University of Cyprus
Department of Computer Science

Undergraduate courses-Fall Semester 2022-2023

CS423 Network and Information Security (7.5 ECTS) Monday and Thursday 10:30-12:00 /Tutorials Monday 18:00-19:30 (in Greek) Vasileiou Vasos

Course Purpose and Objectives:	Introduction to network and information security principles, understanding of basic areas in Cryptography, Authentication and Confidentiality. Gain of knowledge in methods for the evaluation of Software, Applications and Systems with respect to security. Application of tools for the protection of networks, applications and information.
Learning Outcomes:	Upon successful completion of this course the student will have advanced knowledge in the following fields: 1. Identify some of the factors driving the need for network and information security 2. Demonstrates ability to understand of the issues involved in the field of information security and assurance 3. Navigate through the language of the field of network and information security. 4. Explain the CIA triad of Confidentiality, Integrity and Availability 5. Identify and classify computer and network security threats and attacks 6. Compare and contrast encryption systems and algorithms. 7. Encrypt and decrypt messages and sign and verify messages using well- known techniques 8. Acknowledge the ethical and legal considerations of network and information security.

CS434 Logic Programming and Artificial Intelligence (7.5 ECTS) Tuesday and Friday 9:00-10:30 /Tutorials Wednesday 14:00-15:00 (in eglish) Kakas Antonis

Course Purpose and Objectives:	Familiarization with the basic concepts of Logic Programming and practical exercises in implementing them with the PROLOG language. Development of capabilities of applying Logic Programming to problems of Artificial Intelligence.
Learning Outcomes:	Students of the course will have the following knowledge and skills: 1. Theoretical model of Logic Programming 2. Programming in PROLOG 3. The Refutation Theory as Failure in Logic Programming 4. Logic Programming Applications 5. Post-programming elements 6. Argumentation and Common Logic 7. Chronological reasoning in Common Logic 8. Programming under the GORGIA argument system 9. Developing Cognitive Systems

CS 412 Logic in Computer Science (7.5 ECTS) 12:00-13:30/Tutorials Wednesday 12:00-13:00 (in Greek) Philippou Anna

Course Purpose and Objectives:	The main objective of the course is to prepare students for using logic as a formal tool in Computer Science. Furthermore, it aims to develop and cultivate formal and syllogistic reasoning and provide a thorough introduction to computational logic and its applications in Computer Science.
Learning Outcomes:	Upon successful completion of the course, students should: • Understand the basic concepts of propositional and predicate calculus with emphasis on the applications of these concepts in Computer Science. • Be able to construct proofs and apply these skills to practical applications. • Be familiar with the Method of Resolution and its use in Logic Programming • Be familiar with concepts of linear and branching temporal logic and be able to formulate system specifications as temporal logic properties and decide their satisfaction by Kripke structures. • Be familiar with Hoare specifications and their use in the analysis of the correctness of programs. • Be able to use formal systems to represent and reason about problems.

Master courses -Fall Semester 2022-2023

CS 606 Computer Networks and the Internet (8 ECTS) Thursday 18:00-21:00 / Tutorials Monday 16:30-18:00 (in Eglish) Vasileiou Vasos

Course Purpose and Objectives:	Understanding (at a graduate level) of the basic concepts and matters regarding Computer Networks and the Internet. Familiarization with modern views of Computer Networks and exposure to the related open research problems.
Learning Outcomes:	1. Explain the following core concepts of communication networks/computer networks: networking technologies and various network topologies, network layering, protocol basics, applications and Quality of Service, new techniques in networking and network management. 2. Explain the following fundamentals in computer networks: protocol suite TCP/IP, Core networking technologies such as routers, switches. Protocols at application layer, design philosophy for reliable services at the transport layer. New technologies at network layer and link layer. 3. Demonstrate skills in solving networking issues and analysis of communication protocols. 4. Demonstrate skills in deploying and analyzing various routing and congestion control algorithms. 5. Arguing, with regard to the infrastructure of a network and evaluates based on quality and other criteria the performance of networks. 6. Demonstrates ability to solve networking problems and the evaluation of various Internet protocols with regard to performance. 7. Shows ability to use Internet simulators (OPNET) for understanding networking concept and in the design and evaluation of networks. 8. Shows ability to use Wireshark, a real time network monitoring tool and data traffic and protocol analysis, with the aim of assimilation of protocols and data traffic, but also for analysis of possible errors/problems in the functioning of the network. 9. To seek to continuously evaluate new improved ways and mechanisms for network protocols. 10. To constantly seek and analyze new techniques and network technologies, like the Internet of Things

MIA648 Human-centered Intelligent User Interfaces

Instructor: M. Belk belk@cs.ucy.ac.cy

The purpose of the MAI648 course is to introduce students to fundamental principles and methods within the intersection of Artificial Intelligence and Human-Computer Interaction aiming to design and develop more efficient and effective user interfaces through the use of intelligent computation methods. Emphasis is given on incorporating human factors in intelligent interactive systems' design. Specifically, the course covers: i) theoretical foundations of intelligent user interfaces and the importance of human factors in such contexts; ii) state-of-the-art processes and techniques for implementing intelligent interactive systems; and iii) research and practice on how intelligent user interfaces can be applied in various application domains.

