent) in Pure Mathematics, Cambridge University, UK.
MSc in Statistics, Stanford University, USA.
PhD in Electrical Engineering, Stanford University, USA.

Iordanis Koutsopoulos, Associate Professor

Diploma in Electrical and Computer Engineering, National Technical University of Athens.
MSc in Electrical and Computer Engineering, University of Maryland, USA.
PhD in Electrical and Computer Engineering, University of Maryland, USA.

Panagiotis Konstantopoulos, Professor

Diploma in Electrical and Mechanical Engineering, National Technical University of Athens.
MSc in Electrical Engineering, Carnegie-Mellon University, USA.
ScD in Operations Research, Massachusetts Institute of Technology, USA.

Ioannis Kotidis, Associate Professor

Diploma in Electrical and Computer Engineering, National Technical University of Athens.
MSc in Computer Science, University of Maryland, USA.
PhD in Computer Science, University of Maryland, USA.

Nikolaos Malevris, Professor

B.Sc. in Mathematics, National and Kapodistrian University of Athens.
MSc in Operational Research, University of Southampton, UK.
PhD in Computer Science, University of Liverpool, UK.

Ioannis Marias, Assistant Professor

Diploma in Computer Engineering and Informatics, University of Patras.
Ph.D. in Informatics and Telecommunications, National and Kapodistrian University of Athens.

Evangelos Markakis, Assistant Professor

Diploma in Electrical Engineering, National Technical University of Athens.
MSc in Computer Science, Georgia Institute of Technology, USA.
PhD in Computer Science, Georgia Institute of Technology, USA.

Georgios Xylomenos, Associate Professor

B.Sc. in Applied Informatics, Athens University of Economics and Business.
MSc in Computer Science, University of California, San Diego (UCSD), USA.
PhD in Computer Science, University of California, San Diego (UCSD), USA.

Παπαϊωάννου Γεώργιος, Assistant Professor

B.Sc. in Informatics, National and Kapodistrian University of Athens.
Ph.D. in Informatics, National and Kapodistrian University of Athens.

Georgios Polyzos, Professor

Diploma in Electrical Engineering, National Technical University of Athens.
MSc in Computer Science, University of Toronto, Canada.
PhD in Computer Science, University of Toronto, Canada.

Georgios Stamoulis Professor

Diploma in Electrical Engineering, National Technical University of Athens.
MSc in Electrical Engineering and Computer Science, Massachusetts Institute of Technology (MIT), USA.
PhD in Electrical Engineering and Computer Science, Massachusetts Institute of Technology (MIT), USA.

Vasileios Siris, Associate Professor

B.Sc. in Physics, National and Kapodistrian University of Athens.
MSc in Computer Science, Northeastern University, USA.
Ph.D. in Computer Science, University of Crete.

Michail Titsias, Assistant Professor

B.Sc. in Informatics, University of Ioannina.
M.Sc. in Informatics, University of Ioannina.
PhD in Informatics, University of Edinburgh, UK.

Stavros Toumpis, Assistant Professor

Diploma in Electrical Engineering, National Technical University of Athens
MSc in Mathematics, Stanford University, USA.
MSc in Electrical Engineering, Stanford University, USA.
PhD in Electrical Engineering, Stanford University, USA.

Evgenia Foustoukou, Επίκουρη Καθηγήτρια

Maîtrise de Mathématiques, Université Paris 7, France.
Etudes de Philosophie, niveau licence, Université Paris 1 (Sorbonne), France.
DEA d'Informatique Fondamentale, Université Paris 7, France.
Doctorat en Informatique, Université Paris 11 (Orsay), France.

IV.2. Retired/Resigned Faculty Members

- Andreas Veneris
- Evangelos Kiountouzis
- Constantinos Courcoubetis
- Elias Lipitakis
- Evangelos Mageirou
- Papakiriazis Panagiotis
- Martha Sideri
- Elias Flytzanis

IV.3. Departed Faculty Members

- Dimopoulou Maria
- Cavouras Ioannis
- Milis Ioannis
- Mytilineos Michail

IV.4. Scientific Associate

Vasilios Giahalis

B.Sc. in Economics, Athens University of Economics and Business.
MSc in Statistics, London School of Economics and Political Science, UK.

IV.5. Laboratory Teaching Staff

Athanasios Androutsos

B.Sc. in Informatics, Athens University of Economics and Business.
M.Sc. in Information Systems, Athens University of Economics and Business.
Ph.D. in Informatics, Athens University of Economics and Business.

Christos Kallergis

B.Sc. in Informatics, Athens University of Economics and Business.

Chrisostomos Kapetis

B.Sc. in Informatics, Athens University of Economics and Business.

Ph.D. in Informatics, Athens University of Economics and Business.

Anastasia Kastania

B.Sc. in Mathematics, National and Kapodistrian University of Athens
Ph.D. in Medical Informatics, National and Kapodistrian University of Athens.

Anna Kefala

B.Sc. in Informatics, Athens University of Economics and Business.

M.Sc. in Information Systems, Athens University of Economics and Business.

Antonia Kyriakopoulou

B.Sc. in Informatics, Athens University of Economics and Business.
M.Sc. in Information Systems, Athens University of Economics and Business.
Ph.D. in Informatics, Athens University of Economics and Business.

Spilios Spiliopoulos

B.Sc. in Informatics, Athens University of Economics and Business.
M.Sc. i, Athens University of Economics and Business.

Maria Togatzi

B.Sc. in Mathematics, National and Kapodistrian University of Athens.

IV.6. Special Technical Laboratory Staff

Sofia Georgakopoulou

B.Sc. in Business Administration, Athens University of Economics and Business.

Panagiotis Pantouvanos

B.Sc. in Electrical Engineering, Patras University of Applied Sciences.

Maria Papatheodorou

High-school diploma

Ioannis Sazonof

B.Sc. in Informatics, National and Kapodistrian University of Athens.

IV.7. Administrative Personnel

Markos Gad

Maîtrise in Modern Letters (French Literature) Rennes University II (Haute Bretagne).

Evangelos Kotrozos

Computer Programming School graduate
Sound Engineer (Panavision) studies

Christos Sakellariou (Department Secretary)

B.Sc. in Modern Foreign Languages and Literatures, La Sapienza University, Rome.

Elena Stavropoulou

Graduate of the DATA TYPE Educational institute, High School graduate.

V. Department Divisions

Since 2003, the Department of Informatics is organized in three Divisions. Each member of the personnel and each Research Laboratory belongs to one of these Divisions. Divisions bring together members of the faculty that are active in a group of related scientific areas. The organization of the Department in Divisions is primarily of an administrative nature and is not reflected in a strict partition of the scientific areas of the Department or the curriculum. In the following, the scientific areas of the Divisions as well as their personnel and Research Laboratories are described in detail.

V.1. Computer Systems and Communications Division

Personnel

Theodoros Apostolopoulos, Professor

Vasiliki Kalogeraki, Associate Professor

Iordanis Koutsopoulos, Associate Professor

Evangelos Markakis, Assistant Professor

Georgios Xylomenos, Associate Professor

George Papaioannou, Assistant Professor

Georgios Polyzos, Professor

Georgios Stamoulis Professor

Vasileios Siris, Associate Professor

Christos Kalergis, Member of the Laboratory Teaching Staff

Anastasia Kastania, Member of the Laboratory Teaching Staff

Maria Togatzi, Member of the Laboratory Teaching Staff

Panagiotis Pantouvanos, Member of the Special Technical Laboratory Staff

Ioannis Sazonof, Member of the Special Technical Laboratory Staff

Laboratories

Computer and Communication Systems Laboratory

Mobile Multimedia Laboratory

Scientific Areas

Foundations of Computer Science, Data Structures, Algorithm Design and Analysis, Computational Complexity, Theory of Computation and Programming Languages, Programming Languages, Compilers.

Operating Systems, Distributed Systems, Computer System Architectures, Parallel Processing Technology, Graphics and Computer Interfaces.

Computer Networks and the Internet, Data Transmission, Telecommunications, Mobile Communications, Multimedia Systems, System Administration, Quality of Service, Performance Evaluation of Networks and Systems, Business Models, Ubiquitous Computing.

V.2. Information Systems and Database Systems Division

Personnel

Ion (Ioannis) Androutsopoulos, Associate Professor

Michael Vazirgiannis, Professor

Vassalos Vasileios, Associate Professor

Emmanouil Giakoumakis, Professor

Emmanouil Giannakoudakis, Professor

Dimitrios Gritzalis, Professor

Theodore Kalampoukis, Professor

Panagiotis Konstantopoulos, Professor

Ioannis Kotidis, Associate Professor

Nikolaos Malevris, Professor

Ioannis Marias, Assistant Professor

Michail Titsias, Assistant Professor

Antonia Kiriakopoulou, Member of the Laboratory Teaching Staff

Sofia Georgakopoulou, Member of the Special Technical Laboratory Staff

Research Laboratories

Information Systems and Databases Laboratory

Information Processing Laboratory

Scientific Areas

Analysis and Design of Information Systems, Information Systems Applications Development, Security of Information and Communication Systems, Open and Agile Automation, Tools for implementing Information Systems.

Software Engineering, Testing, and Software Reliability.

Databases, Database languages, Conceptual, Logical and Physical Database Modeling, Normalization, View Management, Database Design, Document Coding, Multilingual Models and Interfaces.

Processing of Semi-structured Data, Processing of Information and Data from the Web, Peer-to-Peer Systems, Web Services.

Data Mining from Databases, Ambiguity Resolution, Non-traditional Databases (Multimedia, Spatiotemporal), Pattern Bases.

Human-Computer Interaction Systems, Artificial Intelligence, Natural Language Processing, Storage and Retrieval of Information, Ubiquitous Computing.

Education and Distance-Learning Technologies, Application Development in Multimedia and Virtual Reality Environments in Education and Vocational Education, Development of Educational Material and IT applications for Specialized User Groups, Multimedia Synchronization, Interactivity and Virtual Reality Scenarios.

V.3. Applied Mathematics, Information System Economics and Operations Research Division

Personnel

Paraskevas Vassalos, Assistant Professor

Antonios Dimakis, Assistant Professor

Sofia Dimelis, Professor

Panayiotis Katerinis, Professor

Ioannis Kontogiannis, Professor

Stavros Toumpis, Assistant Professor

Evgenia Foustoukou, Assistant Professor

Vasileios Giahalis, Scientifc Associate

Maria Papatheodorou, Member of the Special Technical Laboratory Staff

Research Laboratories

Theory, Economics and Systems Laboratory

Scientific Areas

Applied Mathematics (especially Analysis, Algebra, and Probability Theory), Logic, Discrete Mathematics (especially Combinatorics and Graph Theory), Mathematical Theory of Algorithms and Complexity, Mathematical Theory of Information.

Computational Mathematics (especially Numerical Analysis, numerical methods and algorithmic techniques) Parallel Algorithms, Mathematical Software, Scientific Calculations and Implementations, High-Performance Computing and applications.

Mathematics of Financial, Commercial, and Actuarial applications.

Economics of Informatics (especially the financial and commercial evaluation of IT projects). Social, administrative, and financial effects of Informatics projects

Operations Research (especially Optimization in Deterministic and Probabilisitc Systems), Decision Theory and Games, System Simulation.

Econometric models, Projections, implementations and applications.

VI. UNDERGRADUATE STUDIES

VI.1. Introduction and General Information

Basic Principles of the Curriculum

The aim of the undergraduate studies at the Department of Informatics is to produce computer scientists with the skills necessary for enabling them to make significant contributions to the development of computing technologies and to become active in all areas of economic and social activity and capable of coping with the rapid technological and scientific developments in the field.

The basic principle of the program is the belief that in order to achieve significant contributions in the field of Informatics it is necessary both to obtain an in-depth knowledge of its core theory and learn also about its various application domains. Thus, a student of the Department must attend, besides courses in Computer Science, also courses in Economics, Administrative Science and Operations Research. This variety of courses gives a special character to the studies provided by the Department.

The curriculum was formed by taking into account the respective programs of Greek and foreign Universities, as well as programs recommended by special bodies such as the Association for Computing Machinery (ACM), the British Computer Society (BCS), and the Institute for Electrical and Electronic Engineers (IEEE). An important part of the studies is devoted to applied courses.

Duration of Studies and Distribution of Courses in Semesters

The normal duration of studies is 8 semesters, and each course is included in one of them. Although the distribution of courses in semesters is indicative, it corresponds to the conditions of normal study, as well as to the sequence of knowledge obtained in various courses. It is recommended that students take the courses by following the suggested sequence. In this manner, burden is equally distributed over the semesters and conflicts between courses in the timetable are avoided.

Organization of Studies

The student must initially complete 22 compulsory courses covering an extensive, but necessary, background common to all students:

- Core of Informatics (15 lessons)
- Mathematics (5 lessons)
- Economics and Administrative Sciences (2 courses)

Then, the student deepens his knowledge in the scientific areas he wants by attending at least 10 additional courses. Such courses are organized in modules, with each module consisting of 3 compulsory courses that provide the basic knowledge of the module as well as some selective courses from the same module that allow further deepening of the individual module specializations. The modules are as follows:

- Theoretical Computer Science
- Computer Systems and Networks
- Information Systems and Information Security
- Databases and Knowledge Management
- Operations Research and Economics of Information Technology
- Applied Mathematics and Scientific Computing

To qualify for a degree, the student may receive either additional module courses or elective courses from other departments of AUEB.

Detailed information on courses and the requirements for obtaining a degree are given in the next chapter.

Admission and placement examinations

Graduates of domestic or foreign (recognized as equivalent by the Hellenic National Academic Recognition Information Center - ΔΟΑΤΑΠ) universities, Technological Educational Institutes (ΤΕΙ) or equivalent institutions, of the School of Pedagogical and Technological Education, and two-year vocational schools under the jurisdiction of the Ministry of Education and Religious Affairs or other ministries, can participate to the admission & placement examinations. The courses examined in these examinations are the following first-semester courses:

- Mathematics I
- Introduction to Computer Programming
- Introduction to Computer Science

All applicants who have succeeded in the examinations can apply to be exempted from completing courses successfully passed in their department of origin, and, in any case, the three courses examined in the admission & placement examination count towards the degree requirements.

Course exceptions

Students admitted through entrance & placement examinations, transfer, or position transfer, can apply to the Department Assembly for a course waiver, i.e., to be exempted from completing a course. Any number of courses amounting up to a total of 80 ECTS units can be waived, provided the student has successfully passed similar courses in his or her department of origin. For each waived course, the final examination is waived, the course is considered as successfully passed, no grade is given, and the course does not affect the degree grade. The ECTS units awarded for a waived course are equal to the ECTS units awarded for that course from the department of origin, provided they do not exceed the ECTS units awarded by the AUEB equivalent course. In the latter case, the ECTS units of the AUEB equivalent course are awarded. If the department of origin has not specified the ECTS units of that course, or it is equivalent to a free elective course of AUEB, the awarded ECTS units are determined according to a proposal made by the Studies Committee of the Department.

VI.2. Core Courses

The 22 core courses, which are compulsory to all students, are distributed in the first 6 semesters. They include 15 courses on the core of Informatics, 5 Mathematics courses, and 2 courses on Economics and Management.

Informatics Core Courses

Course	Semester	ECTS
Introduction to Computer Science	1st	6
Introduction to Computer Programming	1st	6
Computer Programming in JAVA	2nd	6
Digital System Design	2nd	6
Data Structures	3rd	7
Computer Systems Organization	3rd	7
Computer Programming in C++	3rd	8
Algorithms	4th	7
Automata and Complexity	4th	7
Databases	4th	8
Operating Systems	4th	8
Information Systems Analysis and Design	5th	8
Communication Networks	5th	8
Distributed Systems	6th	8
Software Engineering	6th	8

Mathematics Courses

Course	Semester	ECTS
Discrete Mathematics	1st	6
Mathematics I	1st	6
Mathematics II	2nd	6

Probability	2nd	6
Computational Mathematics	3rd	8

Economics/Management Courses

Course	Semester	ECTS
Introduction to Economics	1st	6
Accounting	2nd	6

VI.3. Module Courses

Each module course belongs to one or more of the following six modules:

- Theoretical Computer Science
- Computer Systems and Networks
- Information Systems and Information Security
- Databases and Knowledge Management
- Operations Research and Economics of Information Technology
- Applied Mathematics and Scientific Computing

In each module, courses are categorized as:

- Core module courses, which cover the necessary body of knowledge corresponding to the module.
- Elective module courses, which offer students the flexibility to acquire further knowledge pertaining to the module.

Each module course can be compulsory for at most one module, while it can be an elective course in other modules. Also, module courses can be elective in multiple modules.

The module course titles and their distribution in modules is given in the pages that follow. The letter C in the table means the module course of this row is a core course for the module in the column. The letter E in the table means the module course in the row is elective in the module of the column.

Special Topics Courses

Except courses offered annually, the Department may occasionally offer “Special Topic” courses in areas of current research interest. According to their subject, these courses belong to one or many modules.

Course	Module 1: Theoretical Computer Science	Module 2: Computer Systems and Networks	Module 3: Information Systems and Information Security	Module 4: Databases and Knowledge Management	Module 5: Operations Research and Economics of Information Technology	Module 6: Applied Mathematics and Scientific Computing	Semester	ECTS
Performance Evaluation of Systems and Networks		E				E	8	6
Information Systems Applications Development			E	E			8	6
Investment Science and Related Software					C		5	7
Computer Architecture		C					8	6
Wireless Networks and Mobile Communications		E					7	6
Network Security		E	E				8	6
Information Systems Security		E	C	E			7	6
Computer Graphics	E	E				E	7	6
Computer Networks		C					6	7
Special Topics in Algorithms	C						5	7
Topics in Discrete Mathematics	E					E	7	6
Special Topics in Operations Research					C		7	6
Conceptual System Modelling			C	E			6	7
Data Mining from Large Databases and the Web			E	E			7	6
Software Verification, Validation and Maintenance			C	E			8	6
Human-Computer Interaction		E	E	E			7	6
Business Policy and Strategy			E				8	6
Operations Research	E				C	E	6	7

Course	Module 1: Theoretical Computer Science	Module 2: Computer Systems and Networks	Module 3: Information Systems and Information Security	Module 4: Databases and Knowledge Management	Module 5: Operations Research and Economics of Information Technology	Module 6: Applied Mathematics and Scientific Computing	Semester	ECTS
Applied Probability and Simulation	E				E	C	5th	7
Applied Numerical Analysis	E			E		C	6th	7
Decision and Game Theory	E				E	E	8th	6
Information Theory	E	E				E	8th	6
Logic	C		E	E			5th	7
Accounting Information Systems			E		E		8th	6
Mathematical Programming	E				E	E	8th	6
Compilers	E	C					7th	6
Machine Learning				E	E		7th	6
Network Economics		E			E		7th	6
Statistics in Informatics		E		E	E	C	5th	7
Στοιχεία Δικαίου της Πληροφορίας			E	E			8th	6
Combinatorial Optimization	E	E			E		7th	6
Information Retrieval Systems			E	C			7th	6
Database Systems Design		E	E	C			6th	7
Artificial Intelligence	E		E	C			5th	7
Multimedia Technology		E		E			7th	6
Technologies and Programming of Web Applications		E	E	E			8th	6
Technological Innovation and Entrepreneurship					E		7th	6
Computability and Complexity	C					E	6th	7
Time Series Analysis and Forecasting					E	E	7th	6

VI.4. Elective Courses

Elective courses include the following:

- Selected courses offered by other departments at AUEB and the course "Creation and Use of Digital Education Material in Modern Education Methods", which is offered by the Department of Informatics,
- The Practical Training course, offered by the Department of Informatics,
- The foreign language courses offered at the 5th and 6th semester, and
- The set of courses leading to the Pedagogical and Teaching Certificate, which are offered centrally by the university for all its departments. The coordination of the corresponding program is performed by the Department of Informatics.

Courses offered by other departments

Courses from other departments that students from the Department of Informatics can choose as elective courses are announced by the Department's Secretariat in the beginning of each semester. A student may submit an application to enroll in a course offered by another department which is not included in the list, which must be accepted by the Department's General Assembly. The student must ensure that he has all the prerequisites to enroll in a course from another department. The student must also consider any conflict in the lecture hours of the courses during each semester.

Pedagogical and Teaching Certificate Study Program

Since 2011, AUEB offers to 4th year students the first recognized university-level education program in Greece, which leads to a Pedagogical and Teaching Certificate that is recognized by the Ministry of Education, Research, and Religious Affairs.

The program, whose duration is one year, is offered by the Department of Informatics horizontally to all other Departments at AUEB, and focuses on educating students to teach Economics, Informatics, and Business Management at Primary and Secondary education. The program is addressed to 7th and 8th semester students and includes the following two units:

- Pedagogical competence: has a duration of two semesters and includes a total of eight (8) courses on Education Sciences, which involve 2-hour weekly lectures.
- Teaching competence: has a duration of two semesters and includes two (2) courses («Practical Training in Teaching I» and «Practical Training in Teaching II») that involve a set of student teaching activities.

The Program's goal is the cultivation of the psychological and mental potential of the students, in order to shape characters with the necessary emotional and intellectual skills to meet the future challenges in Primary and Secondary Education. Through innovative experiential activities, students develop leadership abilities for education management and for structuring the learning environment in public schools.

VI.5. Course Distribution in Semesters

The following tables show the Core and Module Courses of each semester. Due to their large number, the Elective Courses are not shown; the Department Secretariat publicizes, at the beginning of each semester, the Elective Courses offered at that semester.

1st Semester

Course	Code	Course Type
Discrete Mathematics	3117	Core course
Mathematics I	3119	Core course
Introduction to Computer Programming	3125	Core course
Introduction to Computer Science	3135	Core course
Introduction to Economics	3151	Core course

2nd Semester

Course	Code	Course Type
Mathematics II	3214	Core course
Computer Programming in JAVA	3222	Core course
Accounting	3252	Core course
Digital System Design	3262	Core course
Probability	3311	Core course

3rd Semester

Course	Code	Course Type
Data Structures	3335	Core course
Computer Systems Organization	3365	Core course
Computer Programming in C++	3321	Core course
Computational Mathematics	3230	Core course

4th Semester

Course	Code	Course Type
Algorithms	3432	Core course
Automata and Complexity	3434	Core course
Databases	3436	Core course
Operating Systems	3464	Core course

5th Semester

Course	Code	Course Type
Information Systems Analysis and Design	3541	Core course
Communication Networks	3571	Core course
Investment Science and Related Software	3751	Core module course (module 5)
Special Topics in Algorithms	3632	Core module course (module 1)
Applied Probability and Simulation	3614	Core module course (module 6) Elective module course (modules 1,5)
Logic	3515	Core module course (module 1) Elective module course (modules 3,4)
Statistics in Informatics	3155	Core module course (module 6) Elective module course (modules 2,4,5)
Artificial Intelligence	3531	Core module course (module 6) Elective module course (modules 1,3)

6th Semester

Course	Code	Course Type
Distributed Systems	3664	Core course

Software Engineering	3648	Core course
Computer Networks	3672	Core module course (module 2)
Conceptual System Modelling	3741	Core module course (module 3) Elective module course (modules 4)
Operations Research	3511	Core module course (module 5) Elective module course (modules 1,6)
Applied Numerical Analysis	3513	Core module course (module 6) Elective module course (modules 1,4)
Database Systems Design	3543	Core module course (module 4) Elective module course (modules 2,3)
Computability and Complexity	3517	Core module course (module 1) Elective module course (module 6)

7th Semester

Course	Code	Course Type
Information Systems Security	3662	Core module course (module 3) Elective module course (modules 2,4)
Special Topics in Operations Research	3812	Core module course (module 5)
Compilers	3634	Core module course (module 2) Elective module course (module 1)
Information Retrieval Systems	3644	Core module course (module 4) Elective module course (modules 3)
Wireless Networks and Mobile Communications	3771	Elective module course (modules 2)
Computer Graphics	3781	Elective module course (modules 1,2,6)
Combinatorial Optimization	8143	Elective module course (modules 1,2,5)
Topics in Discrete Mathematics	3612	Elective module course (modules 1,6)
Data Mining from Large Databases and the Web	3743	Elective module course (modules 3,4)
Human-Computer Interaction	3783	Elective module course (modules 2,3,4)
Machine Learning	3745	Elective module course (modules 4,5)
Time Series Analysis and Forecasting	3715	Elective module course (modules 5,6)
Multimedia Technology	3882	Elective module course (modules 2,4)
Technologies and Programming of Web Applications	3747	Elective module course (modules 2,3,4)
Network Economics	3818	Elective module course (modules 2,5)
Creation and Use of Digital Education Material in Modern Education Methods	3090	Elective Course

8th Semester

Course	Code	Course Type
Computer Architecture	3561	Core module course (module 2)
Software Verification, Validation and Maintenance	3642	Core module course (module 3) Elective module course (module 4)
Information Systems Applications Development	3842	Elective module course (modules 3,4)
Performance Evaluation of Systems and Networks	3862	Elective module course (modules 2,6)

Network Security	3761	Elective module course (modules 2,3)
Business Policy and Strategy	2610	Elective module course (module 3)
Decision and Game Theory	3713	Elective module course (modules 1,5,6)
Information Theory	3814	Elective module course (modules 1,2,6)
Accounting Information Systems	2733	Elective module course (modules 3,5)
Mathematical Programming	8116	Elective module course (modules 1,5,6)
Elements of Information Law	3791	Elective module course (modules 3,4)
Technological Innovation and Entrepreneurship	3584	Elective module course (module 5)
Senior Thesis	3802	Elective module course (all modules)

VI.6. Prerequisite Courses

Students admitted at the start of the 2014-2015 academic year and later are subject to restrictions regarding the courses they can enroll in. In particular, in order to enroll in the 2nd and 3rd year core courses, it is necessary that they have successfully completed, in a past semester, at least one course among a set of courses that are prerequisite for that course, as follows (in the following table, the semester where each course is offered in mentioned in parentheses after the course).

Course	**Set of prerequisite courses for that course**
Data Structures (3rd)	Introduction to Computer Programming (1st) Computer Programming in JAVA (2nd)
Computer Systems Organization (3rd)	Introduction to Computer Science (1st) Digital System Design (2nd)
Computer Programming in C++ (3rd)	Introduction to Computer Programming (1st) Computer Programming in JAVA (2nd)
Algorithms (4th)	Introduction to Computer Programming (1st) Computer Programming in JAVA (2nd) Discrete Mathematics (1st)
Automata and Complexity (4th)	Discrete Mathematics (1st)
Computational Mathematics (3rd)	Mathematics I (1st) Mathematics II (2nd)
Databases (4th)	Introduction to Computer Programming (1st) Computer Programming in JAVA (2nd)
Operating Systems (4th)	Introduction to Computer Programming (1st) Computer Programming in JAVA (2nd)
Information Systems Analysis and Design (5th)	Introduction to Computer Programming (1st) Computer Programming in JAVA (2nd)
Communication Networks (5th)	Operating Systems (4th) Computer Systems Organization (3rd)
Distributed Systems (6th)	Operating Systems (4th) Computer Programming in JAVA (2nd)
Software Engineering (6th)	Data Structures (3rd)

VI.7. Course Enrollment and examination

In order to attend and be graded in courses, in the beginning of each semester students must complete an online course enrollment, which they must submit to the Department's Electronic Secretariat. Course enrollment is mandatory and must be completed at the dates and times announced by the University at the beginning of each semester. Following their enrollment in courses, students are required to submit an electronic textbook selection form through the EYDOXOS platform. It is stressed that course enrollment and textbook selection are distinct, and one does not substitute the other.

The maximum number of courses that students can enroll in, at each semester, are:

1st year students	7 courses and foreign language course
2nd year students	8 courses and foreign language course
3rd year students	9 courses and foreign language course
4th and 5th year students	10 courses and foreign language course
6th and higher years students	12 courses and foreign language course

However, it is recommended that students do not enroll in more than 6 courses per semester, as the requirements of the Department's courses are high. Actions are taken to avoid having lecture hours for courses in the same semester coincide.

Most courses involve 4 hour weekly lectures, spanning 13 weeks. Most courses also include recitations, where exercises are solved and student questions are discussed. Moreover, many courses also include laboratory exercises, which involve practical training of students on the course's subject, under the supervision of the instructors.

The grade in each course is expressed on the scale 0-10, and can include half integers (0.5). Grades above five (5) are passing. The overall Grade Point Average (GPA) upon graduation is calculated as the average grade of the courses that satisfy the conditions for obtaining the degree, as declared by a student at the completion of his studies, excluding the English IV course. 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 take place from January to early February. The examination of courses in the spring semester take 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.

Oral Examination

Students with disabilities that make a written examination problematic or impossible may submit an application to the Department's Secretariat requesting to be examined orally, according to a procedure established by the Department. The application must necessarily be accompanied by an appropriate medical assessment from a competent governmental body. Students can contact the Secretariat for details about the oral examination procedure.

Grade Cancellation

Students who have received a passing grade in a course but wish to be re-examined in it 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 Informatics).
- 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.

Displaying of Grades

For students who have enrolled in the academic year 2014-15 and later, all grades they receive in examinations will be listed in the detailed grade list (therefore, the non-passing ones as well).

VI.8. Scholarships and Awards

The State Scholarships Foundations (Ιδρυμα ΚρατικώνΥποτροφιών - IKY) grants annually scholarships for excellent performance as well as scholarships and grant loans to students who had outstanding performance in the entrance examination and the examinations of universities. The Secretariats of the Departments announce the names of the candidates and set the deadlines for submitting their supporting documents. According to a decision of the Department Assembly, the conditions for granting a scholarship from IKY are defined as follows:

- For new students, the entrance ranking in the Department is taken into account according to the General Examinations for admission to universities. In order to get a scholarship, the candidate for a scholarship should be participating for the first time in the General Examinations.
- For students who have completed their first year of studies, success in the ten (10) core courses of the 1st year is required. The average grade, which should not be less than 6.51, is calculated based on these ten core courses. In the event of a tie, the highest grades obtained by each of the tied students in the other courses are compared, if a tie again occurs the second highest grades are taken into account, and so on.
- For students who have completed their second year of studies, success is required in the eight (8) core courses of the 2nd year. The average score, which should not be less than 6.51, is calculated based on these eight core courses. In the event of a tie, the highest grades obtained by each of the tied students in the other courses are compared, if a tie again occurs, the second highest grades are taken into account, and so on.
- For students who have completed their third year of studies, success is required in the four (4) core courses of the 3rd year as well as in at least six (6) module courses chosen by the student. The average score, which should not be less than 6.51, is calculated based on the four core courses and the six best, based on the grade, of the student's module courses. In the event of a tie, the highest grades received by each of the tied students in the rest of the module courses are compared, a tie again occurs, the second higher grades in module courses are taken into account, and so on, and finally the grades of the elective courses are taken into account, and so on.
- For students who have completed their fourth year of studies, a scholarship is awarded to the best graduate who has earned the highest overall total grade, provided that he/she has not exceeded the eight semesters required to obtain the degree.

The Georgios Halkiopoulos Foundation, which grants scholarships to students with limited financial resources based on their academic performance, also operates at AUEB. In October of each academic year, the Foundation announces the amount of the scholarship, as well as the manner and time of submission of the applications of interested students. Other awards and scholarships are granted to students of the Department and the University from various institutions, organizations and businesses. Information on all these awards and scholarships is provided by the University's Careers Office.

In order to honor its past members who have passed away, the Department of Informatics has established three special monetary awards awarded each year to students who are not holders of a university degree and have displayed excellent performance in certain of the department courses, as follows:

- The **Maria Dimopoulou Prize** is awarded to the first-year student with the highest performance in the first-year Mathematics courses.
- The **Ioannis Kavouras Prize** is awarded to the second-year student with the highest performance in the courses «Computer Systems Organization» and «Operating Systems».
- The **Michalis Mytilinaios Prize** is awarded to the student with the highest performance in the courses «Logic», «Automata and Complexity» and «Computability and Complexity».

VII.DEGREE REQUIREMENTS

To be awarded the B.Sc. degree, a student should satisfy the degree requirements that hold at the time of the application for graduation, taking into account any transitional provisions that may apply.

VII.1.Students enrolled in the academic year 2004-2005 and afterwards

The degree requirements for students that have enrolled in the Department in the academic year 2004-2005 and afterwards are as follows:

- Enrollment for at least 7 semesters.
- Successful completion of the 22 core courses, as well as module courses and electives that cumulatively correspond to at least 240 ECTS units.
- Module Requirement: Successful completion of at least 10 module courses, so that at least one of the following requirements is satisfied:
  - The students has successfully completed two modules.
  - The student has successfully completed at least 9 core module courses.

  To complete a module, the student must successfully complete all three core module courses of that module, as well as two more elective module courses of that module. A successfully completed course may only count towards completing one module (chosen at the discretion of the student).
- The student must hold a level C2 language certificate in English, German, or French, or must have successfully completed any of the courses “English IV”, “German IV”, or “French IV”.

Furthermore, students that have been admitted in any of the academic years from 2004-2005 to 2011-2012 are given the option, **until the end of the academic year 2019-2020**, to fulfill the following Alternative Module Requirement, instead of the Module Requirement described above:

- Alternative Module Requirement: Successful completion of at least 10 module courses so that at least one of the following requirements is satisfied:
  - The students has successfully completed two modules.
  - The student has successfully completed at least 9 core module courses.

  To complete a module, the student must successfully complete all three core module courses of that module, as well as three more elective module courses of that module. A successfully completed course may count towards completing multiple modules.

In the case of the Alternative Module Requirement, the placement of courses in modules differs from the placement according to the Module Requirement, and is presented in the following table.

(IMPORTANT NOTICE: THIS TABLE DOES NOT DESCRIBE THE CURRENT PLACEMENT OF COURSES IN MODULES)

Course	**Module 1: Theoretical Computer Science**	**Module 2: Computer Systems and Networks**	**Module 3: Information Systems and Information Security**	**Module 4: Databases and Knowledge Management**	**Module 5: Operations Research and Economics of Information Technology**	**Module 6: Computational Mathematics and Scientific Computations**
Performance Evaluation of Systems and Networks		E			E	
Information Systems Applications Development			E	E		
Investment Science and Related Software					Y	
Computer Architecture		Y				
Wireless Networks and Mobile Communications		E				
Network Security		E	E			
Information Systems Security		E	Y	E		
Computer Graphics	E	E				E
Computer Networks		Y				
Administration of Human Resources (if passed until the academic year 2013-2014 inclusive) or Business Policy and Strategy (only one of the two courses can count)			E			
Special Topics in Algorithms	Y					
Topics in Discrete Mathematics	E					Y
Special Topics in Operations Research					Y	
Conceptual System Modelling			Y	E	E	
Data Mining from Large Databases and the Web			E	E		
Software Verification, Validation and Maintenance		E	Y	E		
Human-Computer Interaction		E	E	E		
Operations Research	E		E		Y	

(IMPORTANT NOTICE: THIS TABLE DOES NOT DESCRIBE THE CURRENT PLACEMENT OF COURSES IN MODULES)

Course	**Module 1: Theoretical Computer Science**	**Module 2: Computer Systems and Networks**	**Module 3: Information Systems and Information Security**	**Module 4: Databases and Knowledge Management**	**Module 5: Operations Research and Economics of Information Technology**	**Module 6: Computational Mathematics και Επιστημονικοί Υπολογισμοί**
Applied Probability and Simulation	E	E		E	E	Y
Applied Numerical Analysis	E			E		Y
Decision and Game Theory	E			E	E	E
Information Theory	E	E		E	E	
Logic	Y			E		
Accounting Information Systems			E		E	
Mathematical Programming	E				E	E
Compilers	E	Y				
Machine Learning			E	E	E	E
Network Economics		E			E	
Statistics in Informatics		E		E	E	E
Elements of Information Law			E	E		
Strategy and Economics of Information Systems			E		E	
Combinatorial Optimization	E	E				E
Information Retrieval Systems				Y		
Database Systems Design		E	E	Y		
Artificial Intelligence	E			Y	E	E
Multimedia Technology		E		E		
Technologies and Programming of Web Applications		E	E	E		
Technological Innovation and Entrepreneurship					E	E
Computability and Complexity	Y					
Time Series Analysis and Forecasting					E	

VII.2. Students enrolled in the academic year 2003-2004 or earlier

Students enrolled in the Department in the academic year 2003-2004 or earlier may graduate according to the provisions of the previous section, applicable to more recently enrolled students, either using the Module Requirement of the Alternative Module Requirement. Furthermore, students are given the option to enroll using transitional provisions applicable to them only, depending on the exact academic year of their enrollment. These provisions are available at the Department Secretariat upon request.

VII.3. Other provisions (applicable to all students)

Enrolling to more courses than necessary for graduating

Students have the option to enhance their knowledge by enrolling to and successfully completing more module and elective courses than strictly necessary for them to satisfy their degree requirements. Any such extra courses will be duly reported in their transcripts.

Inclusion of completed modules in student transcripts

If a student completes the Module Requirement or the Alternative Module Requirement, the two completed modules are specified in that student's transcripts. Students are not obliged to declare their chosen modules beforehand; it is enough for a student to declare his/her chosen module at the time of his/her application for graduation.

Language Requirement

The C2-level language certificated that are accepted are those specified by the Supreme Council for Civil Personnel Selection (ΑΣΕΠ). Diploma copies should be certified by the relevant authority.

Students not in possession of a C2 certificate must select a 4th-semester language course. Their degree in that course will not count in their Grade Point Average (GPA)

Computing the Grade Point Average

The Grade Point Average (GPA) of graduating students is computed as the unweighted mean of all courses completed by the student upon graduation. In the case where the student has completed more courses than necessary for graduating, the GPA will be computed on a minimal subset of these courses (specified by the student) that satisfy the graduation requirements. Note that excess ECTS units completed by the student will be shown in the student's transcripts.

Provision for courses whose ECTS units have changed

Excepting the provision of the next paragraph, the ECTS units awarded to a student upon his successfully completing a course are those specified for that course at the moment the student completed that course.

However, during the academic years 2016-2017 and 2017-2018, together with their application for graduating, students admitted to the Department in the 2011-2012 or earlier academic years, are allowed:

- To apply to be awarded the number of ECTS units that a course had during an academic year previous to the academic year when the course was completed by the student, if the ECTS units of these two academic years differ.
- To apply to be awarded the 2 ECTS units awarded to students that completed the "English IV" course until the 2013-2014 academic year.

The Department Chair decides on the application.

"Computability" Course

Students that have successfully completed, during the examination periods of January, June, or September 2014, any of the courses 1) Information Theory, 2) Decision and Game Theory, 3) Topics in Discrete Mathematics, can count one of them as a core module course of Module 1, irrespective of when they graduate, in order to substitute the "Computability" course not offered during the academic year 2013-2014. This provision will be revoked after the end of the last examination of the academic year 2018-2019.

Provisions for courses that have been replaced

- Those students that have completed the course "**Entrepreneurship"** (8154) until the academic year 2015-2016 at the latest can use it as an elective module course for module 5 (or modules 5 and 6, if the student graduates using the Alternative Module Requirement) instead of the course "**Technological Innovation and Entrepreneurship**". Students are not allowed to use both courses towards fulfilling their Module Requirement.
- Those students that have, until the end of the academic year 2015-2016 at the latest (including the special examination of period of February 2017), completed the **"Compilers"** course, but not the **"Distributed Systems"** course, can count the "Compilers" course as a core course, in the place of the "Distributed Systems" course instead of as a core module course for module 2. In this case, if they subsequently complete the "Distributed Systems" course, this will count as a core elective course of module 2 and as an elective module course for modules 1 and 4.
- Those students that have completed the course "**Human Resources Administration"** (5414) until the academic year 2013-2014 at the latest may use it as an elective module course for module 3, instead of the course «**Business Policy and Strategy**». Students may not use both courses as elective module courses for module 3.
- Those students that have completed the course "**Accounting Information Systems**" (3852) until the academic year 2015-2016 at the latest may use it as an elective module course for modules 3 and 5 instead of the course "**Accounting Information Systems**" (2733). Students may not use both courses as elective module courses for modules 3 and 5.

Provisions for courses that have been discontinued

- The discontinued courses **"Actuarial Mathematics"**, **"Dynamic Systems"**, and **"Computational Financing"** may be used as elective module courses for modules 5 and 6 in order to satisfy both the Module Requirement and the Alternative Module Requirement.
- The discontinued course **"Information Project Management"** may be used as an elective module course of module 3 in order to satisfy the Module Requirement and the Alternative Module Requirement.

VIII. COURSE DESCRIPTIONS

3117 Discrete Mathematics

Core Course, 1st semester, 6 ECTS units

Instructor: Professor Panayiotis Katerinis

URL: https://eclass.aueb.gr/courses/INF117/

Course Description

Sets. Relations. Functions. Natural Numbers. Mathematical Induction. Equivalence of Sets. Countability of sets. Propositional calculus. Set operations and logical connectives. Boolean algebra. Theorems and proofs. Types of proofs. Basic counting principles. Permutations. Combinations. The inclusion-exclusion principle. Graphs. Isomorphic graphs. Paths, cycles and connectivity in graphs. Matrices of graphs. Directed graphs. Trees. The optimal spanning tree problem. Rooted trees. Eulerian trails and Hamilton cycles. Planar graphs and graph coloring. Linear recurrence relations with constant coefficients.

Learning Outcomes

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

- Describe and manipulate the fundamental concepts and theorems of basic areas of Discrete Mathematics (Logic, Combinatorial Analysis, Set Theory, Difference Equations, and Graph Theory).
- Combine the basic ingredients of the above areas in order to solve complex mathematical problems, for example problems of Set Theory, using tools from Combinatorial Analysis.
- Model and solve problems appearing in Informatics using tools of Discrete Mathematics.

Prerequisite Courses

There are no required prerequisite courses. However, a good working knowledge of all Mathematics taught in high school is required.

Bibliography

- Elements of Discrete Mathematics, C. L. Liu, McGraw-Hill, 1977.
- Discrete Mathematics, S. Lipschutz, M. Lipson, 3rd edition, Shaum's Outlines, 2009.
- Discrete Mathematics and its Applications, K. Rosen, 4th edition, McGraw Hill, 1998.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each weekly) and recitations (1 recitation of 2 hours weekly).

Assessment Criteria

The final grade is set to the grade of the final written examination.

3119 Mathematics I

Core Course, 1st semester, 6 ECTS units

Instructor: Assistant Professor Stavros Toumpis

URL: https://eclass.aueb.gr/courses/INF112/

Course Description

Properties of the real numbers, suprema and infima. Definition and properties of limits. Definition and properties of continuity at a point and in an interval and Lipschitz continuity. Definition, properties, and applications of the derivative. Convexity. The definitions of the integral by Darboux and Riemann and its properties. The Fundamental Theorem of Calculus and its properties. Applications of the integral: volumes of solids of revolution, lengths of curves, and areas of regions defined in polar coordinates. First-order linear and separable differential equations. other types, Euler Method. Taylor polynomials. Sequences, series, and convergence criteria for series with nonnegative terms. Elements of Analytic Geometry: vectors, equations of lines on the plane and in space, equations of planes, coordinate transformations on the plane, conic sections.

Learning Outcomes

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

- Describe and manipulate the basic concepts (function and sequence, supremum, limit, integral, derivative, and their definitions) and the basic theorems (properties of limits, derivatives and integrals, Fundamental Theorem of Calculus, etc.) of Calculus and elementary Analytic Geometry.
- Perform the basic operations of Calculus, such as calculating limits, derivatives and integrals using their definitions and properties.
- Combine the basic components of Calculus and elementary Analytic Geometry in order to solve more complex mathematical problems, such as computing improper integrals, solving differential equations, and calculating the volumes of solids of revolution and lengths of curves.
- Model and solve problems appearing in Informatics using the tools provided by Calculus and elementary Analytic Geometry.

Prerequisite Courses

There are no required prerequisite courses. However, a good working knowledge of all Mathematics taught in high school is required.

Bibliography

- Calculus, M. Spivak, 4th edition, Publish or Perish, 2008.
- Thomas' Calculus: Early Transcendentals, G. B. Thomas Jr., M. D. Weir, 13th edition, Pearson, 2013.
- Calculus, Vol.1: One-Variable Calculus, with an Introduction to Linear Algebra, T. M. Apostol, 2nd edition, Wiley, 1991.
- Calculus: Early Transcendentals, J. Stewart, 8th edition, Brooks Cole, 2015.

Teaching and Learning Activities

Lectures (3 lectures of 2 hours each per week) and weekly homework assignments solved individually. Recitations are lumped with the lectures.

Assessment Criteria

The final grade is set to the grade of the final written examination (which is up to 10), if that grade is not passing, and to the grade of the final written examination increased by at most 2, depending on the performance of the student in the homework assignments, provided the final written examination grade is passing.

3125 Introduction to Computer Programming

Core Course, 1st semester, 6 ECTS units

Instructor: Assistant Professor Michalis Titsias

URL: https://eclass.aueb.gr/courses/INF259/

Course Description

The concept of program. Variables and constants. Java conditional statements and loops: for, while, do-while, switch. Detecting and removing bugs. Fundamental built-in data types and constants, type conversions. The concept of the algorithm. Functions and methods. Algorithm design and repeated refinement. Libraries and Packages. Objects and classes. Expansion of classes and inheritance, creation functions. Introduction to polymorphism. Object-Oriented Programming. Strings and characters, basic text editing. Object-oriented graphics: shapes, groupings. Mono-dimensional and multi-dimensional arrays. Search Algorithms. Sorting algorithms. The ArrayList and HashMap collection classes. The concept of recursion, recursive functions, relationship between loops and recursions.

Learning Outcomes

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

- Know fundamental concepts of programming such as variables, assignment statements, built-in types of data, conditional statements and loops, arrays and input/output.
- Understand more advanced topics of programming in Java, such as object-oriented programming, function and methods, classes, class libraries, ArrayList and graphics.
- Design Java classes and methods and be able to write their own complete computer programs in order to solve specific problems.
- Implement more advanced programs based on recursion and know the relationship between loops and recursions.
- Apply classical algorithms for sorting and searching to perform computations in arrays and strings.

Prerequisite Courses

There are no required prerequisite courses. However, a good working knowledge of all Informatics courses taught in high school is required.

Bibliography

- The Art and Science of Java: An Introduction to Computer Science , E. Roberts, Pearson, 2014.
- Java: The Complete Reference, Tenth Edition, Herbert Schildt, Oracle, 2017.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each per week), laboratory exercises (2 hours weekly) and individual programming assignments.

Assessment Criteria

The final grade is the sum of the grade of the final written examination (which has a maximum of 6), the grade of the laboratory exercises (which has a maximum of 2), and the homework grade (which has a maximum of 2). However, the final grade can be passing only if the final written examination grade is at least 2.

3135 Introduction to Computer Science

Core Course, 1st semester, 6 ECTS units

Instructor: Associate Professor Iordanis Koutsopoulos

URL: https://eclass.aueb.gr/courses/INF111/

Course Description

Algorithms and computer programming principles (basic logic, modularity, sequencing, iteration, recursion, algorithm efficiency). Data structures (arrays, lists, stacks, trees). Theory of computation (computability and complexity, classes P and NP), Computer architecture (logic gates, instruction execution, memory, machine architecture, machine language, parameter passing, input/output devices). Programming languages (grammars, syntactic analysis, compilers). Operating systems (processes, scheduling). File and database systems. Computer networks and the Internet (basic internet protocols, HTML, TCP, WiFi).

Learning Outcomes

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

- Understand and distinguish the basic systems of information representation at the bit level of the binary arithmetic system but also at the file and database levels.
- Describe the basic architecture of a computing system and explain the basic structures of a computer instruction.
- Describe the basic concepts of process management in an operating system and compute the computation latency of different scheduling policies.
- Understand and compare different multiple access protocols in networks and describe and analyze the TCP protocol and the basic procedure of information routing in the internet.
- Understand basic concepts of algorithms (loops, conditions), be able to distinguish and compute the complexity of basic search and sort algorithms, and also design the representation of information with data structures (e.g. trees, linked lists).
- Distinguish the different stages of compilation of a program and distinguish syntactically correct and non-ambiguous syntaxes.
- Describe basic concepts of computability and the distinction of classes of complexity for problems.

Prerequisite Courses

There are no required prerequisite courses. However, a good working knowledge of all high school Informatics courses is required.

Bibliography

- Computer Science: An Overview, J. G. Brookshear, D. Brylow, Pearson Higher Education, 2015.
- Foundations of Computer Science, B. Forouzan, F. Mosharraf, Thompson Learning, 2007.
- Computer Science: A modern introduction, L. Goldshrager, A. Lister, Prentice Hill, 1987.
- Foundations of Computer Science, A. Aho, J. D. Ullman, Computer Science Press, 1992.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), lab lectures (1 lecture of 2 hours weekly), lab exercises, and elective group homework assignments.

Assessment Criteria

The final grade is a weighted average of the final written examination (with a 70% weight) and the grade of the oral lab examination (with a 30% weight).

3151 Introduction to Economics

Core Course, 1st semester, 6 ECTS units

Instructor: Professor Sofia Dimelis

URL: https://eclass.aueb.gr/courses/INF140/

Course Description

Introduction to the content and methodology of the science of Economics. Mechanisms of the market functioning. Consumer behavior and demand and supply theory. Firm behavior and the organization of industry. Production and cost theories. Analysis of markets' structure (competitive markets, monopolies, oligopolies). Introduction to macroeconomic analysis. Measurement of basic macroeconomic aggregates. Stylized facts of economic growth and business cycles. A presentation and analysis of the main macroeconomic facts of the economy of Greece and other countries of the European Union. Emphasis is given on the macroeconomic policy issues related to public finance, productivity and competitiveness of the Greek economy.

Learning Outcomes

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

- Achieve a better understanding of economic life by combining the principles of economic thought, acquired during the course, with the real economic events.
- Explain the measures of economic policy undertaken by economic agents.
- Compute the main economic indicators and other economic measures that may be needed for other applications.
- Draw information from basic economic aggregates about the economic performance of markets.
- Evaluate the position of the Greek economy within the European Union and worldwide.

Prerequisite Courses

There are no required prerequisite courses.

Bibliography

- Economics, D. Begg, G. Vernasca, S. Fischer, R. Dornbusch, McGraw Hill, 2014.
- Economics, N. G. Mankiw, M. P. Taylor, Cengage Learning, 2011.
- Economics for Business: Competition, Macro-stability & Globalisation, D. McAleese, Financial Times Management/Prentice Hall, 3rd Edition, 2004.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each weekly), recitations (1 recitation of 2 hours weekly), individual and group homework assignments, case studies.

Assessment Criteria

The final grade is based on the final written examination. A bonus of one unit is given if there has been participation in the homework sets or the analysis of case studies.

3214 Mathematics II

Core Course, 2nd semester, 6 ECTS units

Instructor: Professor Panagiotis Katerinis

URL: https://eclass.aueb.gr/courses/INF169/

Course Description

Multivariate calculus: partial derivatives, extrema, curves, double integrals, Lagrange multipliers. Linear Algebra: systems of linear equations. Gauss-Jordan Elimination. Vector spaces, subspaces, linear independence, basis and dimension, orthonormal bases, Gram-Schmidt process. Matrices and matrix operations, transpose of a matrix, row-echelon form and reduced row-echelon form, elementary row operations, row equivalent matrices, row canonical form, row space, column space, rank of a matrix, matrices and systems of linear equations. Determinants. Invertible matrices. The inverse of a matrix and systems of linear equations. Cramer's rule. Coordinates, change of bases, orthogonal matrices. Quadratic forms, symmetric matrices, eigenvalues, eigenvectors, diagonalization. Linear transformations. Applications of linear algebra.

Learning Outcomes

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

- Perform basic operations of multivariate Calculus, e.g., find partial derivatives and use them to interpret the manner in which a function varies with respect to its arguments, find the gradient and the directional derivative of a function at a given location, and find the maxima and minima of a two-variable function.
- Manipulate basic concepts of Linear Algebra, such as linear systems, linear independence, bases and dimension, linear mappings, eigenvalues, eignevectors, and diagonalization.
- Model and solve problems appearing in Informatics, such as simple routing cost minimization problems, using tools from multivariate Calculus and Linear Algebra.

Prerequisite Courses

There are no required prerequisite courses. However, it is advisable that the student has successfully completed the courses "Mathematics I" and "Discrete Mathematics" in past semesters.

Bibliography

- Ανώτερα Μαθηματικά, Π. Katerinis, Η. Φλυτζάνης, Εκδόσεις Γ. Μπένου, 2012.
- Elementary Linear Algebra: Applications Version, H. Anton, C. Rorres, 10th edition, Wiley, 2010.
- Vector Calculus, J. Marsden, A. Tromba, 6th edition, W.H. Freeman and Company, 2011.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each per week) and recitations (1 recitation of 2 hours per week).

Assessment Criteria

The final grade is set to the grade in the final written examination.

3222 Computer Programming in Java

Core Course, 2nd semester, 6 ECTS units

Instructor: Associate Professor Vasileios Siris

URL: https://eclass.aueb.gr/courses/INF176/

Course Description

In-depth study of inheritance and polymorphism: optimization of class hierarchies and code reuse, polymorphism and dynamic method binding, abstract classes and methods, interfaces. Object oriented design: identification and implementation of class relations, identification of class features and functionality. Data structures and collections: recursive classes and dynamic memory allocation, linked lists, arrays, queues, stacks, lists, iterators, sets, maps. Generics. Input and output: byte/character streams, object streams, filters, interfaces and classes for input/output, serial and random file access. Exceptions. Programming window-based applications: GUI components, data communication in window applications, event-based programming, applets.

Learning Outcomes

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

- Describe and manipulate basic concepts and principles of object-oriented programming: encapsulation (data and code), inheritance, and polymorphism.
- Develop an object-oriented program in Java including class definition, constructors, methods, object variables, static variables, etc.
- Apply object-oriented programming techniques, such as class hierarchies, code reuse and dynamic method binding, abstract and final classes and methods, and interfaces, with the aim of developing functional, compact, and extensible code.
- Select among the basic data structures and input/output methods that are available in Java.
- Develop basic window applications using event-driven programming.

Prerequisite Courses

There are no required prerequisite courses. However, it is recommended that students have successfully completed the course "Introduction to Computer Programming" in a previous semester.

Bibliography

- Java How To Program, H. M. Deitel, P. J. Deitel, 10th Edition, Pearson, 2015.
- Java in 21 Days, R. Cadenhead, 7th Edition, Sams publishing/Pearson, 2016.
- The Art and Science of Java, E. S. Roberts, Addison-Wesley, 2008.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), recitations (1 recitation of 2 hours weekly), individual lab exercises, and 3 group programming homework assignments.

Assessment Criteria

The final grade equals the final examination grade (for a maximum of 8), if this grade is less than 4 and, if the final examination grade is at least 4, equal to the final examination grade increased by at most 2, depending on the performance of the student in the three group programming homework assignments. These assignments are graded based on an oral examination at the end of the semester, and students are individually graded.

3262 Digital System Design

Core Course, 2nd semester, 6 ECTS units

Instructor: Professor Georgios Polyzos

URL: https://eclass.aueb.gr/courses/INF157/

Course Description

Binary Arithmetic. Boole Algebra. Logic gates and synthesis of simple circuits. Logic functions, circuits and don't-cares. Introduction to technologies implementing logic functions (transistors, NMOS, CMOS). Introduction to Programmable Logic Devices (PLDs), Programmable Logic Arrays (PLAs) and Field-Programmable Gate Arrays (FPGAs). Optimization of logic functions and circuits (Karnaugh maps, Quine-McCluskey algorithm). Number representations. Arithmetic circuits. Efficiency and cost issues in large circuits. Principles of digital design. Analysis and synthesis of combinational circuits (adders, multiplexers, coders and decoders) and synchronous sequential circuits (registers, counters, Mealy and Moore machines). Introduction to asynchronous sequential circuits. Bi-stable circuits (latches και flip flops). Analysis and design of microprocessor control units. Design, control and simulation of digital circuits with Altera's CAD Quartus II tool. Design and programming of digital circuits (adders, multiplexers, decoders, registers, counters, Arithmetic and Logic Units, simple processors) with VHDL (Very High Speed Integrated Circuit Hardware Description Language).

Learning Outcomes

After the successful completion of this course, students will be able to:

- Understand what is a digital circuit and how it works
- Analyse a given digital circuit
- Understand the representation of Boolean circuits through mathematical and graphical methods
- Perform arithmetic operations in various number systems and design digital circuits to implement them
- Design the optimal combinational circuit for a given logic function
- Distinguish different logic gates and other elements used in the design of logic circuits
- Design and program a combinational or synchronous sequential circuit with VHDL and Quartus II
- Verify the correct operation of an implemented logic circuit through functional and timing simulation on Quartus II.

Prerequisite Courses

There are no required prerequisite courses. However, it is recommended that students have successfully completed the course "Introduction to Computer Programming" in a previous semester.

Bibliography

- Stephen Brown and Zvonko Vranesic, *Fundamentals of Digital Logic with VHDL Design*, McGraw-Hill, 2009.
- M. Morris Mano and Michael D. Ciletti, *Digital Design*, 5th edition, Pearson Education, 2013.

Teaching and Learning Activities

Lectures, Laboratory lectures, (4 lab exercises), Tutorials (weekly), Online Video Tutorials on eClass for introduction to the use of the CAD Quartus tool and VHDL.

Assessment Criteria

The final grade is obtained from the grades of a midterm, (group) lab exercises and a final exam.

3311 Probability

Core Course, 2nd semester, 6 ECTS units

Instructor: Assistant Professor Stavros Toumpis

URL: https://eclass.aueb.gr/courses/INF113/

Course Description

Introduction to probability theory. Fundamental notions: probability measure, probability space, disjoint events, independent events, equiprobable states. Random variables, mean value and variance, independence. Modeling methods and techniques for computing probabilities. Combinatorial methods: ordered and unordered arrangements, combinations. Discrete and continuous random variables, probability density functions, the distribution function. Important cases of distributions. Relations between random variables, joint distributions, correlation and covariance. Markov's inequality and Chebychev's inequality. Sampling with and without replacement. The behavior of large samples, the Law of Large Numbers, the Central Limit Theorem, and applications.

Learning Outcomes

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

- Describe and manipulate the basic concepts (probability, sample space, event, etc.), the axioms, the basic properties, and the basic tools (probability mass and density functions, the Central Limit Theorem, etc.) of Probability Theory.
- Compute the probabilities of events in non-trivial probability problems using Probability Theory, Combinatorics, and Calculus.
- Discern known probabilistic models in problems related to Informatics.
- Compose new probabilistic models, modelling problems and systems appearing in Informatics using simpler component probabilistic models.

Prerequisite Courses

There are no required prerequisite courses. However, it is recommended that, before enrolling to the course, students have successfully completed the course "Mathematics I" in a previous semester. It is also recommended that students enroll concurrently to the course "Mathematics II", due to the use, in both courses, of double integrals.

Bibliography

- A First Course in Probability, Sh. M. Ross, 9th edition, Pearson Education, 2013.
- Introduction to Probability, D. P. Bertsekas, J. N. Tsitsiklis, 2nd edition, Athena Scientific, 2008.
- Probability and Random Processes, G. R. Grimmett and D. R. Stirzaker, 3rd edition, Oxford University Press, 2001.

Teaching and Learning Activities

Lectures (3 lectures of 2 hours each, weekly) and weekly homework assignments solved individually. Recitations are lumped with the lectures.

Assessment Criteria

The final grade is set to the grade of the final written examination (which is up to 10), if that grade is not passing, and to the grade of the final written examination increased by at most 2, depending on the performance of the student in the homework assignments, provided the final written examination grade is passing.

3252 Accounting

Core Course, 2nd semester, 6 ECTS units

Instructor: Assistant Professor Christos Tzovas

URL: https://eclass.aueb.gr/courses/INF285/

Course Description

Basic accounting definitions: accounting entity, accounting equation, accounting event, accounting year, accounting result, account. Definition of assets, liabilities and owner's equity. The accounting cycle for accounting entities: posting events in accounting books, accounting errors, trial balances, account adjustments, determination of financial results, income statement and balance sheet. Stock inventory and its valuation. Fixed assets and their valuation, depreciation.

Learning Outcomes

The purpose of the course is to introduce students to the basic elements of accounting concepts and techniques concerning the preparation and preparation of financial statements. Upon completion of the course, students will be able to have a thorough understanding of:

- Conceptual and regulatory framework of Accounting.
- Generally accepted accounting principles.
- Balance sheet and Income statement, Statement of changes in equity.
- Accounts
- Accounting Cycle (journal entries, general ledger, trial balances, adjusting entries, closing entries)
- Accounting for fixed assets
- Accounting for inventory.

Prerequisite Courses

There are no required prerequisite courses.

Bibliography

- Financial Accounting, International Financial Reporting Standards, D, Gikas, A. Papadaki, G.Siougle, E. Demoirako, C.Tzovas, 5th Edition, Benos Publishing, 2016.
- Financial Accounting, A. Ballas and D. Hevas, 5th Edition, Benos Publishing, 2016.
- Intermediate Accounting, Volumes 1 and II, IFRS edition, D.E. Kieso, J.J. Weygandt and T.D.Warfield, John Wiley & Sons, 2011.
- Financial Accounting, International Accounting Standard», W. T. Harrison Jr., C. T. Horngrern, C.W. Thomas and T. Suwardy, 9th edition, Pearson, 2014.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly)

Assessment Criteria

The final grade is set to the grade of the final written examination

3321 Computer Programming in C++

Core Course, 3rd semester, 8 ECTS units

Instructor: Assistant Professor Georgios Papaioannou

URL: https://eclass.aueb.gr/courses/INF232/

Course Description

Pointers and dynamic memory allocation. References. Argument-passing by value, reference or pointer. Functions that return pointers or references. Function overloading and function templates. Input and output streams. Multiple source code files, header files, object and executable code. Name spaces. Classes and dynamic memory allocation, copy constructors, destructors. Operator overloading. Inheritance, virtual and non-virtual methods, polymorphism, abstract classes. Class templates. Implementation of simple data structures using class templates, pointers, and dynamic memory allocation. Elements of the STL library. Iterators and their implementation with pointers. Main differences between C and C++.

Learning Outcomes

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

- Map a computational problem/task to the C and C++ language constructs and structure.
- Read, write, and understand code in C/C++ and compile it into executable programs, using good programming practices.
- Understand the execution cost of the generated machine code.
- Validate and debug their C/C++ programs.
- Extend and optimize code written in C++ and propose alternative implementations using polymorphism, operators, templated classes and function templates.
- Combine their code with third-party libraries and code to build larger and more complex applications.
- Use professional-grade development tools and environments to write high-performance code.

Prerequisite Courses

To enroll in the course, students must have successfully completed, in a previous semester, either the course “Introduction to Computer Programming” or the course “Computer Programming in Java”. However, it is recommended that students have successfully completed both these courses, as well as the course “Introduction to Computer Science”, before enrolling to the course.

Bibliography

- C++ How to Program, H. M. Deitel, P. J. Deitel, 9th edition, PHI, 2014.
- The C++ Programming Language, B. Stroustrup, 4th edition, Addison-Wesley Professional, 2013.
- C++ in One Hour a Day, Sams Teach Yourself, S. Rao, 8th edition, SAMS, 2017.
- C++: The Ultimate Beginners Guide to C++ Programing, S. Tale, CreateSpace Independent Publishing Platform, 2016.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), laboratory recitations (1 recitation of 2 hours, weekly), and 2 or 3 (depending on the difficulty) homework assignments, submitted individually or in pairs.

Assessment Criteria

The final grade is set to the final written examination grade (which is up to 7), if that grade is less than 3.5, and, otherwise, to the final written examination grade, increased by at most 3, depending on the performance of the student in the homework assignments. The grading of the homework assignments involves an oral examination at the lab.

3230 Computational Mathematics

Core Course, 3rd semester, 8 ECTS units

Instructor: Assistant Professor Paraskevas Vassalos

URL: https://eclass.aueb.gr/courses/INF207/

Course Description

Introduction to computational methods. Errors and computer arithmetic. Algorithms and convergence. Horner's method. Finite differences and linear operators. Interpolation and polynomial approximation. Piecewise polynomial interpolation. Numerical solution of algebraic equations. Numerical differentiation and integration. Direct methods for solving linear systems. Introduction to sparse matrix methodology. Matrix computations. Numerical solution of ordinary differential equations. Mathematical software and numerical algorithms. Programming with Octave/Matlab.

Learning Outcomes

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

- Understand computer arithmetic and the source of errors in numerical algorithm.
- Understand the concepts of convergence, accuracy, operations cost and stability of a numerical algorithm.
- Apply numerical methods for various mathematical operations and tasks, such as solving nonlinear equations, polynomial interpolation, numerical quadrature, solving linear systems, and solving numerically Initial-Boundary Value Problems.
- Combine numerical methods to obtain approximate solutions to mathematical problems.
- Write efficient, well-documented code and present numerical results in an informative way.

Prerequisite Courses

To enroll in the course, students must have successfully completed, in a previous semester, either the course "Mathematics I" or the course "Mathematics II". However, it is recommended that students have successfully completed both these courses, before enrolling to the course.

Bibliography

- Numerical Analysis, R. Burden, D. Faires, Brooks/Cole, Cengage Learning, 2011.
- Numerical Analysis, T. Sauer, Pearson, 2012.
- Numerical Mathematics and Computing, W. Cheney, D.Kincaid, Thomson Brooks/Cole, 2008.
- Numerical Mathematics, A. Quarteroni, R. Sacco, F. Saleri, Springer,2000.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), laboratory recitations (1 recitation of 2 hours, weekly), laboratory exercises (a total of 10 hours), computational group homework assignments and theory individual homework assignments.

Assessment Criteria

The final written examination awards at most 8 units. If this examination is passing (i.e., at least 4/8), then the group homework assignments award at most another 2 units. Furthermore, a bonus unit is awarded for thoroughly solving the theory individual homework assignments.

3335 Data Structures

Core Course, 3rd semester, 7 ECTS units

Instructor: Assistant Professor Evangelos Markakis

URL: https://eclass.aueb.gr/courses/INF231/

Course Description

Introduction to algorithm analysis. Searching and sorting, asymptotic approximations and notations. Stacks and queues: definition, operations, array-based implementation. Linked lists: single, double, circular linking, traversal, insertion, removal. Binary trees: definitions and fundamental theorems, depth-first and breadth-first traversal, recursive and iterative traversal, Euler tours. Binary search trees: definition, search, insertion, removal, adaptive, splay and random binary search trees. Balanced search trees: AVL trees, 2-3-4 trees, red-black trees, B-trees. Priority queues. Binary heaps: definition, operations, heap-sort. Binary heap-based priority queues. Hash tables: polynomial hashing, address compression (division, multiplication, and truncation), conflict resolution (chaining, linear probing, double hashing). External searching. B-Trees and hash tables.

Learning Outcomes

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

- Describe the role and the functionality of the most important data structures in computer science, such as linked lists, FIFO and LIFO queues, priority queues, binary search trees, and their variations.
- Analyze the computational complexity of the basic methods supported by the data structures presented during the course.
- Compare algorithms based on their time and space complexity.
- Design new algorithms utilizing the data structures presented during the course.
- Select suitable data structures for solving algorithmic problems.

Prerequisite Courses

To enroll in the course, students must have successfully completed, in a previous semester, either the course “Introduction to Computer Programming” or the course “Computer Programming in JAVA”. However, it is recommended that students have successfully completed both these courses, before enrolling to the course.

Bibliography

- Algorithms in Java, Parts 1-4, R. Sedgewick, 3rd edition, Addison Wesley, 2008.
- Data Structures and Algorithms in Java, R. Lafore, 2nd edition, Pearson, 2003.
- Data Structures and Algorithms in Java, M. Goodrich, R. Tamassia, John Wiley and Sons, 2003.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), laboratory recitations (1 recitation of 2 hours, weekly), and 3 group programming homework assignments.

Assessment Criteria

The final grade is equal to the final written examination grade, if this grade is not passing; otherwise, the final grade is the weighted average of the final written examination grade (with a weight of 70%) and the grade of the group programming homework assignments (with a weight of 30%).

3365 Computer Systems Organization

Core Course, 3rd semester, 7 ECTS units

Instructor: Associate Professor Iordanis Koutsopoulos

URL: https://eclass.aueb.gr/courses/INF103/

Course Description

Historical overview. Introduction to computer hardware structure and functionality. Main memory structure and organization, data storage and representation. Machine and symbolic language programming. Symbolic computer language MIPS32. Computer instructions and memory addressing modes. Computer arithmetic (integer and floating-point). Hardwired and microprogrammable control units. Pipelining and hazards. Functionality and control of peripheral devices, magnetic and optical devices. Secondary storage, cache memory and memory hierarchy. Traps, interrupts and input/output control systems. Channel and peripheral processors and computers. Basic single user systems software (assemblers, loaders, linkers etc.).

Learning Outcomes

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

- Understand and describe the structure of a computing system.
- Understand the structure of instructions in the MIPS32 language, explain the functionality of programs in MIPS32 and be able to develop their own programs.
- Understand the arithmetic representation of numbers in integer and floating-point arithmetic, and do computations in these arithmetics.
- Understand basic arithmetic operations on a hardware level.
- Describe basic structural elements of the processor, the datapath for different instructions, and the functionality of pipelining, and also to discover and correct with different means the associated hazards.
- Understand the structure and hierarchy of the memory of a computing system and the functioning of the cache memory.
- Measure the performance of a hierarchical memory system.

Prerequisite Courses

To enroll in the course, students must have successfully completed, in a previous semester, either the course “Introduction to Computer Science” or the course “Digital System Design”. However, it is recommended that students have successfully completed both these courses, before enrolling to the course.

Bibliography

- Computer Organization and Design: The hardware/software interface, D. Hennessy, J. Patterson, 4th edition, Morgan Kaufmann, 2011.
- Computer Architecture: A quantitative approach, D. Hennessy, J. Patterson, 5th edition, Morgan Kaufmann, 2011.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), recitations (1 recitation of 2 hours weekly), individual homework assignments, group homework assignments, and individual lab assignments.

Assessment Criteria

The final grade is a weighted average of the final written examination (with an 80% weight) and the grade of all assignments (with a 20% weight).

3464 Operating Systems

Core Course, 4th semester, 8 ECTS units

Instructor: Associate Professor Georgios Xylomenos

URL: https://eclass.aueb.gr/courses/INF168/

Course Description

Basic concepts of operating systems, operating system structure, historical perspective. Concurrent processes, threads of execution, mutual exclusion, process management and scheduling. Interprocess communication and thread synchronization. Memory management, address spaces, virtual memory, paging and segmentation, memory management hardware. Files and directories, storage space management, file system implementation. Input/output management, user interfaces, power management. Deadlocks and deadlock management. Operating system security, cryptography, protection mechanisms, security threats, threat mitigation. Case study: LINUX and POSIX/UNIX. Introduction to the C programming language, programming with processes and threads.

Learning Outcomes

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

- Define the basic operating system concepts (process, thread, memory, device, file) and describe the various ways of structuring them (kernel, microkernel, hierarchy, virtualization).
- Distinguish different methods of organizing and implementing the basic components of operating systems (execution units, memory systems, devices and file systems).
- Identify the various types of security threats to operating systems and assess the possible ways of mitigating them.
- Compose low level programs that take advantage of concurrency and system calls of a typical POSIX/UNIX system.

Prerequisite Courses

To enroll in the course, students must have successfully completed, in a previous semester, either the course “Introduction to Computer Programming” or the course “Computer Programming in JAVA”. However, it is recommended that students have successfully completed both these courses, as well as the courses “Computer Programming in C++” and “Computer Systems Organization”.

Bibliography

- Modern Operating Systems, A. S. Tanenbaum, 3rd edition, Prentice Hall, 2007.
- Operating Systems Concepts, P. Silberschatz, P. Galvin, G. Gagne, 9th edition, Wiley, 2012.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), recitations (1 recitation of 2 hours every 2 weeks), and programming homework assignments.

Assessment Criteria

The final grade is set to the final written examination grade (which is up to 7), if that grade is less than 3, and, otherwise, to the final written examination grade, increased by at most 3, depending on the performance of the student in the programming homework assignments.

3436 Databases

Core Course, 4th semester, 8 ECTS units

Instructor: Professor Emmanouil Giannakoudakis

URL: https://eclass.aueb.gr/courses/INF243/

Course Description

Basic principles, the three architectural levels (internal, logical, external). Data modelling (practical aspects, data interrelationships). SQL (direct and indirect usage). Introduction to data normalisation (1NF, 2NF, 3NF, 4NF, 5NF). Relational algebra, Tuple Relational Calculus (TRC), Domain Relational Calculus (DRC), query composition (advanced query formulation, attribute and relational representation). Database design and management using SQL (schemata, views, cursors, permissions). Triggers (design and applications). Application development using a host language (connectivity, indexing, retrieval). Web application design (XML, HTML, web-based languages). Sub-schemata and renaming, equivalence of algebraic operations, logical checks and constraints. Transactions (semantics, processing, verification and commitment). Advanced query optimisation. The network model and NDL.

Learning Outcomes

Upon successful completion of this course, students will be able to:

- Understand, appreciate, and effectively explain the underlying concepts of database systems.
- Describe the basic concepts of the relational model and understand its mathematical foundation.
- Apply conceptual database modeling methods to design a relational database.
- Understand data normalization and apply normal forms to evaluate the quality of the logical schema of a relational database.
- Use SQL in conjunction with a modern RDBMS to define, query and manipulate a relational database.
- Develop database applications using a host language.

Prerequisite Courses

To enroll in the course, students must have successfully completed, in a previous semester, either the course “Introduction to Computer Programming” or the course “Computer Programming in JAVA”. However, it is recommended that students have successfully completed both these courses in a previous semester.

Bibliography

- Database management systems, R. Ramakrishnan, J. Gehrke, 3rd edition, McGraw-Hill, 2012.
- Database system concepts, A. Silberschatz, H. F. Korth, S. Sudarshan, 6th edition, McGraw-Hill, 2006.
- Βάσεις Δεδομένων: Θεωρία και πράξη, Ε. Ι. Γιαννακουδάκης, Εκδόσεις Μπένος, 2014.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), recitations (1 recitation of 2 hours weekly), group and individual homework assignments.

Assessment Criteria

The final grade is based on the final written examination grade (which has a maximum of 10) and an individual oral lab examination, as follows: if the final written examination grade is at least 5, then the final grade is the weighted average of that grade (with an 80% weight) and the oral examination grade (with a 20% grade). Otherwise, the final grade is set to the final written examination grade.

3432 Algorithms

Core Course, 4th semester, 7 ECTS units

Instructor: Dr. Katia Papakonstantinopoulou

URL: https://eclass.aueb.gr/courses/INF161/

Course Description

Problems and algorithms, correctness and complexity, examples. Analysis of algorithms: growth of functions and asymptotic notation, O, Ω, Θ. Divide and conquer: integer multiplication, matrix multiplication (Strassen's algorithm), sorting (mergesort, quicksort), selection (median and order statistics), recurrence equations, Master theorem. Basic graph algorithms: graph traversal, connected components, directed acyclic graphs, cycle detection, topological sorting, strongly connected components. Greedy algorithms: shortest paths (Dijkstra's algorithm),minimum spanning trees (algorithms of Prim and Kruskal), satisfiability of Horn clauses, Huffman coding, fractional knapsack. Dynamic programming: shortest paths (algorithms of Bellman-Ford and Floyd-Warsall), matrix multiplication, dynamic optimal binary tree algorithm, longest increasing subsequence, integer knapsack, traveling salesman problem. Introduction to NP-completeness: the classes P and NP, NP-complete problems, polynomial time reductions, basic examples.

Learning Outcomes

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

- Analyze the time complexity of algorithms using asymptotic notation.
- Design algorithms using the 3 basic algorithmic techniques: divide and conquer, dynamic programming and greedy algorithms.
- Evaluate the previously mentioned techniques with respect to solving algorithmic problems.
- Compare algorithms according to their time and space complexity.
- Describe the complexity classes P and NP.
- Describe NP-completeness reductions among problems.

Prerequisite Courses

To enroll in the course, students must have successfully completed, in a previous semester, any of the three courses "Introduction to Computer Programming", "Computer Programming in JAVA" and "Discrete Mathematics". However, it is recommended that students have successfully completed all three courses in a previous semester.

Bibliography

- Introduction to Algorithms, T. H. Cormen, C. E. Leiserson, R. L. Rivest, C. Stein, 3rd edition, MIT Press, 2012.
- Algorithms, S. Dasgupta, C. H. Papadimitriou, U. V. Vazirani, McGraw-Hill, 2006.
- Algorithm Design, J. Kleinberg, E. Tardos, Pearson, 2005.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), recitations (1 weekly recitation of 2 hours), a written intermediate examination, and 2 individual homework assignments.

Assessment Criteria

The final grade equals the grade of the final written examination, if that grade is not passing; otherwise, it is equal to the weighted average of the final written examination grade (with a weight for 70%), the intermediate written examination grade (with a weight of 20%), and the individual homework assignments grade (with a weight of 10%).

3434 Automata and Complexity

Core Course, 4th semester, 7 ECTS units

Instructor: Assistant Professor Evgenia Foustoucou

URL: https://eclass.aueb.gr/courses/INF148/

Course Description

Fundamental proof techniques (proofs by induction, pigeonhole principle, diagonalization). Alphabets, strings, languages and problems. Regular languages. Regular expressions. Finite automata (deterministic, non-deterministic and their equivalence). Convertion of regular expressions to finite automata and vice versa. Complexity of decision problems concernng finite automata. Pumping lemma for regular languages. Examples of context-free languages, stack automata and context-free grammars. Turing machines (deterministic, non-deterministic and their equivalence). Turing-decidable languages (recursive languages). Turing-recognizable languages (recursively enumerable languages). Decidability, reductions, undecidable problems (halting problem for Turing machines, etc.). Complexity, classes P and NP, polynomial time reductions, NP-complete problems (3-satisfiability problem, clique problem, etc.).

Learning Outcomes

Upon completion of the course, students will be able:

- To understand and manipulate fundamental concepts of Formal Languages Theory and Computability Theory (such as computation, finite state machine, determinism, nondeterminism) and basic theorems (Pumping Lemma for finite automata, undecidability of the halting problem for Turing machines etc.).
- To understand and manipulate the basic computational models, i.e. finite automata, stack automata, Turing machines, starting from the less expressive ones.
- To model and classify solvable decision problems as languages (regular ones, context-free ones, Turing-decidable ones, Turing-recognizable ones) w.r.t. the computational model that is sufficient to resolve them.
- To prove the unsolvability of some known decision problems using diagonalization and reductions.
- To classify solvable decision problems w.r.t. the time resources they need and depending on the deterministic or not nature of the underlying Turing machine (complexity classes P and NP, NP-complete problems, polynomial-time reductions).

Prerequisite Courses

To enroll in the course, students must have successfully completed, in a previous semester, the course “Discrete Mathematics”.

Bibliography

- Elements of the Theory of Computation, H. Lewis and Ch. Papadimitriou, 2nd edition, Prentice-Hall, 1998.
- Introduction to the Theory of Computation, Michael Sipser, Cengage Learning, 3rd edition, 2013.
- Automata and Computability , Dexter Kozen, Undergraduate Texts in Computer Science Springer, 1997.
- Introduction to Automata Theory, Languages and Computation, J. Hopcroft , R. Motwani, J. Ullman, Pearson New International Edition, 3rd Edition, 2014.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), recitations (1 recitation of 2 hours weekly), optional intermediate written examination, and optional individual homework sets.

Assessment Criteria

The final grade is set to the final written examination grade. Active participation in the classroom (with well-posed observations, answers and questions) as well as in the intermediate written examinations and the submission of homework will raise the final grade.

3541 Information Systems Analysis and Design

Core Course, 5th semester, 8 ECTS units

Instructor: Professor Panagiotis Konstantopoulos

URL: https://eclass.aueb.gr/courses/INF261/

Course Description

This course offers a systematic introduction to information systems analysis and design, covering theoretical, technical and methodological issues. Information, information system (IS), IS development lifecycle. Organizational view, organizational processes, functional kinds of IS. Requirements analysis. Modelling functions (SADT, IDEF0, DFD, decision tables and trees), modeling data (E-R diagrams), introduction to UML. IS architectures. IS user interfaces: user interface design principles, input and output design. Managing IS development: IS development methods, standards, quality assurance, project management. Case studies.

Learning Outcomes

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

- Understand the function of an IS within an organizational environment, and the IS development life cycle.
- Use methods for IS requirements analysis and specification.
- Use function and data modelling methods.
- Analyze and design information structures and IS functions.
- Appreciate the bearing of human-computer interaction on IS effectiveness and efficiency.
- Be familiar with methods for managing information systems development.

Prerequisite Courses

To enroll in the course, students must have successfully completed, in a previous semester, either the course "Introduction to Computer Programming" or the course "Computer Programming in JAVA". However, it is recommended that students have successfully completed both these courses in a previous semester.

Bibliography

- Requirements Analysis and System Design, L. A. Maciaszek, 3rd ed., Pearson, 2007.
- Requirements Engineering: From System Goals to UML Models to Software Specifications, Axel van Lamsweerde, Wiley, 2009

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), recitations (1 recitation of 2 hours weekly), individual or group homework assignments.

Assessment Criteria

If the final written examination grade is passing, the final grade is the weighted average of the final written examination grade (with a weight of 60%) and the homework assignments grade (with a weight of 40%). Otherwise, the final grade is set to the final written examination grade.

3571 Communication Networks

Core Course, 5th semester, 8 ECTS units

Instructor: Professor Theodoros Apostolopoulos

URL: https://eclass.aueb.gr/courses/INF119/

Course Description

Key concepts and principles of communication networks. Network hardware and software, reference models, review of existing networks, standardization. Physical layer: theoretical basis for data transmission, analog and digital transmission systems, transmission media, wireless transmission, local loop. Data link layer: framing, error detection and correction, standards and protocols. Multiple access and local area networks: multiple access protocols, local area networks (Ethernet, Fast Ethernet, Gigabit Ethernet, VLANs), switching, introduction to wireless networks. Network layer of the Internet: the TCP/IP protocol family, Internet addresses and subnetting, control protocols, routing algorithms, internetworking. Transport layer: introduction to TCP and UDP protocols, flow and congestion control. Introduction to main network services: Domain Name Service (DNS), World Wide Web (WWW) and HTTP protocol, e-mail service.

Learning Outcomes

Upon successful completion of this course, students will be able to:

- Describe and analyze the operating principles and design choices of modern communication networks, as well as describe the basic characteristics of the more prevalent networking technologies.
- Describe the operation of the networking layer of the TCP/IP protocol stack and understand the design and IP addressing issues of networks employing it, as well as the most common TCP/IP routing protocols.
- Describe the basic concepts of the transport layer and of the better known network services.
- Evaluate the performance of modern network technologies and observe the research evolutionary trends in the area of communication networks.

Prerequisite Courses

To enroll in the course, students must have successfully completed, in a previous semester, either the course “Operating Systems” or the course “Computer Systems Organization”. However, it is recommended that students have successfully completed both these courses in a previous semester.

Bibliography

- Computer Networking: A Top-Down Approach, J. F. Kurose, K. W. Ross, 7th edition, Addison Wesley, 2016.
- Computer Networks, A. S. Tanenbaum, 5th edition, Prentice Hall, 2010.
- Computer Networks and Internets, D. Comer, 6th edition, Prentice Hall, 2014.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), recitations (1 recitation of 2 hours weekly), presentations, and assignments on the use of networking tools.

Assessment Criteria

The final grade is a weighted average of the final written examination (with a 70% weight), the grade of an intermediate written examination (with a weight of 20%), and the grade of the assignments on the use of web tools (with a weight of 10%).

3664 Distributed Systems

Core Course, 6th semester, 8 ECTS units

Instructor: Associate Professor Vasiliki Kalogeraki

URL: https://eclass.aueb.gr/courses/INF363/

Course Description

Introduction, non-centralized systems, goals and services of distributed systems, the client-server model. Event ordering and mutual exclusion. Global states. Global predicate evaluation, deadlocks, distributed termination. Leader election algorithms. Networking in Java. Remote procedure calls. Threads and their implementation in Java. Organization of processors and processes. Code migration. Distributed naming (entity naming, naming, directory and entity location services). Distributed file systems, case studies (NFS and AFS). Atomic transactions. Distributed object systems, architectures and case studies (Java RMI and CORBA). Fault tolerance, replication, recovery, load balancing, distributed agreement. Security in Java. Peer-to-peer systems, distributed hash tables, applications. Programming models for parallelism, case studies (MapReduce).

Learning Outcomes

Upon completion of this course, students will be able to:

- Understand the basic structures and functions of a distributed system
- Study modern distributed systems
- Understand the abstractions provided in the middleware layers in the distributed system
- Implement parts of a distributed system
- Use modern technologies to create novel distributed applications

Prerequisite Courses

To enroll in the course, students must have successfully completed, in a previous semester, either the course “Operating Systems” or the course “Computer Programming in JAVA”. However, it is recommended that students have successfully completed both these courses, as well as the courses “Communication Networks” and “Introduction to Computer Programming” in a previous semester.

Bibliography

- *Distributed Systems: Concepts and Design,* G. Coulouris, J. Dollimore and T. Kindberg, Fifth Edition, Addison Wesley, 2011.
- *Distributed Systems: Principles and Paradigms,* Andrew Tanenbaum, Maarten van Steen, Prentice Hall, 2016.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), seminars, group and individual laboratory exercises, group homework assignments, written research report and field exercise.

Assessment Criteria

The final grade is the average (with equal weights) of the final written examination and the group homework assignments. The grade of the group homework assignments is based in an oral examination, an intermediate examination and a final examination.

3648 Software Engineering

Core Course, 6th semester, 8 ECTS units

Instructor: Professor Emmanouil Giakoumakis

URL: https://eclass.aueb.gr/courses/INF138/

Course Description

The scope of software engineering. The software development process, software quality factors, software lifecycle models. Planning and management of software development projects (planning, organization, staffing, costing). Software requirements (system modeling, requirements specification, requirements documentation, requirements validation). Architectural (system) software design (design methods, design documentation, design quality). Detailed software design, user interfaces. Coding. Program testing, system testing, system delivery. Software maintenance, software configuration management, software documentation. Object oriented software (analysis / design methods, object oriented modeling languages). The UML language. Software development, operation and maintenance environments. Improving the software development process.

Learning Outcomes

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

- Understand software development processes (including iterative and agile processes).
- Derive and specify software requirements.
- Analyze, model, and specify software problems.
- Understand the basic concepts of software architecture and software design with emphasis on object-oriented methods.
- Create, model, and document design solutions and implement them into software modules.

Prerequisite Courses

To enroll in the course, students must have successfully completed, in a previous semester, the course “Data Structures”. In addition, it is recommended that students have successfully completed the courses “Introduction to Computer Programming” and “Computer Programming with JAVA” in a previous semester.

Bibliography

- Software Engineering: A Practitioner's Approach, R. S. Pressman, McGraw-Hill Education, 2014.
- Software Engineering, I. Sommerville, Pearson, 2015.
- Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development, C. Larman, Addison Wesley, 2004.
- Agile Software Development: Principles, Patterns and Practices, R. C. Martin, Prentice Hall, 2003.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), recitations (1 weekly recitation of 2 hours), individual and group optional homework assignments.

Assessment Criteria

The final grade is set to the final written examination grade, taking into account the optional group homework assignments (with a weight of 40%) and individual homework assignments (with a weight of 10%).

3515 Logic

Core Module Course (Module 1) and Elective Module Course (Modules 3, 4), 5th semester, 7 ECTS units

Instructor: Assistant Professor Evgenia Foustoukou

URL: https://eclass.aueb.gr/courses/INF146/

Course Description

Formal analysis of the concepts of provability and semantical implication. Propositional Logic: propositional formulas, assignments and satisfiability, logical implication, complete set of connectives , axiomatic system using the Modus Ponens rule, axiomatic system using the resolution rule, formal proofs, soundness and completeness theorems, compactness theorem. Predicate Logic: propositional formulas, structures, valuations, truth within a structure, logical implication, formal proofs, axiomatic system with Modus Ponens rule of proof, axiomatic system with resolution rule of proof, the soundness and completeness theorems, the compactness theorem. Introduction to the principles of Logic Programming. Other topics of logic with applications in Computer Science may include: (Monadic) Second Order Logic, modal logics and temporal logics.

Learning Outcomes

Upon completion of the course, students will be able:

- To understand and manipulate fundamental concepts of logical systems (logical formulas, satisfiability, logical implication, logical equivalence, axiomatic systems, proof rules, formal proofs) focusing on Propositional Logic and (First-Order) Predicate Logic.
- To understand and manipulate fundamental concepts of Propositional Logic as well as basic theorems (Soundness, Completeness, Deduction and Compactness).
- To understand and manipulate fundamental concepts of Predicate Logic (predicate symbols, function symbols, constant symbols, quantifiers, structure, interpretation) as well as basic theorems.
- To understand and find the differences between syntactic notions and semantic ones and between the object-language and the metalanguage (both in Propositional Logic and in Predicate Logic).
- To describe the use of Logic as a Programming Language.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students have successfully completed the course “Discrete Mathematics”, as well as other mathematical courses with derivations and proofs, in a previous semester.

Bibliography

- A Mathematical Introduction to Logic, Herbert B Enderton, Second Edition, Academic Press, 2001.
- From logic to logic programming, Kees Doets, The MIT Press, 1994.
- Στοιχεία Μαθηματικής Λογικής, Τζουβάρας Αθανάσιος, Εκδ. Ζήτη, Θεσσαλονίκη, 1986.
- Λογική: η δομή του επιχειρήματος, Δ. Πορτίδης, Σ. Ψύλλος, Δ. Αναπολιτάνος, Νεφέλη, 2007.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), two optional intermediate written examinations, and optional individual homework sets.

Assessment Criteria

The final grade is set to the final written examination grade. Active participation in the classroom (with well-posed observations, answers and questions) as well as in the intermediate written examinations and the submission of homework will raise the final grade.

3517 Computability and Complexity

Core Module Course (Module 1) and Elective Module Course (Module 6), 6th semester, 7 ECTS units

Instructor: Assistant Professor Evgenia Foustoukou

URL: https://eclass.aueb.gr/courses/INF146/

Course Description

Computability: Inductive proofs and recursive definitions. Encodings. Introduction to computation models. Primitive recursive functions and relations. Partial recursive functions and minimization. Device computability. Turing machines and Turing-computable functions. Equivalence between recursive functions and Turing-computable functions. Church-Turing Thesis. The basic theorems: normal type theorem, enumeration theorem and parameters theorem (s-m-n theorem). Recursively enumerable sets and unsolvable problems. Definability and arithmetical hierarchy. Turing-reductibility and degrees of unsolvability. Complexity: Classes NP and co-NP. The classes of the polynomial hierarchy and the class PSPACE. Complexity classes for finding problems (FP, FNP, PPAD). Counting problems: the class #P. Classes for optimization problems (APX, MAXSNP). Gap reductions and PCP theorem.

Learning Outcomes

Upon completion of the course, students will be able:

- To understand and manipulate definitions and proofs concerning the intuitive/empirical definition of algorithm and computable function.
- To understand and manipulate definitions and proofs concerning the notion of algorithm defined as a mathematical object within two equivalent theories (the Recursive Functions Theory and the.Turing-Computable Functions Theory).
- To understand and manipulate the encoding of recursive functions, of Turing machines and of algorithms into natural numbers, as well as the reverse process of decoding.
- To understand and manipulate fundamental notions of Recursive Functions Theory on natural numbers (recursion, minimization, Kleene's T-predicate, recursively enumerable sets, non solvable problems viewed as non recursive sets of natural numbers) as well as basic theorems (Kleene normal form theorem, enumeration theorem, s-m-n theorem).
- To understand and manipulate the computation model of Turing-computable functions (Turing machines, oracle Turing machines, m-reducibility, Turing-reducibility, non solvable problems).
- To describe the following complexity classes (together with the kind of reductions they use and their complete problems): classes NP and co-NP, classes of the polynomial hierarchy, class PSPACE, complexity classes for finding problems (FP, FNP, PPAD), for problems of counting (#P) and for optimization problems (APX, MAXSNP).

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students have successfully completed the courses "Automata and Complexity" and "Logic" in a previous semester.

Bibliography

- Introduction to the Theory of Computation, M. Sipser, Cengage Learning, 3rd edition, 2013.
- Computable functions, A. Shen, N.K. Vereshchagin, Student Mathematical Library Vol 19, American Mathematical Society, 2003.
- Theory of Computation, Dexter Kozen, Texts in Computer Science, Springer, 2006.
- Theory of computation, George Tourlakis, Wiley Editions, 2012.

Teaching and Learning Activities

Lectures (2 lectures of two hours each, weekly), optional homework and an optional intermediate written exam.

Assessment Criteria

The final grade is set to the final written examination grade. Active participation in the classroom (with well-posed observations, answers and questions) as well as in the intermediate written examinations and the submission of homework will raise the final grade.

3632 Special Topics in Algorithms

Core Module Course (Module 1), 6th semester, 7 ECTS units

Instructor: Dr. Georgios Zois

URL: https://eclass.aueb.gr/courses/INF171/

Course Description

Number theoretic algorithms and applications to cryptography: exponentiation, Euclidean algorithm for greatest common divisor, modulo arithmetic, primality testing, RSA and ElGamal cryptosystems. Average case complexity and randomized algorithms: introductory examples, quicksort, order statistics, analysis of binary search trees, hashing. Amortized complexity: UNION-FIND, splay trees. Dynamic programming algorithms. Combinatorial optimization problems: clique, independent set, vertex cover, set cover, Hamilton cycle and Hamilton path, traveling salesman problem (TSP), 3D-matching, Subset sum, integer knapsack, Partition, bin packing. Complexity classes, NP-completeness and polynomial reductions. Approximation algorithms: algorithms with a constant factor approximation, applications to vertex cover, TSP with triangle inequality and job scheduling. Randomized approximation algorithms. Polynomial Time Approximation Schemes (PTAS and FPTAS). Linear programming and integer linear programming. Maximum flows and matchings. Complementary slackness conditions, LP duality theory. Applications of linear programming for the design of approximation algorithms (LP-rounding and primal-dual methodologies).

Learning Outcomes

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

- Analyze the complexity of basic number-theoretic algorithms, such as exponentiation, computing Fibonacci numbers, finding the greatest common divisor, and primality testing.
- Design algorithms using the technique of dynamic programming.
- Design approximation algorithms for NP-complete problems.
- Use linear programming techniques to model combinatorial problems and design algorithms for them.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students have successfully completed the course "Algorithms" in a previous semester.

Bibliography

- Introduction to Algorithms, T. H. Cormen, C. E. Leiserson, R. L. Rivest, C. Stein, 3rd edition, MIT Press, 2012.
- Algorithms, S. Dasgupta, C. H. Papadimitriou, U. V. Vazirani, McGraw-Hill, 2006.
- Algorithm Design, J. Kleinberg, E. Tardos, Pearson, 2005.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), recitations (1 weekly recitation of 2 hours), 1 intermediate examination, 1 individual homework assignment, and 1-2 individual presentations of publications related to the course material.

Assessment Criteria

The final grade equals the grade of the final written examination, if that grade is not passing; otherwise, it is equal to the weighted average of the final written examination grade (with a weight for 70%), the intermediate written examination grade (with a weight of 15%), and the individual homework assignment and presentation grade (with a weight of 15%).

3561 Computer Architecture

Core Module Course (Module 2), 8th semester, 6 ECTS units

Instructor: Professor Georgios Polyzos

URL: https://eclass.aueb.gr/courses/INF156/

Course Description

Modern computer architectures and design cycle of integrated circuits and systems. MIPS assembly, compilers and their relation to computer architecture. Computer architecture and the VHDL language. Design of the data path and control circuit for MIPS (one cycle), pipeline and MIPS design, MIPS of multiple cycles. Instruction level parallelism, out of order execution, microprogramming, memory hierarchy, cache memories, and I/O. Cluster computers. Case studies of Pentium, PowerPC and other RISC architectures. Embedded systems and Systems-on-Chip.

Learning Outcomes

Understanding of the principles and specific details in operation of computer sub-systems and complete computers and their trade-offs

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students have successfully completed the courses "Digital Systems Design" and "Algorithms" in a previous semester.

Bibliography

- Computer Organization and Design MIPS Edition: The Hardware/Software Interface, D. Patterson and J. Hennessy, 5th edition, Morgan Kaufmann, 2013.
- Structured Computer Organization, A. S. Tanenbaum and Todd Austin, 6th edition, Pearson, 2013.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), recitations (1 weekly recitation of 2 hours), and laboratory exercises.

Assessment Criteria

The final grade is based on the grades of an intermediate examination, group laboratory exercises, and the final examination.

3672 Computer Networks

Core Module Course (Module 2), 6th semester, 7 ECTS units

Instructor: Professor George Stamoulis

URL: https://eclass.aueb.gr/courses/INF178/

Course Description

The course aims on the in-depth understanding of the fundamental issues of computer networks belonging to the main networking architectures and of the most prevalent technologies (with emphasis on the Internet) and their protocols, and of issues on the specification and provisioning of services to applications. Data link layer: sliding window protocols, verification of protocol correctness. Network layer: design topics, routing algorithms, flow control, quality of service, internetworking, IP extensions (multicasting, mobility, IPv6). Transport layer: client-server model, network APIs (sockets), transport protocol design, TCP algorithms, performance issues. Application layer and services: e-mail (protocols SMTP, POP, IMAP), the World Wide Web (WWW), content delivery networks. Introduction to network security: cryptography, digital signatures, authentication, IPsec architecture, network protection, virtual private networks (VPNs).

Learning Outcomes

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

- Describe the functionalities pertaining to the various layers of computer networks.
- Explain the corresponding solutions and protocols of the main networking architectures.
- Understand the requirements imposed on networks by the main networking applications.
- Understand the entirety of functionalities of computer networks as a whole in all layers and the interaction among the protocols of the different layers, with emphasis on the Internet.
- Evaluate the level of service of the most common networking applications by the most prevalent networking architectures and technologies.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the courses “Communication Networks”, “Operating Systems”, “Probability”, and “Introduction to Computer Programming”, before enrolling to this course.

Bibliography

- Computer Networks, A. Tanenbaum, D. Wetherall, 5th edition, Pearson, 2010.
- Computer Networks and Internets, D. Comer, 6th edition, Pearson, 2014.
- Computer Networking: a Top-Down Approach, J. Kurose, K. Ross, 7th edition, Pearson, 2016.
- Data and Computer Communications, W. Stallings, 10th edition, Pearson, 2013.
- Computer Networks: a Systems Approach, L. Peterson, B. Davie, 5th edition, Morgan Kaufmann, 2012.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), recitations (1 recitation of 2 hours every 2 weeks), 3 homework assignments (based on theoretical exercises and applied exercises on the Wireshark tool), and a semester-long assignment on sockets (submitted in two parts). Students complete assignments in groups of 3.

Assessment Criteria

The final grade is set to the final written examination grade (which has a maximum of 10), or the weighted average of the final written examination grade and the grades of the homework assignments, if this weighted average is greater than the final written examination grade. Assignments are counted only if the final examination grade passes a given threshold.

3634 Compilers

Core Module Course (Module 2) και Elective Module Course (Module 1), 7th semester, 6 ECTS units

Instructor: Associate Professor Vasiliki Kalogeraki

URL: https://eclass.aueb.gr/courses/INF320/

Course Description

Principles and history of compilers. Lexical analysis, Syntax analysis, Semantic analysis (SLR and LR(1) machines). Type analysis, run-time environments, communication with the operating system and the effect of the underlying computer architecture to a compiler. Intermediate code generation, assembly code generation, garbage collection and introduction to code optimization. Implementation of all compiler phases for aa MiniJava compiler.

Learning Outcomes

Upon completion of this course, students will be able to:

- Understand the basic structures and functions of a compiler
- Study techniques for lexical, syntax and semantic analysis, run-time environment, intermediate code and assembly code generation
- Implement parts of a compiler
- Use practical tools and techniques to build a compiler

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the courses “Introduction to Computer Programming”, “Computer Programming with JAVA”, and “Operating Systems”, before enrolling to this course.

Bibliography

- "Compilers Principles, Techniques and Tools," A.V.Aho, R. Sethi, J. D. Ullman. Εκδόσεις, Addison Wesley 1986
- "Modern Compiler Implementation in Java" by A.W.Appel, J.Palsberg. Cambridge University Press, 2002

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), seminars, group and individual laboratory exercises, group homework assignments, written research report and field exercise.

Assessment Criteria

The final grade is the average (with equal weights) of the final written examination and the group homework assignments. The grade of the group homework assignments is based in an oral examination, an intermediate examination and a final examination.

3662 Information Systems Security

Core Module Course (Module 3) και Elective Module Course (Modules 2, 4), 7th semester, 6 ECTS units

Instructor: Professor Dimitrios Gritzalis

URL: https://www.infosec.aueb.gr/index.php/2009-01-24-13-20-46?id=68

Course Description

Basic Concepts and Definitions. Analysis and presentation through E-R diagrams. Risk Assessment: Goals, capabilities and limitations of risk analysis and management methodologies. Example methodologies (CRAMM, OCTAVE, etc.). Access Control: Identification, Authentication, Authorization, Use of CAPTCHA Methods, Agnostic and Probabilistic Protocols, Biometric Technologies. Introduction to Cryptography: Conceptual foundation. Symmetric and Asymmetric Cryptography. Public Key Infrastructures (PKI). Digital Signatures and Certificates. Cryptanalysis. Malicious Software: Definition and Classification. Trojan horses, worms, viruses. Algorithmic approach. Foundations: Cohen (Turing Machines), Adleman (Gödel Numbering), Kephart (directed-graphs). Policies, methods and techniques for proactive and reactive defenses. Internet Security, Hackers and Hacking: Theory of Four Discontinuities. Ethics of Security. Hacking and Hacktivism. Wireless Local Area Network (WLAN) security. Security assessment and auditing software (Openvas | Nessus, Metasploit, Nmap, Aircracking, etc.). Personal Data Protection: Privacy and protection of personal data, General Data Protection Regulation. Role and responsibility of the IT professionals. Security in Ubiquitous Computing: Cloud Computing Security. Internet of Things. Security and Privacy Strategies in the Information Society. Topics in security and privacy protection (OSN, VoIP, critical infrastructures, etc.).

Learning Outcomes

After successful completion of the course, students will be able to:

- Understand in depth and be able to use the Information Systems Security terminology.
- Assist in the design and implementation of information systems security plans and policies.
- Evaluate the risk of an information system, using appropriate tools.
- Design, implement, and evaluate an access control system.
- Evaluate and choose the appropriate cryptosystem to protect a system.
- Protect an information system using Cryptologic techniques and methods.
- Overcome an attack by viral software (virus, worm, Trojan horse, etc.)
- Conduct penetration testing to evaluate the security of an information system or application.
- The role and impact of the sociopolitical context for protecting an information system.
- Evaluate, highlight and support the importance of privacy protection.
- Understand and comply with the current legislation on the protection of personal data.

Prerequisite Courses

There are no formally required prerequisite courses. Good knowledge of a programming language, of a popular operating system, as well as the principles of architecture and computer networks are useful.

Bibliography

- Gritzalis S., Katsikas S., Gritzalis D., Computer Network Security, pg. 69-141, Papasotiriou, 2011.
- Gritzalis D., Autonomy and Civil Disobedience in Cyberspace, pg. 295-365, Papasotiriou, 2014.
- Katsikas S., Gritzalis D., Gritzalis S., Information Systems Security, , New Tech Pub, 2010.
- Anderson R., Security Engineering, Wiley, 2013.

Teaching and Learning Activities

Lectures (2 weekly lectures, 2 hours each) and laboratory exercises (6 meetings, 2 hours each).

Assessment Criteria

The final grade is the weighted sum of a written homework (30%), a laboratory examination (30%) and the grade in the final written examination (40%).

3741 Conceptual System Modelling

Core Module Course (Module 3) και Elective Module Course (Module 5), 6th semester, 7 ECTS units

Instructor: Professor Panagiotis Konstantopoulos

URL: https://eclass.aueb.gr/courses/INF224/

Course Description

Role of conceptual modeling in the analysis and development of enterprise and information systems. Semiotic background. Conceptual modeling elements: entities, properties, relations, instances, classes. Abstraction mechanisms: classification, attribution, generalization. Inheritance. Conceptual modeling languages and environments: UML, Telos, RDF, OWL, ADOxx. Derivation rules and integrity constraints. Attribute reification. General kinds of relations: meronymy, grouping, role, materialization. Meta-models. Knowledge organization systems: taxonomies, thesauri, SKOS. Ontologies. Basic elements of general ontology from the CIDOC CRM standard. Linked data. Metadata. Schema, data and metadata transformations. Special subjects.

Learning Outcomes

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

- Have in-depth working knowledge of conceptual modeling methods.
- Perform domain analysis and design models on a real scale.
- Use advanced modeling languages and environments.
- Have working knowledge of knowledge organization systems and ontologies.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the courses “Databases”, “Logic”, and “Information Systems Analysis and Design”, before enrolling to this course.

Bibliography

- Conceptual Modeling of Information Systems, A. Olivé, Springer, 2007.
- Conceptual Modelling, M. Boman, J. Bubenko Jr., P. Johannesson, B. Wangler, Prentice Hall, 1997.
- Metamodeling for Method Engineering, M. Jeusfeld, M. Jarke, J. Mylopoulos, MIT Press, 2009.
- Analysis Patterns, M. Fowler, Addison-Wesley, 1997

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), recitations (1 recitation of 2 hours weekly), individual homework assignments and a group homework assignment.

Assessment Criteria

If the final written examination grade is passing, the final grade is set to the weighted average of the final written examination grade (with a weight of 50%), the individual homework assignment grade (with a weight of 30%) and the group homework assignment grade (with a weight of 20%). Otherwise, the final grade is set to the final written examination grade.

3642 Software Verification, Validation and Maintenance

Core Module Course (Module 3) Elective Module Course (Module 4), 8th semester, 6 ECTS units

Instructor: Professor Nikolaos Malevris

URL: https://eclass.aueb.gr/courses/INF198/

Course Description

The importance of user requirements and software specifications. Programming practice and the impact of programming languages on software development. Production of high quality software. Software quality and methods for achieving it. Software quality assurance. Testing methods. Software verification and related techniques. Software validation with respect to specifications and requirements. Formal methods for software verification. Software portability and reuse. Software maintenance. The need for effective methodologies for software maintenance. The importance of software and testing documentation. Software development cost evaluation. Principles of software reliability. The intricacies of object oriented software and web applications. Software tools for the above topics.

Learning Outcomes

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

- Understand that when a piece of software delivers acceptable results upon running it with a data set, it is not necessarily implied that this will also be the case with all test data sets.
- Understand that if certain methodologies are used, the produced software will be of high quality and therefore its maintenance will be performed easier.
- Anticipate how the rules and quantitative criteria ought to be applied in order to establish high quality assurance.
- Be in the position to apply techniques for revealing software errors in a piece of software.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the course "Software Engineering" as well as the compulsory programming courses before enrolling to this course.

Bibliography

- Software Testing and Analysis: Process, Principles and Techniques, M. Pezze, M. Young, Wiley, 2008.
- Software Testing: A Craftsman's Approach, P. C. Jorgensen, CRC Press, 2013.
- Επαλήθευση, Επικύρωση και Συντήρηση Λογισμικού, Πανεπιστημιακές παραδόσεις, Ν. Μαλεύρης, ΟΠΑ, 2015.
- Software Engineering, I. Sommerville, 9th Edition, Pearson, 2010.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), recitations (1 recitation of 2 hours every 2 weeks), and an elective, individual or group, homework assignment.

Assessment Criteria

For those students that have not complete the elective homework assignment, the final grade is set to the final written examination grade. For the rest of the students, the final grade is set to the weighted average of the final examination grade (with a weight of 60%) and the homework assignment grade (with a weight of 40%).

3644 Information Retrieval Systems

Compulsory Module Course (Module 4) and Elective Module Course (Module 4), 8th semester, 6 ECTS units

Instructor: Professor Theodoros Kalampoukis

URL: https://eclass.aueb.gr/courses/INF248/

Course Description

Introduction. Crawlers, Text pre-processing, Tokenization, stemming, Zipf's law, term weighting. Automatic indexing, inverted files, fast inversion algorithm, compression of inverted files. Bag-of-words model of retrieval, Evaluation of information retrieval systems. Multi-field and multimodal retrieval, Relevance feedback, probabilistic retrieval model, language model of retrieval, latent semantic indexing. Retrieval from the Web (PageRank), topic sensitive PageRank, collaborative filtering. Text classification, and multimedia retrieval, Applications.

Learning Outcomes

By the end of the course student will be able:

- to explain the theory behind the basic information retrieval models from textual collections and the web
- to face problems derived while pre-processing indexing and retrieval of information
- to analyze, compose and implement real problems of information retrieval.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the courses "Data Structures" and "Mathematics II" as well as the compulsory programming courses before enrolling to this course.

Bibliography

- Introduction to Information Retrieval, C. D. Manning, P. Raghavan, H. Schütze. Cambridge University Press New York, 2008.
- R. A. Baeza-Yates, B. A. Ribeiro-Neto, Modern Information Retrieval - the concepts and technology behind search, Second ed., Pearson Education Ltd., Harlow, 2011.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), recitations (1 recitation of 2 hours every 2 weeks), one individual homework assignment and one individual programming assignment.

Assessment Criteria

The final grade is the weighted average of the final examination grade (with a weight of 70%), the homework assignment grade (with a weight of 10%), and the programming assignment grade (with a weight of 20%). However, for the grade to be passing, the final examination grade must exceed 4.

3543 Database Systems Design

Core Module Course (Module 4) and Elective Module Course (Modules 2, 3), 6th semester, 7 ECTS units

Instructor: Associate Professor Ioannis Kotidis

URL: https://eclass.aueb.gr/courses/INF216/

Course Description

Physical design, the memory hierarchy, modern storage media (HDD, SSD), their operational characteristics and performance considerations, the 5 minute rule. Database indices (simple, B-trees, hashing), their operation and performance in database applications. Overview of query optimization, join algorithms, cost estimation. Logical database schema design, entities, attributes, keys. Redundancy, anomalies during insertions/deletions/updates. Functional dependencies, normalization, normal forms, synthesis and decomposition of relational schemas. Transactions, isolation levels, transactional systems, performance considerations. Data warehouses, definition and architecture, logical schema design, views, the Data Cube.

Learning Outcomes

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

- Analyze and design database schemas using proper conceptual, logical and physical level design techniques.
- Describe the architecture and operation of modern storage media and assess their performance in different database applications.
- Describe and use data indexing structures and data manipulation algorithms.
- Estimate the performance of user queries and suggest optimizations that can expedite long-running queries.
- Identify the differences between on-line transactional processing and on-line analytical processing.
- Know the architecture of a data warehouse and applications of the data cube.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the course “Databases” before enrolling to this course.

Bibliography

- Fundamentals of Database Systems, R. Emasri, S. B. Navathe, 6th Edition, Addison-Wesley Publishing Company, 2012.
- Database Systems, The Complete Book, H. Garcia-Molina, J. D. Ullman, J. Widom, Prentice Hall, 2012.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), recitations (1 recitation of 2 hours every two weeks), 2 individual homework assignments, and 2 individual programming assignments.

Assessment Criteria

The final grade is set to the weighted average of the final examination grade (with a weight of 60%) and the homework assignment grade (with a weight of 40%).

3531 Artificial Intelligence

Core Module Course (Module 4) and Elective Module Course (Modules 1, 4), 5th semester, 7 ECTS units

Instructor: Associate Professor Ion Androutsopoulos

URL: https://eclass.aueb.gr/courses/INF248/

Course Description

Turing test, Searle's Chinese room. Problem-solving by search: breadth/depth-first, iterative deepening, admissible and consistent heuristics, A*, hill climbing, beam search, simulated annealing, genetic algorithms, MiniMax, alpha-beta pruning. Knowledge representation and inference in propositional and first-order predicate logic: syntax, semantics, entailment, soundness, completeness, satisfiability, validity, decidability, conjunctive normal form, unification, resolution, inference with Horn clauses. Semantic networks and frames. Ontologies, description logics, OWL, Semantic Web. Production systems. Expert systems. Machine learning: candidate elimination, inductive logic programming, k-nearest neighbors, k-means, Naïve Bayes, entropy, feature selection, overfitting, ID3, linear regression, gradient descent, logistic regression, linear separability, Perceptron, neural networks, back-propagation. Natural language processing: processing stages, Chomsky's grammar hierarchy and corresponding automata, chart parsing, Earley algorithm, augmented context-free grammars, DCG grammars, semantic analysis, use of machine learning, natural language processing systems.

Learning Outcomes

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

- Describe examples of problems that Artificial Intelligence aims to solve and algorithms it uses, especially in the areas of problem solving by search, knowledge representation and inference, machine learning, natural language processing.
- Select appropriate Artificial Intelligence algorithms per problem, especially in problems of the areas above.
- Implement and apply Artificial Intelligence algorithms, especially in problems of the areas above.
- Evaluate the effectiveness and efficiency of Artificial Intelligence algorithms and systems, especially in problems of the areas above.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the courses "Discrete Mathematics", "Mathematics I", "Mathematics II", "Probability", "Algorithm", "Automata and Complexity", "Introduction to Computer Programming", "Computer Programming with JAVA", and "Data Structures" before enrolling to this course.

Bibliography

- "Artificial Intelligence – A Modern Approach", 3rd Edition, Russel, S. and Norvig, P. Pearson, 2009.
- "Artificial Intelligence: Structures and Strategies for Complex Problem Solving", 6th Edition, G.F. Luger. Pearson, 2008.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), recitations (1 recitation of 2 hours every two weeks), and group homework assignments.

Assessment Criteria

The final grade is the weighted average of the final written examination grade (with a weight of 70%) and three group homework assignments (with a weight of 10% each). However, if the final written examination grade is less than 4, then the final grade is set to that grade.

3751 Investment Science and Related Software

Core Module Course (Module 5)

Instructor: Emeritus Professor Evangelos Mageirou

URL: https://eclass.aueb.gr/courses/INF118/

Course Description

Introduction: classification and nature of investment decisions. The principle of arbitrage. Simple interest and its justification by arbitrage principles. Applications to accounts, bond discounting. Compound and continuous interest. Compound interest accounts and their analysis with difference equations. Elementary investment analysis: Net Present Value (NPV), Internal Rate of Return (IRR). Annuities: simple, uniform, geometric, general and applications to equipment selection. Loans and Bonds. Investment cash flows. Spreadsheet programming for investment analysis.

Learning Outcomes

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

- Compile the cash flows of an investment proposal.
- Apply the fundamental methods of investment evaluation.
- Describe the fundamentals of modern finance and capital markets.
- Use proficiently spreadsheet programming in order to implement the fundamental investment evaluation methods in a spreadsheet form.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the courses “Mathematics I”, “Probability”, “Economics”, and “Accounting” before enrolling to this course.

Bibliography

- D. Luenberger: Investment Science, 2nd edition, Oxford University Press, 2013.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), recitations (1 weekly recitation of 2 hours), an intermediate examination, and weekly homework assignments.

Assessment Criteria

The final grade is set to the weighted average of the final examination grade (with a weight of 75%) and the grade of the intermediate written examination (with a weight of 25%). The latter grade is only taken into consideration if it exceeds the final written examination grade.

3812 Special Topics in Operations Research

Core Module Course (Module 5), 7th semester, 6 ECTS units

Instructor: Assistant Professor Antonios Dimakis

URL: https://eclass.aueb.gr/courses/INF197/

Course Description

Topics in linear programming. Duality theory and its applications, the Simplex Method and Phases I, II. Markov Chains: transition matrices, ergodic systems, steady-state theory, first-passage probabilities, expected time, classification of states, the final matrix. Cost functions. Markov Decision Processes, optimal policies for finite or infinite horizon problems. Queueing Theory: the birth – death process, M/M/1 queueing systems, M/M/s queuing systems, M/M/s/k queueing systems. Elementary Decision Theory: decision trees, Bayesian trees, utilities. Game Theory: Two person zero sum games and their LP equilibria.

Learning Outcomes

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

- Understand the value of duality theory in the analysis of optimization problems.
- Develop mathematical models for phenomena which evolve randomly in time.
- Design systems which behave optimally in time.
- Recognize transport and assignment problems.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the courses “Operations Research” and “Probability” before enrolling to this course.

Bibliography

- Stochastic Models in Operations Research (in Greek), D. Fakinos, 2nd edition, Symmetria, 2007.
- Operations Research: An Introduction, H. Taha, 9th edition, Pearson, 2010.
- Introduction to Operations Research, F. S. Hillier and G. J. Lieberman, 10th edition, McGraw-Hill, 2014.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), recitations (1 weekly recitation of 2 hours), an intermediate written examination, and homework assignments, which students complete either individually or in pairs.

Assessment Criteria

The final grade is set to the weighted average of the final examination grade (with a weight of 60%), the grade of the intermediate written examination (with a weight of 20%), and the grades of the homework assignments (with a weight of 20%).

3511 Operations Research

Core (Module 5) and Elective (Modules 1 and 6) Module Course, 6th semester, 7 ECTS units

Instructor: Assistant Professor Antonios Dimakis

URL: https://eclass.aueb.gr/courses/INF114/

Course Description

Introduction to problem formulation in operations research and problem solving software. Linear Programming: LP problem formulation, Simplex Method (phase I and phase II), introduction to duality theory. Nonlinear programming: unconstrained optimization, optimization under equality constraints (theory and algorithms), optimization with inequality constraints (the Karush-Kuhn-Tucker conditions), algorithmic implementation. Inventory theory: deterministic models (economic ordering quantity), stochastic models, (s, S) policies. Dynamic programming: characteristics, implementations, deterministic models, stochastic models. Application to dynamic inventory models, the Wagner-Whitin algorithm.

Learning Outcomes

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

- Design systems with optimal behavior.
- Develop mathematical models for optimizing systems.
- Recognize the different types of mathematical models of optimization problems.
- Determine the optimal solutions of optimization problems.
- Explain the mathematical properties and algorithms underlying the solution of optimization problems.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the courses “Mathematics II” and “Introduction to Computer Programming” before enrolling to this course.

Bibliography

- Operations Research: An Introduction, H. Taha, 9th edition, Pearson, 2010.
- Introduction to Operations Research, F. S. Hillier and G. J. Lieberman, 10th edition, McGraw-Hill, 2014.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), recitations (1 weekly recitation of 2 hours), and homework assignments, which students complete either individually or in pairs.

Assessment Criteria

The final grade is set to the weighted average of the final examination grade (with a weight of 60%), the grade of an intermediate written examination (with a weight of 20%), and the grades of the homework assignments (with a weight of 20%).

3614 Applied Probability and Simulation

Core (Module 6) and Elective (Modules 1 and 5) Module Course, 5th semester, 7 ECTS units

Instructor: Professor Yannis Kontoyiannis

URL: http://pages.cs.aueb.gr/~yiannisk/aps-16/

Course Description

Introduction to important methods in applied probability. Introduction to the basic elements and concepts of Bayesian statistics, in theory and in practice. Applications of statistics and probability to problems in computer science and to simulation methods. Statistical modeling, parameter estimation, and hypothesis testing. Markov chain models and random walks; theoretical analysis and long-term behavior of these models. Applications to Markov chain Monte Carlo Algorithms. Introduction to simulation algorithms: convergence, variance, confidence intervals. Probabilistic analysis of classical algorithms, and randomized algorithms.

Learning Outcomes

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

- Describe, use and apply the basic concepts (Markov chains, prior and posterior distribution) and the basic theorems (stationary distribution and convergence theorems of Markov chains, properties of specific models and of particular prior and posterior distributions) of applied probability and Bayesian statistics.
- Model and solve problems appearing in computer science and statistics using the tools provided by Bayesian statistics and through basic as well as modern probabilistic methods.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the courses “Mathematics I”, “Mathematics II” and “Probability” before enrolling to this course.

Bibliography

- Introduction to Probability Models, Sh. Ross, 10th edition, Academic Press, 2009.
- Introduction to Probability, 2nd Edition, D.P. Bertsekas and John N. Tsitsiklis, Athena Scientific, 2009.
- Probability and Computing: Randomized Algorithms and Probabilistic Analysis. M. Mitzenmacher, E. Upfal, Cambridge University Press, 2005.
- A First Course in Bayesian Statistical Methods. P. D. Hoff, Springer, 2009.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each weekly), recitations (1 weekly recitation of 2 hours), and individual, weekly homework assignments.

Assessment Criteria

The final grade is set to the final written examination grade.

3513 Applied Numerical Analysis

Core (Module 6) and Elective (Modules 1, 4) Module Course, 6th semester, 7 ECTS units

Instructor: Assistant Professor Paraskevas Vassalos

URL: https://eclass.aueb.gr/courses/INF223/

Course Description

Fundamentals of Linear Algebra. Inner product, vector/matrix/function norms. Iterative methods for solving linear systems of algebraic equations (generic iterative, Jacobi, Gauss-Seidel, and S.O.R methods and iterative improvement). Numerical solution of partial differential equations. Approximation theory. Introduction to Fourier analysis. Linear Least Square problem. The QR and SVD methods. Iterative techniques for the computation of eigenvalues and eigenvectors.

Learning Outcomes

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

- Choose the most appropriate numerical method to solve a given linear algebra problem.
- Analyze the speed, rate of convergence, and stability of numerical algorithms.
- Use the basic iterative methods for solving systems of linear equations.
- Describe the basic matrix methods for solving linear least square problems.
- Explain and describe the properties of the SVD and QR methods.
- Apply the basic numerical methods for computing the eigenvalues/eigenvectors of a matrix.
- Understand the spectral methods for data analysis and compression.
- Implement effectively the above numerical methods in MATLAB/Octave.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the courses “Mathematics II” and “Computational Mathematics” before enrolling to this course.

Bibliography

- Numerical Linear Algebra and Applications, B. Datta, SIAM, 2010.
- Numerical Methods in Scientific Computing Volume II, A. Bjorck, G.Dahlquist, SIAM, 2010
- Applied Numerical Linear Algebra, J. Demmel, Philadelphia, PA: Society for Industrial and Applied Mathematics, 1997.
- Numerical Linear Algebra, L. Trefethen & D. Bau.. Philadelphia, PA: Society for Industrial and Applied Mathematics,1997.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), recitations (2 recitation of 2 hours each, weekly), weekly group computational homework assignments, weekly optional individual homework assignments on the theory, and three optional intermediate written examinations.

Assessment Criteria

The final written examination is awarded a maximum of 7.5 units. If the grade of this examination is greater than 3.5, then the group computational homework assignments provide an extra 2.5 units, towards the maximum of 10 units. An extra bonus unit is awarded if the weekly individual homework assignments are solved satisfactorily. Instead of sitting in the final examination, students have the option to sit in three intermediate written examinations that also award 7.5 units, provided the student secures the minimum passing grade (1.25 out of 2.5) in each of them.

3155 Statistics in Informatics

Core Module Course (Module 6) and Elective Module Course (Modules 2,4,5), 5th semester, 7 ECTS units

Instructor: Assistant Professor Antonios Dimakis

URL: https://eclass.aueb.gr/courses/INF223/

Course Description

Producing data, sampling and sampling distributions. Review of probability theory. Statistical inference: confidence intervals, z and t tests of hypothesis for the mean, comparing the means of two populations. Inference for categorical variables: hypothesis testing, confidence intervals, comparing two populations, χ^2 tests for independence and goodness of fit. Inference for linear regression. Analysis of variance, logistic regression. The principle of maximum likelihood. Analysis with statistical software. Applications to Informatics.

Learning Outcomes

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

- Understand the different type of statistical inference.
- Understand the nature of statistical inference.
- Explore data using numeric and graphical descriptors.
- Make inferences about the general population using statistical surveys.
- Evaluate the accuracy of statistical studies.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the courses “Mathematics I”, “Mathematics II” and “Probability” before enrolling to this course.

Bibliography

- Introduction to the Practice of Statistics, D. S. Moore, G. P. McCabe, B. A. Craig, 6th edition, W. H. Freeman, 2007.
- Using R for Introductory Statistics, J. Verzani, Chapman & Hall/CRC The R Series, 2014.
- Στατιστική Μεθοδολογία, Π. Ζαΐρης, αναθεωρημένη έκδοση, Εκδόσεις Κριτική, 2010.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each weekly), statistical analysis lab (1 lab of 2 hours every two weeks), recitations (1 recitation of 2 hours every two weeks), and homework assignments (either individual or in pairs).

Assessment Criteria

The final grade is set to the weighted average of the final examination grade (with a weight of 70%) and the grade of the homework assignments (with a weight of 30%).

3862 Performance Evaluation of Systems and Networks

Elective Module Course (Modules 2, 6), 8th semester, 6 ECTS units

Instructor: Professor George Stamoulis

URL: https://eclass.aueb.gr/courses/INF334/

Course Description

The objective of this course is to offer the student the main analytical and experimental tools for performance evaluations of systems and networks, as well as to teach the student how to apply these tools and how to exploit the results in optimizing the design and operation of such systems. The content of the course covers the following topics. Introduction: the need for performance evaluation, performance metrics. Queueing systems: M/M/1, M/M/m, M/G/1 queues and their variations, queuing networks. Applications to computer systems and networks: computer system and network performance models, load and performance analysis of Web-based systems. Simulation: random number generation, systematic design of simulation experiments, statistical analysis of simulation results, measurement and evaluation of parameters, performance metric evaluation formulas. Experimental methods: load selection, benchmarks, monitoring test execution.

Learning Outcomes

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

- Describe and manipulate the basic performance metrics and tools used in the performance evaluation of systems and networks.
- Combine simple models (such as queues) in order to construct and study more challenging system models (such as networks of queues).
- Model real systems and networks, possibly making suitable simplifications, and establish their performance with mathematical means, if this is possible, and with simulations, if necessary.
- Compare different systems and networks, and their models, by evaluating both their quantitative and qualitative characteristics.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the courses “Probability”, “Communication Networks” and “Computer Networks” before enrolling to this course.

Bibliography

- Introduction to Probability Models, Sh. Ross, 10th edition, Academic Press, 2009.
- Data Networks, D. Bertsekas, R. Gallager, 2nd edition, Prentice Hall, 1992.
- Network Performance Analysis, Th. Bonald, M. Feuillet, ISTE, John Wiley & Sons, 2011.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), recitations (1 weekly recitation of 2 hours), and individual homework assignments.

Assessment Criteria

The final grade is set to the grade of the final written examination (which is up to 10), if that grade is not passing, and to the grade of the final written examination increased by at most 2, depending on the performance of the student in the homework assignments, provided the final written examination grade is passing.

3842 Information Systems Applications Development

Elective Module Course (Modules 3, 4), 8th semester, 6 ECTS units

Instructor: Associate Professor Ioannis Kotidis

URL: https://eclass.aueb.gr/courses/INF183/

Course Description

Tools and environments used in developing Information Systems. Management of IT projects. Scheduling, network analysis, Activity on Arrow, Activity on Node networks, PERT analysis. Resource management, adjustments, cost estimation, monitoring. Big Data applications. Caveats of using big data analytics in decision making. Big data systems and tools. Data streams management systems. Applications of hashing in big data systems. Quick introduction to data mining. Data reduction techniques. Locality sensitive hashing for nearest neighbor queries. Implementation of an IT application (group project), requirement gathering and analysis. Conceptual modeling, technical design. Demonstration of working system.

Learning Outcomes

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

- Know the methodology of designing, scheduling and monitoring an IT project.
- Publicly present and defend the goals of their IT project.
- Conceptualize and implement a group IT project.
- Identify opportunities for applying data analysis techniques in order to enhance the functionality of a modern Information System.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the courses “Databases” and “Information Systems Analysis and Design” before enrolling to this course.

Bibliography

- Fundamentals of Project Management, R. Burke, Burke Publishing, 2010.
- Modern Systems Analysis and Design, J. Hoffer, J. George, J. Valacich, Prentice Hall Publishing, 2011.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each weekly), recitations (a total of 2 recitation of 2 hours each), a group project assignment, 2 group presentations, and a final group project assignment presentation.

Assessment Criteria

The final grade is set to the weighted average of the final examination grade (with a weight of 30%) and the grade of the group assignment (with a weight of 70%). The grade of the group project assignment is based on the project code, its documentation, its deliverables, and its presentations.

3771 Wireless Networks and Mobile Communications

Elective Module Course (Module 2), 7th semester, 6 ECTS units

Instructor: Associate Professor Vasileios Siris

URL: https://eclass.aueb.gr/courses/INF124/

Course Description

Introduction and general overview of wireless and mobile communications. Wireless signal propagation. Wireless telecommunication systems. 1G and 2G mobile telecommunications. Handover. Wireless packet networks. Wireless multiple access schemes. Satellite systems. Wireless Local Area Networks. Fixed wireless access. Mobile IP, micro-mobility. TCP over wireless networks. Supporting multimedia over wireless networks. 2.5G, 3G and 4G mobile telecommunications. Ad hoc networks. Sensor networks. Security issues. Mobile Computing. This course does not focus on physical layer issues, but exposes the peculiarities of wireless channels in order to cover general issues related to and applications of wireless communications, mobility, location awareness aspects, etc.

Learning Outcomes

After successful completion of the course, the students will be able to

- Describe and manipulate the fundamental concepts and principles of wireless networks and mobile communications.
- Describe how protocols for medium access, network, and transport need to be adapted to the characteristics of the wireless medium and wireless signal propagation.
- Describe and manipulate the basic protocols and procedures for mobile metropolitan and wireless local area networks.
- Design at a high level the architecture of integrated wired, mobile and wireless local area networks.
- Solve problems related to the design and operation of wireless and mobile networks.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the courses “Communication Networks” and “Computer Networks” before enrolling to this course.

Bibliography

- Wireless Communication Networks and Systems, C. Beard, W. Stallings, Pearson, 2016.
- Wireless Networks C. Smith, D. Collins, 3rd edition, McGraw-Hill, 2014.
- Wireless Communications Fundamental and Advanced Concepts, S. Kumar, River Publishers, 2015.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), recitations (1 recitation of 2 hours weekly), and a group experimental/programming project assignment.

Assessment Criteria

If the final written examination grade is equal to or greater than 4/10, then the final grade is the weighted average of the final examination grade (with a weight of 50%), the grade of an intermediate written examination (with a weight of 15%), and the grade of the group assignment (with a weight for 35%). If the final written examination grade is smaller than 4/10, then the final grade equals the final written examination grade.

3781 Computer Graphics

Elective Module Course (Modules 1, 2, 6), 7th semester, 6 ECTS units

Instructor: Assistant Professor Georgios Papaioannou

URL: https://eclass.aueb.gr/courses/INF124/

Course Description

Digital imaging synthesis, applications and representation models. Basic drawing algorithms, antialiasing and supersampling. 2D and 3D transformations and coordinate systems, kinematic chains, scene graphs and modeling. Culling, viewing transformations and projections. Data structures for polygonal models. Back face removal. Hidden surface elimination and depth sorting. Scan-conversion and the Z-buffer algorithm. Illumination models, the bidirectional reflectivity distribution function and empirical local illumination models and algorithms. Texturing: Texture maps, texture coordinates and transformations, antialiasing and procedural textures. Introduction to shaders. Animation techniques and motion synthesis. Shadow generation: Shadow volumes and the stenciled shadow volumes algorithm. Shadow maps. Hardware implementation of the above topics and graphics programming using OpenGL and C/C++.

Learning Outcomes

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

- Have a grasp of computer graphics and 2D/3D geometry representation foundations.
- Describe and analyze the principal phenomena governing light transport on surfaces and within media.
- Apply elements of real-time computer graphics theory to modern applications.
- Implement interactive applications, such as computer games, using OpenGL.
- Implement models and algorithms for shading, animation and display of surfaces using shaders.
- Describe, design and implement basic rendering architectures using the GPU.
- Evaluate the suitability of a given computer graphics algorithm or model to solve a particular problem.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the courses “Mathematics II”, “Computer Programming in C++”, and “Computer Systems Organization” before enrolling to this course.

Bibliography

- Graphics and Visualization: Principles & Algorithms, T. Theoharis, G. Papaioannou, N. Platis, N. M. Patrikalakis, A. K. Peters, Ltd., 2008.
- Real-Time Rendering, T. Akenine-Möller, E. Haines, N. Hoffman, 3rd edition, CRC Press, 2008.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each, weekly), lab in OpenGL (1 weekly lab of 2 hours), and a final group (of 2-3 persons) or individual project assignment.

Assessment Criteria

The final grade is equal to the final written examination grade, if that grade is not passing, and the final written examination grade increased by at most 3, depending on the performance of the student in the final project.

3612 Topics in Discrete Mathematics

Elective Module Course (Modules 1 και 6), 8th semester, 6 ECTS units

Instructor: Professor Panagiotis Katerinis

URL: https://eclass.aueb.gr/courses/INF238/

Course Description

Graph theory: graphs and subgraphs. Trees. Optimal spanning trees. Optimal paths and optimal spanning trees. Counting trees. Rooted trees. Prefix codes and Huffman's algorithm. Paths and distances. Connectivity and construction of reliable communication networks. Hamilton cycles. The traveling salesman problem. Euler trails. The Chinese postman problem. Designs: fundamental concepts. Fisher's theorem. Symmetric designs. Designs and codes. Algebraic systems: groups. Subgroups. Generators and evaluation of powers. Cosets and Lagrange's theorem. Codes and group codes. Isomorphisms and automorphisms. Homomorphisms and normal subgroups. Rings.

Learning Outcomes

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

- Describe and manipulate the basic concepts and theorems of the selected topics in Discrete Mathematics covered in this course, such as Graph Theory, Design Theory, and Coding Theory.
- Combine the basic tools of the above topics in order to solve problems spanning them.
- Model and solve problems appearing in Informatics using the above selected topics of Discrete Mathematics.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the course "Discrete Mathematics" before enrolling to this course.

Bibliography

- Aspects of Combinatorics, V. Bryant, Cambridge University Press, 1993.
- Graph Theory with Applications, J. A. Bondy, U. S. R. Murty, North Holland, 1976.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each weekly).

Assessment Criteria

The final grade is set to the grade in the final written examination.

3743 Data Mining from Large Databases and the Web

Elective Module Course (Modules 3, 4), 7th semester, 6 ECTS units

Instructor: Professor Michail Vazirgiannis

URL: https://eclass.aueb.gr/courses/INF131/

Course Description

Introduction to Machine Learning: data pre-processing, exploratory analysis, feature selection, dimensionality reduction, feature extraction and evaluation, supervised learning (k-nn, linear regression, logistic regression, decision trees, naive Bayes), unsupervised learning (k-means, EM, spectral clustering). Text/Web Mining: text representation models, text retrieval, novelty detection, recommendations/collaborative filtering. Graph Mining: ranking algorithms and evaluation measures, graph clustering and classification, community detection methods & applications in social networks. Big Data: MapReduce, distributed processing (Hadoop, Spark, NoSQL storage).

Learning Outcomes

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

- Demonstrate an understanding of the key concepts in data mining/science.
- Use statistical methods and visualization to quickly explore a dataset.
- Apply machine learning algorithms for making predictions based on data.
- Write code to statistically analyze a dataset.
- Think critically in making decisions based on data.
- Apply data mining techniques to text and graph data.
- Implement data-intensive computations on computer clusters using MapReduce.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the courses “Introduction to Computer Programming”, “Mathematics II”, “Probability”, “Algorithms”, and “Statistics in Informatics” before enrolling to this course.

Bibliography

- Principles of Data Mining, D. Hand, H. Mannila, P. Smyth, MIT Press, 2001.
- Learning from Data, Y. Abu-Mostafa, M. Magdon-Ismail, H.-T. Lin, AMLBook New York, 2012.
- Doing Data Science, Straight Talk from the Frontline, C. O'Neil, R. Schutt, O'Reilly, 2014.
- Mining of Massive Datasets, J. Leskovek, A. Rajaraman, J. Ullman, Cambridge University Press, 2014.
- Pattern Recognition and Machine Learning, C. Bishop, Springer, 2007.
- Data Mining: Concepts and Techniques, J. Han, M. Kamber and J. Pei, Morgan Kaufmann, 2011.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each weekly), laboratories (1 laboratory session of 2 hours weekly), and a semester-long project.

Assessment Criteria

The final grade is the weighted average of the final written examination grade (with a weight of 60%) and the project grade (with a weight of 40%).

3783 Human-Computer Interaction

Elective Module Course (Modules 2,3, 4), 8th semester, 6 ECTS units

Instructor: Associate Professor Ion Androutsopoulos

URL: https://eclass.aueb.gr/courses/INF144/

Course Description

Cognitive models, memory, perception, attention, automatic processes, scripts, metaphors, structural and functional models. Interaction styles: command line, menus, forms, direct manipulation, virtual worlds, natural language, gestures, multimodal interfaces, brain interfaces, natural interfaces, cooperation support systems, social networks, interfaces for people with special needs. Developing interactive systems: waterfall model, spiral model, principles of human-centered development, star model, LUCID model, user and context studies, task analysis. User interface design guidelines: design rules, examples of errors, design guidelines for web sites. Evaluating interactive systems: formative and summative assessment, keystroke-level models, cognitive walkthrough, usability inspection, measures of effectiveness, efficiency, satisfaction, thinking aloud, logging actions, interviews, questionnaires, field studies. Developing interactive applications for mobile devices: examples, good and bad practices, tools. Computer vision: introduction, mathematical background, data structures used, image preprocessing, image segmentation, applications. Human language technology: introduction, language models, parsing, semantic analysis, smart keyboards, speech recognition, spoken dialogue systems.

Learning Outcomes

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

- Describe the main kinds of user interfaces and methods to design, implement, and evaluate interactive computer systems.
- Design, implement, and evaluate user interfaces, assigning central importance to the needs, skills, and preferences of users.
- Describe basic computer vision concepts and apply them to user interfaces.
- Describe basic human language technology concepts and apply them to user interfaces.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the courses “Introduction to Computer Programming”, “Computer Programming with JAVA”, “Mathematics I”, “Mathematics II”, Probability”, and “Artificial Intelligence” before enrolling to this course.

Bibliography

- Interaction Design: Beyond Human-Computer Interaction, 4th Edition, J. Preece, H. Sharp, Y. Rogers. Wiley, 2015.
- Human-Computer Interaction, 3rd Edition, A. Dix, J.E. Finlay, G.D. Abowd, R. Beale. Pearson, 2003.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each weekly), laboratories and recitations (2 hours weekly), and group homework assignments.

Assessment Criteria

Students are graded based on a final written examination, a compulsory group assignment, and an optional group assignment. Grading the assignments involves an oral examination. For students submitting only the compulsory assignment, the final grade is the weighted average of the final written examination grade, with a weight of 70%, and the compulsory assignment grade, with a weight of 30%. For students also submitting the optional assignment, the final grade is the weighted average of the final written examination grade, with a weight of 50%, the compulsory assignment grade, with a weight of 30%, and the optional assignment grade, with a weight of 20%. However, if the final written examination grade is less than 4, then the final grade is set to that grade.

2610 Business Policy and Strategy

Elective Module Course (Module 3), 8th semester, 6 ECTS units

Instructor: Professor Vasileios Papadakis

URL: https://eclass.aueb.gr/courses/ODE293/

Course Description

The course approaches a plethora of problems that puzzle every company and manager. We discuss such issues as:

- How to analyze the external environment of the company (Structural Analysis of Industries, Strategic Groups, Trends).
- How to exploit and build resources and capabilities needed to achieve, maintain and improve the firm's market positioning (strategy as the creation of dynamic capabilities).
- The processes of strategy formulation and to what extent Greek companies are following them.
- How to direct the company into the future (mission/vision/strategic intent).
- How to make a strategic choice, given a number of alternative strategic options (choices include: in which areas should we diversify, in which products/services should we expand, how are we going to implement this expansion, are we going to acquire, merge, form an alliance with another business).
- How to build and sustain competitive advantage.
- What type of structure, systems, people, does a company need to successfully implement a chosen strategy.
- How to make better strategic decisions and how to avoid the hidden traps that lead to erroneous decisions.

Learning Outcomes

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

- Understand the basic theories and tools of strategy that have been developed in theory and practice.
- Use the tools and techniques of strategy analysis and to understand their pros and cons.
- Understand how to craft and implement strategy, given a number of alternative strategic options
- Evaluate alternative strategies and choose the optimal ones.
- Develop understanding on how to build and sustain competitive advantage.
- Realize what type of structure, systems, people, a company needs to successfully implement a chosen strategy.
- Spot and discuss the most common strategy mistakes taking place.

Prerequisite Courses

The knowledge of basic concepts of Business Administration and Marketing helps in the better understanding of the material of this course.

Bibliography

- Contemporary Strategy Analysis, R. M. Grant, Wiley, 9th edition, 2016.
- Strategic Management Theory, C. Hill, G. Jones, M.A. Schilling, Cengage Learning, 11th edition, 2015.
- Exploring Strategy, G. Johnson, R. Whittington, K. Scholes, D. Angwin, P. Renger, Prentice Hall, 10th Edition, 2014.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each weekly).

Assessment Criteria

The final grade is based on a final written examination.

3713 Decision and Game Theory

Elective Module Course (Modules 1, 5, 6), 8th semester, 6 ECTS units

Instructor: Assistant Professor Evangelos Markakis

URL: https://eclass.aueb.gr/courses/INF220/

Course Description

A priori, a posteriori and subjective probabilities. Decision problem formulation through Decision trees. Decision selection criteria. Bayes' theorem and Bayes' decision rules. Utility function determination. Competitive decisions. Game theory: game trees, extensive and normal form. Two player games, zero and nonzero sum. Applications to auctions, and other applications in economics, computer science and business.

Learning Outcomes

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

- Describe basic decision problems, using decision trees.
- Analyze decision problems and portfolio selection problems.
- Model scenarios of competition as multi-player games.
- Analyze games according to the solution concept of Nash equilibrium, and describe the recommended strategies.
- Evaluate different strategies using game-theoretic criteria.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the courses “Mathematics I” and “Probability” before enrolling to this course.

Bibliography

- An Introduction to Game Theory, M. J. Osborne, Oxford University Press, 2003.
- A Primer in Game Theory, R. Gibbons, Pearson Education Limited, 1992.
- Decision Analysis: Introductory Lectures on Choices under Uncertainty, H. Raiffa, Addison Wesley, 1968.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each weekly), recitations (1 weekly recitation of 2 hours), and 2 individual homework assignments.

Assessment Criteria

The final grade is equal to the grade of the final written examination, if that grade is not passing; otherwise, it is equal to the weighted average of the final written examination (with a weight of 85%) and the grade of the homework assignments (with a weight of 15%).

3814 Information Theory

Elective Module Course (Modules 1 ,2, 6), 8th semester, 6 ECTS units

Instructor: Professor Yannis Kontoyiannis

URL: http://pages.cs.aueb.gr/~yiannisk/it/

Course Description

Information theory studies the fundamental questions relating to data compression and transmission. This class offers a broad introduction to the basic concepts of information theory, together with some elements of practical applications to data compression and to channel coding. Connections with computer science are also discussed. Specifically: entropy and information. The "asymptotic equipartition" property. Lossless data compression: theory and the algorithms of Shannon and Huffman, arithmetic coding. Noisy channels: coding and channel capacity. Source-channel separation. Quantization and lossy data compression; the rate-distortion function. Kolmogorov complexity and entropy.

Learning Outcomes

At the conclusion of the course, students should be able to:

- Describe, manipulate, and apply the basic concepts (entropy, mutual information, capacity, rate-distortion function) and basic coding theorems (compression with or without losses, channel coding through noisy channels) of Information Theory.
- Identify the fundamental tradeoffs and limitations that are present in systems for transmitting and storing information.
- Model systems that create, transmit, and store information using the fundamental, constituent models of Information Theory.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the courses "Probability", "Mathematics II", and "Applied Probability and Simulation" before enrolling to this course.

Bibliography

- Elements of Information Theory, T. Cover, J. Thomas, 2nd edition, Wiley, 2006.
- Information Theory, Inference and Learning Algorithms, D. J. C. MacKay, Cambridge University Press, 2003.

Teaching and Learning Activities

Lectures (1 lecture of 3 hours weekly), recitations (1 recitation of 2 hours weekly) and weekly individual homework assignments.

Assessment Criteria

The final grade is set to the grade in the final written examination.

2733 Accounting Information Systems

Elective Module Course (Modules 3, 5), 8th semester, 6 ECTS units

Instructor: Dr. Odysseas Pavlatos

URL: https://eclass.aueb.gr/courses/ODE334/

Course Description

The course is an introduction to Accounting Information Systems (AIS). It presents the operation of an AIS through the lens of an accountant that works in an accounting department that uses accounting software. It also provides basic knowledge in relation to the setting up of a AIS and the management of databases related to accounting processes. The course covers the following topics: Introduction to AIS, Accounting as an Information System, Greek Regulatory Accounting Framework that influences AIS based on Greek Accounting Standards (chart of accounts, accounting statements, accounting records, accounting books), Documentation techniques: Data Flow Diagrams, Document Flowcharts, Entity Relationships models, Requirement analysis and modeling of business subsystems, Management and Control of AIS, AIS Development, Processes and Data Structure in AIS, REA (Resource – Event – Agent) Model, Development and Data Base Normalization.

Learning Outcomes

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

- Understand the "system thinking" in relation to the implementation of the IASs as management tools of a Business System
- Understand the logical development of an AIS, the modeling of business and accounting processes and the basic issues pertaining the operation of AIS.
- Understand the way AIS operate in practice by analyzing the processes that relate to collection, registration and book keeping in companies.
- Process the accounting information within a real accounting software.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the course “Accounting” before enrolling to this course.

Bibliography

- Accounting Information Systems, M. B. Romney, P. J. Steinbart, 11th Edition, Prentice Hall, 2008.
- Accounting Information Systems: Controls and Processes, L. Turner, A. Weickgenannt, John Wiley, 2009.
- Accounting Information Systems, J. A. Hall, 7th Edition, Cengage Learning, 2011.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each weekly), recitations (1 recitation of 2 hours weekly), and laboratory exercises.

Assessment Criteria

The final grade is based on the grade of the final written examination and a final laboratory examination. Passing grades in both examinations are required for the final grade to be passing.

8116 Mathematical Programming

Elective Module Course (Modules 1, 5, 6), 8th semester, 6 ECTS units

Instructor: Assistant Professor Ioannis Mourtos

URL: https://edu.dmst.aueb.gr/

Course Description

This course examines the theory and the algorithms of Mathematical Programming and their relations to other areas (e.g., Game Theory). In particular, the course includes the Linear Programming problem, Duality Theory, basic algorithms for Linear Programming, introductory concepts of Non-Linear Programming and Integer Programming, problem formulation in Mathematical Programming, Dynamic Programming and Linear Programming's relation with Game Theory. The expected outcome is the solid understanding of all the above and, in addition, the applications of Mathematical Programming arising from real-life settings. More specific outcomes include the in-depth knowledge of mathematical structures and properties of classes of problems, the use of algorithms but also the design of variants for special cases and, last, the modeling and solving of relevant practical problems.

Learning Outcomes

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

- Describe and employ the fundamental concepts, the basic theorems (Farkas, Karush-Kuhn-Tucker) and the methods or algorithms (simplex, ellipsoid, dynamic programming) of Mathematical Programming.
- Perform the calculations for specific methods or algorithms of Mathematical Programming for problems of reasonable scale, e.g., steps of the simplex algorithm, steps of dynamic programming, identification of dual problem, formulation and checking of the necessary condition for the minimum under constraints.
- Model real-life problems arising from a variety of applications (e.g., production, distribution, network design, games) as Mathematical Programming problems and identify the appropriate optimization method or algorithm.
- Comprehend the proofs of relevant theorems and the broader mathematical foundations of Mathematical Programming, use specific theorems (e.g., strong duality) in order to resolve more effectively relevant problems and be able to explain and reproduce the most basic among these proofs.
- Study autonomously and in depth the current literature from academic journals and books of Mathematical Programming, even in areas that marginally fall within the content of this course.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the courses “Mathematics I”, “Mathematics II”, and “Operations Research” before enrolling to this course.

Bibliography

- Wayne L. Winston: Introduction to Mathematical Programming: Operations Research, Thomson Learning; 4th edition, 2002.
- H. Paul Williams: Model Building in Mathematical Programming, 5th edition, Wiley, 2013
- D. Bertsimas and J. Tsitsiklis: Introduction to Linear Optimization, 3rd edition, Athena Scientific, 1997.
- D. Alevras and M. W. Padberg: Linear Optimization and Extensions: Problems and Solutions, Springer, 2013.
- L. A. Wolsey: Integer Programming, Wiley-Interscience, 1998.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each weekly), recitations (1 recitation of 2 hours weekly), and optional individual homework assignments (weekly).

Assessment Criteria

The final grade is set to the grade in the final written examination.

3745 Machine Learning

Elective Module Course (Modules 4, 5), 8th semester, 6 ECTS units

Instructor: Assistant Professor Michail Titsias

URL: https://eclass.aueb.gr/courses/INF267/

Course Description

General learning techniques with supervised and unsupervised learning. The model selection problem and the cross-validation method. Sampling and bootstrapping. Introduction to probabilistic modeling and statistical learning techniques. Linear regression and classification models. Optimization methods and the gradient ascent method. Nonlinear regression and classification models using feature vectors, radial basis functions and neural networks. Descriptive classification methods using nearest neighbors and Bayes' theorem. Kernel methods and support vector machines. Data clustering and the k-means algorithm. Spectral clustering. Mixture distributions and the expectation-maximization algorithm. Latent variable models for dimensionality reduction using principal component analysis and factor analysis. Graphical models. Markov models and hidden Markov models.

Learning Outcomes

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

- Fully understand classical machine learning methods, such as linear regression, logistic regression, K-nearest neighbor classification, data clustering, and dimensionality reduction techniques.
- Know more advanced techniques such as neural networks, support vector machines, probabilistic modeling with hidden variables and probabilistic graphical models.
- Program and train machine learning models in MATLAB and Python using optimization algorithms and perform model selection using cross-validation.
- Know a wide range of machine learning applications as well as real data modeling problems.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the courses “Mathematics II”, “Probability”, “Statistics in Informatics” and “Operations Research”, as well as programming courses, before enrolling to this course.

Bibliography

- Pattern Recognition and Machine Learning, Christopher M. Bishop, Springer, 2006.
- Bayesian Reasoning and Machine Learning, David Barber, Cambridge University Press, 2012.
- Deep Learning, Ian Goodfellow and Yoshua Bengio and Aaron Courville, MIT Press, 2016.
- Machine Learning: a Probabilistic Perspective, Kevin Murphy, MIT Press, 2012.
- Elements of Statistical Learning by Hastie, Tibshirani and Friedman, Springer, 2009.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each weekly), laboratory exercises (1 two-hour session every two weeks), and two individual homework programming assignments.

Assessment Criteria

The final grade is the sum of the final written examination grade (which has a maximum of 6) and the programming assignments grade (which has a maximum of 4).

3818 Network Economics

Elective Module Course (Modules 2, 5), 8th semester, 6 ECTS units

Instructor: Professor George Stamoulis

URL: https://eclass.aueb.gr/courses/INF155/

Course Description

This course aims to present the main economic issues on networking technologies and services, and to familiarize the student with the relevant microeconomic concepts and models. In particular, the course aims to build the background necessary for the student to understand (among others) the different charging models, the economics of flow and congestion control, as well as practical topics such as the new value chains formed in communication services due to the prevailing of Internet technologies, and analyze the strategies of the players participating in such chains. Basic economic concepts: consumer and producer models, application in networks, basic notions of social welfare, externalities, competition models, game theory, lock-in. Basic telecommunication services concepts: multiplexing and data transportation services, telecommunication services and contracts, the Internet value chain. Pricing of communication network services: congestion pricing, resource allocation, flow control models and pricing, pricing in the Internet. Auctions. The telecommunications market today: broadband services, mobile and wireless services, competition in the Internet. Economic models of new services in the Internet and strategies of the players: content delivery, network neutrality.

Learning Outcomes

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

- Know and apply the basic micro-economic concepts and models,
- Explain the role of charging as a control mechanism in networks,
- Understand the use of auctions as a mechanism for allocation of scarce resources,
- Know the main technologies for broadband services, both wired and wireless,
- Understand in depth the most important economic and business issues of the Internet (network neutrality, competition, strategies of providers),
- Compose value chains for services offered to users over Internet that cover from content delivery to infrastructure provision,
- Evaluate the strategies of providers in value chains.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the courses “Mathematics I”, “Probability”, “Communication Networks” and “Computer Networks” before enrolling to this course.

Bibliography

- Pricing Communication Networks: Economics, Technology, and Modelling, C. Courcoubetis and R. Weber, Wiley 2003.
- Telecommunication Network Economics: From Theory to Applications, P. Maille and B. Tuffin, Cambridge University Press, 2014.

Teaching and Learning Activities

Lectures (1 lecture of 3 hours weekly), recitations (a total of 3 hours in the semester), 3 homework assignments and a semester project with an overview of a business sector or research articles, on which a report is submitted and an oral presentation is made). The homework assignments and the project are undertaken by pairs of students.

Assessment Criteria

The final grade is set to the weighted average of the final written examination grade and the grades of the projects and the homework assignments, if the final written examination grade exceeds a threshold. Otherwise, the final grade is set to the final written examination grade.

8143 Combinatorial Optimization

Elective Module Course (Modules 1, 2, 5), 7th semester, 6 ECTS units

Instructor: Assistant Professor Ioannis Mourtos

URL: https://edu.dmst.aueb.gr/

Course Description

Networks: mathematical representation in graph form, formulation of network optimization problems, shortest path, maximum flow, least cost flow, applications. Network algorithms: reachability, shortest path, maximum flow, introduction to the complexity of algorithms. Generic combinatorial optimization methods, backtracking, branch and bound, depth first and breadth first tree traversal, applications of branch and bound, knapsack and correspondence problems, 0-1 algorithms and partial solutions, Balas algorithms, special types of integer 0-1 programming problems, packing, partitioning, covering, linear and quadratic correspondence, the traveling salesman problem, map coloring, applications.

Learning Outcomes

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

- Describe and employ the fundamental concepts, the basic theorems of Combinatorial Optimisation.
- Perform the calculations for specific methods or algorithms of Combinatorial Optimisation for problems of reasonable scale, e.g., steps of max-flow algorithm, steps of integer programming.
- Model real-life problems arising from a variety of applications as Combinatorial Optimisation problems and identify the appropriate optimisation method or algorithm.
- Comprehend the proofs of relevant theorems and the broader mathematical foundations of Combinatorial Optimisation, use specific theorems (e.g., max-flow min-cut theorem) in order to resolve more effectively relevant problems and be able to explain and reproduce the most basic among these proofs.
- Study autonomously and in depth the current literature from academic journals and books of Combinatorial Optimisation, even in areas that marginally fall within the content of this course.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the courses “Mathematics I”, “Mathematics II”, and “Operations Research” before enrolling to this course.

Bibliography

- A First Course in Combinatorial Optimization, J. Lee, Cambridge Texts in Applied Mathematics, 2004.
- Integer and combinatorial optimization, L. A. Wolsey , G. L. Nemhauser, Wiley, New York, 1988.
- Combinatorial optimization: Networks and Matroids, E. L. Lawler, Oxford University Press, 1995.
- Surveys in combinatorial optimization, S. Martello, North-Holland, Amsterdam, 1987.

Teaching and Learning Activities

- Lectures (2 lectures of 2 hours each weekly), recitations (1 recitation of 2 hours weekly), and optional individual homework assignments (weekly).

Assessment Criteria

The final grade is set to the weighted average of the final written examination grade (with a weight of 80%) and the home assignments grade (with a weight of 20%), or the final written examination grade, whichever is larger.

3882 Multimedia Technology

Elective Module Course (Modules 2, 4), 8th semester, 6 ECTS units

Instructor: Professor Georgios Polyzos

URL: https://eclass.aueb.gr/courses/INF179/

Course Description

Introduction, motivation, relationship with other fields and trends. Definitions and attributes of media types. Data streams, media and multimedia. Multimedia applications. Operating system support for interactive multimedia. Audio: speech and music. Images and graphics. Video and animation. Elements of information theory. Data encoding and compression, entropy coding. Compression standards: JPEG, H.26x, MPEG (1, 2, 4), MP3. Synchronization, SMIL. Multimedia in communication networks and the World Wide Web. Multimedia multicasting. Media streaming, media servers, RTP and RTCP, RTSP. Teleconferencing with H.32x and SIP. Quality of Service. Digital Rights Management (DRM). Programming multimedia applications. Mobile multimedia.

Learning Outcomes

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

- Define the concept of multimedia, describe the basic media types and distinguish the various types of multimedia applications.
- Distinguish various schemes of digital media representation (audio, image, video) and distinguish the basic encoding schemes (entropy, differential, transform, vector quantization).
- Describe the basic standard media encoding schemes (JPEG, H.26x, MPEG-x).
- Determine the basic problems in quality of service provisioning for networked multimedia and describe the main protocols used (RTP, RTCP, RTSP, DASH).
- Compose networked multimedia applications using standardized libraries and programming environments of their choice.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students successfully complete the courses “Probability”, “Computer Systems Organization”, “Operating Systems”, and “Computer Networks” before enrolling to this course.

Bibliography

- Multimedia Communications, F. Halsall, Addison-Wesley, 2001.
- Fundamentals of Multimedia, Z. N. Li and M.S. Drew, Prentice Hall, 2004.
- Multimedia Systems, R. Steinmetz, K. Nahrstedt, Springer, 2004.
- Multimedia Applications, R. Steinmetz, K. Nahrstedt, Springer, 2004.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each weekly), recitations (1 recitation of 2 hours weekly), and programming homework assignments.

Assessment Criteria

The final grade is set to the final written examination grade (which has a maximum of 5), if that grade is below 2.5. Otherwise, it is set to the final written examination grade increased by at most 5, depending on the performance of students in the homework assignments.

3584 Technological Innovation and Entrepreneurship

Elective Module Course (Module 5), 8th semester, 6 ECTS units

Instructor: Professor Theodore Apostolopoulos, Dr. Aggeliki Karagiannaki

URL: https://eclass.aueb.gr/courses/INF309/

Course Description

The course covers key modules, such as: development and design of innovative products and services; innovative trends recognition and creativity techniques; market and competition analysis; design and evaluation of the business model using the business model canvas; presentation of innovative applications and case studies; mockup and customer-centric design; developing presentation skills (Pitching); financial analysis for start-ups; managing innovation teams; digital marketing, sales and online promotion; legal guide to an innovative idea; writing a business plan; funding opportunities; technology transfer models. During the course, students are encouraged to work together (ideally in groups) with a project/assignment/start-up company to better consolidate and apply knowledge. During the project, the students understand all the steps starting from the concept of business opportunity, the design and development of the business model to the implementation of mockup screens and a first prototype version and all the necessary challenges encountered when setting up a new business. The innovative business idea may involve new products or services but also new processes, new ways of interacting with the customer, and new business models and practices.

Learning Outcomes

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

- Apply techniques for boosting creativity and the production of novel ideas.
- Focus on the target market, conduct market research, and evaluate competition.
- Analyze how to design and evaluate alternative business models.
- Understand basic aspects of business planning (such as digital marketing and sales, legals issues, financing issues, etc.)
- Structure their ideas around a robust whole and support them with appropriate arguments, combining persuasion, action, and creativity.
- Understand the challenges of building a work team and have a better understanding of themselves as businessmen and their incentives, roles, and basic responsibilities.

Prerequisite Courses

No specific prerequisite courses are required, but it is essential for the students to have a good background on Informatics.

Bibliography

- Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, A. Osterwalder, Y. Pigneur, Wiley, 2010.
- Diffusion of Innovations, E. M. Rogers, 4th edition, Simon and Schuster, 2003.
- The Lean Startup: How Constant Innovation Creates Radically Successful Businesses, E. Ries, Penguin Books Limited, 2011
- Ten Types of Innovation: The Discipline of Building Breakthroughs, L. Keeley, H. Walters, R. Pikkel, B. Quinn, John Wiley & Sons, 2013.
- Managing Innovation, J. Tidd, J. Bessant, K. Pavitt, Wiley, 2001.
- Managing Technological Innovation, F. Betz, Wiley, 2003.
- Successful Innovation, Cobbenhagen, MPG Books Ltd, 2000.
- The Four Steps to the Epiphany: Successful Strategies for Products that Win, S. G. Blank, Cafepress.com, 2007.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each weekly) and a semester project.

Assessment Criteria

The final grade is determined based on the final written examination grade and the grade of the semester project.

3715 Time Series Analysis and Forecasting

Elective Module Course (Modules 5 και 6), 7th semester, 6 ECTS units

Instructor: Professor Sofia Dimelis

URL: https://eclass.aueb.gr/courses/INF141/

Course Description

Purpose and usefulness of the analysis of time series and forecasting. Statistical methods for analyzing time-series data and their use in the area of forecasting. Linear and non-linear regression models of trend fitting. Stochastic models of time-series analysis. Autoregressive (AR), moving average (MA) and mixed (ARMA) models. The Box-Jenkins methodology in time-series analysis (ARIMA modeling). Forecasting with ARIMA models and criteria for the evaluation of forecasts. Unit root tests and applications. Vector autoregressive (VAR) models and causality tests. Studying and forecasting time-series using statistical packages and real data. Empirical examples and exercises.

Learning Outcomes

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

- Achieve an understanding of the main properties of time series data and to choose the proper statistical techniques for their analysis.
- Specify and estimate the proper models for the analysis of real time series data.
- Apply such models for forecasting or testing of various policy measures.
- Combine various forecasting techniques in order to improve the forecasting ability of the models.
- Compare and evaluate the various time series techniques in order to obtain more reliable results.

Prerequisite Courses

There are no required prerequisite courses. It is, however, recommended that students have a good grasp of High-school Mathematics courses.

Bibliography

- Applied econometric Time Series, Enders, W., New York: Wiley, 3rd edition, 2009.
- Forecasting in Business and Economics, Granger, C.W.J., 2nd edition, 1989.
- Time Series Analysis, Hamilton, J.D. (1994), Princeton University press, 1994.
- Analysis of Financial Time Series (Wiley Series in Probability and Statistics), Tsay, R. S., Wiley, 3rd Edition, 2010.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours each weekly), recitations, (1 weekly recitation of 2 hours), individual and group homework and laboratory assignments and case studies.

Assessment Criteria

The final grade is equal to the final written examination grade, but a bonus of one unit is awarded if the student has participated in assignments and case studies.

3090 Digital educational content creation & usage, in contemporary learning methodologies

Elective Course, 8th semester, 6 ECTS units

Instructor: Dr. Athanassios Androutsos

URL: https://eclass.aueb.gr/courses/INF183/

Course Description

Contemporary educational methodologies: Design-oriented pedagogy (DOP), Phenomenon-Based Learning (PhenoBL) and Learning by Collaborative Design (LCD). Organization, management and design of educational projects. GANTT charts and mind maps. Introduction to ICT. Web technologies, Web 2.0, Semantic Web (Web 3.0). Search, find, share and organize information on World Wide Web. Digital presentation tools. Development of digital educational material. Insert, edit multimedia (text, audio, video) in presentations and synchronization. Video Conferencing, Digital Storytelling, Screen recording and production of annotated presentations. Cooperative learning. Digital Learning Objects. Creating Learning Objects. Metadata and Educational Metadata. Online Digital Courses. Learning Management Systems (LMS). Synchronous and Asynchronous eLearning. Sharing of educational material. Educational communities. Social media. Massive Open Online Courses (MOOCs). Intellectual Property and Open Educational Resources (OER).

Learning Outcomes

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

- Understand, describe and discern the theory and practical aspects of Phenomenon-based Learning, Design-Oriented Pedagogy and Learning by Collaborative Design.
- Analyze and solve real-world problems with economic, technological and social dimensions by combining their subject area with pedagogical objectives.
- Design and organize educational projects using GANTT charts and mind maps.
- Discover, analyze and classify information and resources from World Wide Web using digital tools and appreciate the value of collaboration within a contemporary technological framework with advanced digital tools.
- Combine, compose, explain, evaluate and present information by using digital media, produce digital educational material, and develop and demonstrate digital learning objects.
- Understand intellectual property and open educational resources, share digital educational material, and create online communities using digital tools and social media tools.
- Understand and discern the use of Learning Management Systems (LMS) and Massive Open Online Courses (MOOCs).

Prerequisite Courses

None.

Bibliography

- Educational Technology for Teaching and Learning, T. Newby, D. Stepich, J. Lehman και J. Russel, Pearson, 4th Edition, 2010.
- Vartiainen, H. (2014) Principles for Design-Oriented Pedagogy for Learning from and with Museum Objects, Publication of the University of Eastern Finland, Dissertations in Education, Humanities, and Technology No 60. Joensuu: Kopijyvä Oy.
- Griffin, P & McGaw, P & Care, E. (eds.), (2012) Assessment and Teaching of 21st Century Skills, New York: Springer.
- Ananiadou, K. & Claro, M. (2009) "21st Century Skills and Competences for New Millennium Learners in OECD Countries", OECD Education Working Papers, No. 41, OECD Publishing.
- European Parliament (Ed.). (2015) Innovative Schools: Teaching & Learning in the Digital Era – Workshop Documentation. Brussels: European Parliament.

Teaching and Learning Activities

Lectures (2 lectures of 2 hours weekly), group assignment.

Assessment Criteria

The final grade is set to the weighted average of the final written examination grade (with a weight of 40%) and the group assignment grade (with a weight of 60%).

Practical Training

Elective Course, 6 ECTS units

URL: https://eclass.aueb.gr/courses/INF141/

Course Description

Practical Training is optional, and can be performed in any semester after the 6th semester, provided that the student has a passing grade in all core courses, except for at most two. Practical Training requires the written approval from a faculty member the Department of Informatics, which will select the topic in collaboration with the practical training host, supervise it, and finally grade it. A successful grade is equivalent to one elective course with 6 ECTS units. More information on practical training is available at http://internship.cs.aueb.gr/

Prerequisite Courses

All the core courses, except at most two, must be completed before starting Practical Training

Assessment Criteria

The final grade is decided by the supervising faculty member.

Senior Thesis

Elective module course, 6 ECTS units

URL: https://eclass.aueb.gr/courses/INF141/

Course Description

The Senior Thesis offers the opportunity for in-depth concentration on a specific subject. Written consent from a supervising faculty member is required for a Senior Thesis to commence. The supervising faculty will assign the project subject and specify the final grade. The project work may include research, literature survey, experimentation, programming, development, or theoretical work. The Senior Thesis is optional, its length spans one semester, and it is equivalent to a module elective course. The module it corresponds to is decided by the supervising faculty member. The Senior Thesis can commence in any semester, but only after the student has passed all but up to two compulsory courses. The Senior Thesis corresponds to 6 ECTS units.

Assessment Criteria

The final grade is decided by the supervising faculty member.

IX. POSTGRADUATE STUDIES

The Department of Informatics offers three postgraduate programs that lead to Master's (M.Sc.) and Doctoral (Ph.D.) degrees: the Postgraduate Program in Information Systems, the Postgraduate Program in Computer Science, and the Postgraduate Program in Data Science. Furthermore, the Department offers a Postgraduate Program, jointly with the Departments of Mathematics and Economics of the National and Kapodistrian University of Athens, in Business Mathematics. All these postgraduate programs provide high quality studies and are strongly competitive at both the national and the international level.

The programs that lead to a Master's degree accept university (including university of applied sciences) graduates that have majored in Informatics, Computer Science, Computer Engineering, and Economics, as well as graduates from universities of applied sciences and higher military educational institutions or other equivalent institutions in Greece or abroad, provided they satisfy the necessary requirements for successful completion of each program.

More information on the postgraduate programs offered by the Department of Informatics can be obtained by the Secretariat of Postgraduate Studies of the Department at the Evelpidon Building, tel. 2108203643-645-646. Applicants may also refer to the Postgraduate Studies Guides, which provide additional information on the objectives, requirements, program structure and areas of specialization of these programs. Information on all postgraduate programs is also available on the web pages listed below.

IX.1. M.Sc. in Information Systems

The Postgraduate Program in Information Systems (http://mscis.cs.aueb.gr/) offers postgraduate level expertise in the area of Information Systems. The courses offered aim at promoting excellence by developing an interdisciplinary research agenda, as well as strengthening practical skills required for building state-of-the-art IT applications.

The program aims at the development of qualified graduates, with strong theoretical background coupled with practical skills who are able to successfully meet the ever-increasing needs of enterprises and organizations related to planning, implementing and managing IT and Telematics applications. Special emphasis is given to areas that are related to Information Systems Development, Data Management (Databases, Big Data), Management Information Systems, E-Commerce, Software Engineering, Multimedia, Computer Networks, Network Security, and Information Systems Security.

IX.2. M.Sc. in Computer Science

The Postgraduate Program in Computer Science (http://grad.cs.aueb.gr/) aims at providing a solid background in Computer Science fundamentals. It covers key areas of significant theoretical and applied interest, such as the areas of Foundations of Computer Science, Information Retrieval, Networks and Mobile Communications, and others. Specialization in these areas helps our graduates to successfully pursue their personal career goals in business, academia and research.

The aim of the program is to provide our students with a solid background in Computer Science fundamentals in one of these areas and to prepare them for a successful career in the industry. It also offers graduates the opportunity to participate in cutting edge research and, for the case of Doctoral candidates, fulfill the breadth and depth requirements for their Ph.D.

IX.3. M.Sc. in Data Science

The purpose of the program (https://www.dept.aueb.gr/el/node/5765) is to prepare scientists and executives who have the following skills. First, understanding of the representation, storage and manipulation theory and practices of different data types and formats by modern data management algorithms, systems, and applications. Second, theoretical knowledge and practical skills in Probability, Statistics, and Algebra covering both basic an well as state-of-the-art practices and tools from these fields and applications of these techniques in various datasets. Thirdly, knowledge of the major developments over the last 10 years in the field of Data Science that involve the joint application of algorithmic, algebraic and statistical problem-solving techniques and recent advances in big data processing for the extraction of predictive models and decision-making. Fourthly, knowledge and skills for the effective and scientifically sound presentation and summarization of complex datasets and models, and, finally, basic knowledge in selected fileds of application. A last skill involves identifying and abstracting similarities between different problem descriptions in order to address new challenging technical problems.

The students of the program are encouraged to apply the techniques learned via laboratory assignments and a capstone project. The program has an international outreach, responding to the worldwide demand in the field of Data Science.

IX.4. M.Sc. in Business Mathematics

The Postgraduate Program in Business Mathematics (http://map.aueb.gr) is jointly organized by the National and Kapodistrian University of Athens (Department of Mathematics and Department of Economics) and the Athens University of Economics and Business (Department of Informatics). Mathematics was always essential in analyzing markets, production systems and business operation in general. The quantification of business activities intensified in the beginning of the 20th century, took explosive proportions in the 70's, and contributed to the reformulation of whole fields such as banking and finance. The expansion of computing power also contributed to the expanded use of quantitative methodologies, as it allowed both the data collection and its advanced processing.

Those aspiring to actively participate in modern developments in finance, logistics, and production, to mention just a few areas, need to have a firm grasp of quantitative techniques. The program in Business Mathematics provides a first step towards such an understanding. The program aims to prepare individuals who will follow a career applying mathematics in real-world problems, and not in research establishments. This is not to say that a career in research is precluded for our students - on the contrary. But the emphasis is not on mathematical depth but in a thorough exposition of important applications of quantitative techniques in everyday business and industrial practise.

IX.5. Doctoral Diploma

The doctoral program of the Department leads to a Ph.D. degree and is implemented through the aforementioned postgraduate programs. Admission for doctoral studies is granted upon request and evaluation to holders of M.Sc. or equivalent degrees in Informatics or in a related subject. In exceptional cases, university graduates who are not holders of a Master's degree may be admitted. The duration of the doctoral studies is at least three years after the appointment of the three-member Advisory Committee of the Ph.D. candidate and at most six from the date of his enrolment in the doctoral program.

Ph.D. candidates undertake, as part of their training, research and teaching assistantship appointments. They are also required to attend an assigned list of graduate courses offered by the Department's Postgraduate Programs.

Ph.D. candidates are expected to publish their research in top-tier journals and conferences in order to compile a doctoral dissertation that constitutes a substantial and original contribution to science.

The Department regularly announces positions for Ph.D. candidates. More information about doctoral studies in the Department can be found in the available Doctoral Studies Guide.

X. GENERAL INFORMATION FOR STUDENTS

The Athens University of Economics and Business places an emphasis not only on providing students with high quality education, but also high-quality auxiliary student services. Notably, with the promulgation of Presidential Decree 387/83 and Law 1404/83, the operation and administration of Student Clubs in Greek universities was set forth. The aim of these clubs was to improve the living standards of students, their entertainment, and their social and spiritual well-being through a variety of participatory processes and initiatives.

The implementation of these objectives is pursued by ensuring the necessary infrastructure for housing, catering, sports activities, by providing restaurants, cafeterias, reading rooms, libraries, by organizing lectures, concerts, theater performances and excursions in Greece and abroad, by developing international student relations, teaching foreign languages and Greek as a foreign language for foreigners and persons of Greek descent, and by any other means possible.

Living Costs

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

Housing

The Student Club of AUEB provides free accommodation to its students under certain conditions, which are available on the Student Club's website https://www.aueb.gr/en/content/student-club. At the same time, the Student Club of the University also has a House Finding Office, which collects advertisements for renting apartments.

Meals

In the main building of AUEB there is a restaurant where all members of the university community can eat for free or for a fee. Free meals are available to those who fulfil the necessary conditions for which they can be informed by the Student Club office.

Medical Services, Insurance / Healthcare

Undergraduate, postgraduate and doctoral candidates of the University who have no other medical and hospital care are entitled to full medical and hospital care in the National Health System (ΕΣΥ) with coverage of the relevant costs by the National Health Service Provider (ΕΟΠΥΥ). There is a doctor's office in the main building that is open a few hours every week. The Mental Health Counseling Service also operates at the university; there, a physician specializing in mental health issues is employed.

Services for Students with Disabilities

The University caters to students with special needs through the design, implementation and application of adaptations to the environment for access to university buildings. More specifically, in the main building there are specially designed lifting equipment, ramps and lifts. There are also special exam regulations for students with special needs.

In addition, through the Library, the visually impaired students may access online the proposed Greek bibliography of the courses taught at the University. In this context, the Association of Greek Academic Libraries (ΣΕΑΒ) has developed a multimodal electronic library called AMELib (http://amelib.seab.gr/). Entry to this service requires user authentication as well as the use of username and password. More information can be found on the Library website http://www.aueb.gr/library.

Student financial support

The undergraduate students of Higher Education Institutions and Higher Ecclesiastical Academies, of Greek citizenship or with citizenship of other European Union countries, are eligible for an annual housing allowance according to the terms and conditions mentioned in the Joint Ministerial Decision (JMD) 140832/Z1/25-8-2017 (Greek Government Gazette 2993 B/31-8-2017).

Additionally, the State Scholarships Foundation (IKY) provides, based on performance, grants, scholarships and loan grants each year to students that excelled in the exams of: a) the semester courses and b) the entrance examinations to Greek universities. The Secretaries of the corresponding departments disclose with an announcement the names of the candidate scholars and set the deadlines within which their supporting documents should be submitted.

Furthermore, the "George Chalkiopoulos Institution", which provides scholarships based on the performance of their studies and the economic status of the candidates, operates at the university. In October of each academic year the Department of Public Relations announces the amount of the scholarship, as well as the submission method and time of applications for those interested.

Finally, other awards are granted occasionally by different institutions, organizations and businesses. Information is provided by the Directorate of Education Department of Student Affairs (ground floor of the main building) and the Secretaries of the Departments where appropriate, as well as in the main webpage of the AUEB.

Office of Students Affairs – Faculty Advisors

At each department a faculty advisor is designated for each student, appointed by the Assembly 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.

Classrooms - Study Halls - Libraries

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

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

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

- printed collection of books and scientific journals,
- the textbooks taught in the courses,
- collection of electronic scientific journals,
- collection of electronic books,
- the postgraduate dissertations and PhD theses completed at AUEB and filed in digital format at the Institutional Repository PYXIDA,
- sectoral studies,
- statistical series from national and international organizations,
- audiovisual material,
- information material (encyclopedias, dictionaries),
- collections of the official governmental publications of the European Union, the OECD, and the UNWTO,
- databases of issues cultivated at the University,
- printed collection of other academic libraries

The Library is a lending library for its members in regard to all printed collections, except for the collection of journals and statistical series, according to its internal operating rules. The Library and Information Center (LIC) of AUEB features a study hall, working stations with PCs for the guests, photocopying and printing equipment, and also provides the option to the students to lend them books and journal articles of other academic libraries that are members of the networks that the library participates.

International programs and practical information for international student mobility

AUEB actively participates in the Erasmus+ Program, promoting cooperation with universities, businesses and international organizations of the European Union (EU) and the mobility of the University students, teaching and administrative faculty. As part of the above program, the University collaborates with more than 220 European Institutions in scientific areas relevant to the University Departments. It is worth mentioning that more the 7000 students have participated in the "ERASMUS" Program up until today. Among them, approximately 4000 students of AUEB attended courses in collaborating universities in the European Union and approximately 3000 foreign students conducted a period of their studies in AUEB, with ensured academic recognition through the European Credit Transfer and Accumulation System (ECTS). Moreover, the Institution coordinates the Internship Association Erasmus+ in partnership with the National Technical University of Athens and the Universities of Crete, Ioannina and Macedonia, giving both the ability of internship to students of the five universities and also the ability of teaching/education to faculty members. Finally, AUEB, in the context of an internationalization openness strategy, successfully participates in the International Credit Mobility Program Erasmus+, aiming in the advancement of international collaborations in education and research with University

Partners in countries outside EU through: a) student mobility, b) teaching faculty mobility for short-term teaching appointments, and c) mobility of teaching/administrative faculty for educational purposes. The Program is operating at the University since the academic year of 2015-2016 and up until today 52 students and faculty members in total moved from or towards 8 Partner Institutions in countries outside EU (USA, Canada, Singapore, Russia, South Korea, Armenia). For more information, you can search at the main webpage of the Institution (https://www.aueb.gr/el/content/πρόγραμμα-έρασμος).

Foreign Language Courses

The knowledge of foreign languages, as a universally accepted educational value, comprises an essential asset towards successful participation of an individual to the complex professional and social reality. The Students Association, realizing this modern educational necessity, provides each university student interested with the opportunity to attend relevant courses. The courses conducted concern the English, French, German, Spanish, Italian and Russian languages, while there is also the ability to organize courses in other languages, assuming there is corresponding interest.

Internship Office

The mission of the Internship Office is to promote the connection between theory and practice and the transition of the intern students from the academic to the professional life in the best way possible. The internship comprises an integral part of the education at AUEB, as all departments have established it and included it in their Curriculum. The internship duration is 2-4 months and it is mainly conducted in three periods (winter semester, spring semester and summer period). Before each internship period, preparation seminars are carried out. Information: Elpidos 13 Str Building, 3rd floor.

Sports Facilities

Athens University of Economics and Business organizes a variety of sport activities. It has a long history in sports accompanied by multiple distinctions, metals, cups and awards in national and international events. In order to continuously provide a complete education to its students, AUEB collaborates with the Cultural, Sports and Youth Organization of the City of Athens, and utilizes its sport facilities, located at 10 Passov Str, Grava, Ano Patisia (indoor pool, indoor basketball and volleyball court, open sports field of classic sports - track & field), at the junction of Ermonassis & Pitiountos Streets - Thermida (open soccer stadium 5x5) and at the junction of Mitsaki and Polyla - Ano Patisia (open-air tennis court).

The teaching of the courses at the Physical Education Department of AUEB follows the teaching schedule of the academic courses. It begins at the beginning of the courses in the winter semester and expires at the end of the courses in the spring semester. It is worth mentioning that students are permitted to attend courses of the Physical Educational Department up until six months after their graduation. The Physical Education Department of AUEB comprises highly qualified Physical Education teachers and contingent qualified educational faculty.

Student Associations

Within the university community of the Athens University of Economics and Business various Organizations and Student Associations are active and developing. For more information you can search the main webpage of AUEB (https://www.aueb.gr/el/content/σύλλογοι-φοιτητών).

XI. SYNOPSIS OF RECENT CHANGES TO THE COURSE GUIDE

In this chapter, the most important changes made to the course guide in recent years are compiled.

2012-2013 Course Guide

In relation to the 2012-2013 Course Guide, the following change has been instituted:

- Course "Networks and Combinatorial Optimization" has been renamed to "Combinatorial Optimization".

2013-2014 Course Guide

In relation to the 2013-2014 Course Guide, the following change has been instituted:

- Course "Computability" has been renamed to "Computability and Complexity".
- The content of numerous courses was updated.
- Foreign Language Courses were removed from the list of core courses. However, a language requirement is still in effect – see the related chapter of this Course Guide.
- Special provisions pertaining to the Pedagogical and Teaching courses were lifted.
- Modifications to the application of the ECTS system were made.
- Prerequisite courses were instituted.
- The "Human-Computer Interaction" course started to count as an elective module course of module 4.
- The course 5414 "Human Resources Administration" ceased to be an elective module course for module 3 and currently counts only as an elective course. Substituting it, the course 2610 "Business Policy and Strategy" became an elective module course for module 3.

2014-2015 Course Guide

In relation to the 2014-2015 Course Guide, the following change has been instituted:

- Course "Distributed Systems" became a core course with 8 ECTS units, in the place of the "Compilers" course, and was placed in the 6th semester.
- Course "Compilers" became a core module course, for module 2 as well as an elective module course, for module 2,with 6 ECTS units, and was placed in the 7th semester.
- The new course "Technological Innovation and Entrepreneurship" was introduced in the 8th semester, as an elective module course with 6 ECTS units.

2015-2016 Course Guide

In relation to the 2015-2016 Course Guide, the following change has been instituted:

- Course 3852 "Accounting Information Systems" was substituted by course 2733 "Accounting Information Systems", offered by the Business Administration Department.
- Courses 3844 "Information Technology Project Management" and 3582 "Computational Financing" were discontinued.
- The course "Information Theory" was added as an elective module course of module 2, both in the Module Requirement and the Alternative Module Requirement.
- The course "Applied Numerical Analysis" was added as an elective module course of module 4, both in the Module Requirement and the Alternative Module Requirement.

2016-2017 Course Guide

In relation to the 2016-2017 Course Guide, the following change has been instituted:

- The courses 3844 "Actuarial Mathematics" was discontinued.

XII.CHANGES TO THE COURSE GUIDE THAT WILL COME IN EFFECT IN SUBSEQUENT ACADEMIC YEARS

Changes in the contents of the course «Introduction to Computer Programming»

Starting from the 2018-2019 academic year, the contents of the course "Introduction to Computer Programming" will be as follows: *"The concept of the program. Variables, variable types, expressions, and numerical calculations. Control structures and iteration structures of the Python programming language. Input/output of data. Finding and removing bugs. Functions and methods. The concept of the algorithm. Designing algorithms and the principles of structured programming. Structured types, strings, lists, arrays. Search algorithms, ordering algorithms, mathematical problems. Data files. The concept of recursion. Basic principles of functional and object-oriented programming using the Python language".*

Changes in the contents of the course 3125 «Computer Programming in JAVA»

Starting from the 2018-2019 academic year, the contents of the course "Computer Programming in JAVA" will be as follows: *«Δομή ενός προγράμματος Java και εντολές ελέγχου. Κλάσεις και αντικείμενα: συναρτήσεις δημιουργίας, μεταβλητές στιγμιότυπου, στατικές μεταβλητές, αναφορές σε αντικείμενα. Μέθοδοι: εμβέλεια μεθόδων, απόκρυψη κώδικα, υπερφόρτωση μεθόδων, στατικές μέθοδοι. Πακέτα. Κληρονομικότητα και πολυμορφισμός: βελτιστοποίηση ιεραρχίας κλάσεων και επαναχρησιμοποίηση κώδικα, πολυμορφική επεξεργασία και δυναμική δέσμευση μεθόδων, αφηρημένες και τελικές κλάσεις και μέθοδοι, δημιουργία και χρήση διεπαφών. Σχεδίαση με αντικειμενοστρεφή προγραμματισμό: προσδιορισμός και υλοποίηση σχέσεων μεταξύ κλάσεων, προσδιορισμός ιδιοτήτων και λειτουργιών κλάσεων. Data Structures και συλλογές: αυτό-αναφερόμενες κλάσεις και δυναμική δέσμευση μνήμης, συνδεδεμένες λίστες, πίνακες, ουρές, στοίβες, λίστες, διάσχιση, σύνολα, χάρτες. Γενικεύσεις. Είσοδος και έξοδος: ροές bytes/χαρακτήρων, ροές αντικειμένων, φίλτρα, διασυνδέσεις και τάξεις για είσοδο και έξοδο, σειριακή και τυχαία προσπέλαση αρχείων. Χειρισμός εξαιρέσεων.»*

Discontinuation of the Alternative Module Requirement

The Alternative Module Requirement, as described in the Degree Reqirements Chapter, will be discontinued at the end of the 2019-2020 Academic Year.

Μάθημα «Υπολογισιμότητα»

The following provision will be discontinued at the end of the 2018-2019 academic year: *"Students that have successfully completed, during the examination periods of January, June, or September 2014, any of the courses 1) Information Theory, 2) Decision and Game Theory, 3) Topics in Discrete Mathematics, can count one of them as a core module course of Module 1, irrespective of when they graduate, in order to substitute the "Computability" course not offered during the academic year 2013-2014. This provision will be revoked after the end of the last examination of the academic year 2018-2019."*

Last Update, 21/6/2018, ST