DSC 516 Cloud Computing

Instructor: M. Dikaiakos (mdd@ucy.ac.cy, (+357) 22892720)

Course purpose and objectives: The main objective of this graduate-level course is to provide an introduction to and understanding of advanced concepts in the field of Cloud Computing, and enable students to design, develop, deploy, monitor and analyze applications on state-of-the-art Cloud computing platforms. Learning outcomes: Upon completing this course, students will: (1) Master the fundamental concepts, the main enabling technologies and the key programming and application-development paradigms of modern Cloud Computing services. (2) Be able to design develop, deploy, and monitor highly scalable cloud-based applications by creating and configuring virtual machines, containers, microservices on the cloud. (3) Be familiar with techniques for big data analysis in Cloud Computing environments. (4) Compare, contrast, and evaluate the key trade-offs between multiple approaches to cloud system design, and Identify appropriate design choices when solving real-world cloud computing problems. (5) Write comprehensive case studies analyzing and contrasting different cloud computing solutions. (6) Make recommendations on cloud computing solutions for an enterprise.

MAI611 AI Fundam-entals (8 -ECTS credits)

Instructor: E. Keravnou (elpida@cs.ucy.ac.cy, (+357) 22892694)

Course Title	**Artificial Intelligence Fundamentals**				
Course Code	**MAI611**				
Course Type	**Mandatory**				
Level	Master				
Year / Semester	1/1 (Fall Semester)				
Teacher's Name	Elpida Keravnou-Papailiou				
ECTS	8	Lectures / week	2 x 2hrs	Laboratories / week	0
Course Purpose and Objectives	The purpose of the course is to introduce students to the fundamental principles and techniques that underline software systems that exhibit "intelligent" behavior.				
Learning Outcomes	Upon completion of this course, students will have acquired a good understanding of modern Artificial Intelligence, the problems that it addresses and the fundamental solution methods that it uses. More specifically the students will know the main knowledge representation techniques and reasoning methods that underlie artificial intelligence problem solving and be able to develop simple solvers for artificial intelligence systems.				
Prerequisites	None	Required	Knowledge of a high-level programing language,		

			object-based data concepts and structures.
Course Content	The course introduces the fundamental principles and methods used in Artificial Intelligence to solve problems, with a special focus on the search in the state space, action planning, knowledge representation and reasoning, constraint satisfaction, intelligent agents and on the methods for dealing with uncertain knowledge. The course content includes the following thematic units: • **Introduction to Artificial Intelligence:** Turing test for machine intelligence, historical perspective, symbol processing, algorithms and heuristics, main application fields, introduction to knowledge-based systems and architectural organization. • **Problem Solving in AI:** Representation problem, navigation mechanisms (blind search, heuristic guidance), classification and synthesis problems. Games. Constraint satisfaction problems. Local search methods, meta heuristics, solving through decomposition, constraint relaxation, branch-and-bound techniques. Introduction to Planning, Linear planning, partial order planning, graph-based methods (GraphPlan), Scheduling. • **Knowledge Representation and reasoning:** Distinction between data, information and knowledge, expertise (types of knowledge), desirable practical and theoretical properties, descriptive/declarative versus procedural representation. Predicate logic. Conjunctive Normal Form and resolution-refutation. Horn clauses and negation as failure. Representing Terminological Knowledge: semantic networks, frames and inheritance, description logics, foundation of ontologies. Representing actions, situations, and events. Reasoning with Beliefs. Nonmonotonic Reasoning and reasoning with default Information, Truth Maintenance Systems. Uncertainty and probabilistic reasoning. • **Rule-based systems:** Production rules, control structure and rule chaining, forward chaining and RETE, backward chaining, goal-driven reasoning and explanations, meta-rules, strategic explanations. Limitations of rule-based systems. • **Expert Systems Technology and Knowledge Engineering:** Basic forms of reasoning (deduction, abduction, induction). First and second generation of expert systems. Knowledge engineering methodologies. Intelligent agents, agents and expert systems. Case-based reasoning. Fuzzy reasoning.		
Teaching Methodology	Lectures, discussions of practical examples and (unsupervised) lab activities where the active learning element is encouraged and supported. Students would be strongly guided to view all topics presented and discussed with a critical eye, identifying the limits of AI both in its foundational years and the current state of affairs characterized by an explosion of multimedia data of varying degrees of usability, quality and ethical considerations.		
Bibliography	*Main text:* S. Russel and P. Norvig, *Artificial Intelligence: A Modern Approach*, 4th Edition, Pearson, 2021. *Other reading:* • R. J. Brachman, H. J. Levesque, *Knowledge Representation and Reasoning*, Elsevier, 2004.		

	• N. J. Nilsson: *The Quest for Artificial Intelligence: A history of ideas and achievements,* Cambridge University Press, 2010. • M. Ginsberg: *Essentials of Artificial Intelligence*, Morgan Kaufman,1993. • P. H. Winston: *Artificial Intelligence*, 3rd Edition, Addison-Wesley, 1992. • Ε. Κεραυνού, *Τεχνητή Νοημοσύνη και Έμπειρα Συστήματα*, Ελληνικό Ανοικτό Πανεπιστήμιο, 2000. • G.F. Luger and W.A. Stubblefield, *Artificial Intelligence: Structures and Strategies for Complex Problem Solving*, 5th edition, Addison-Wesley, 2005. • G. Weiss (editor), *Multiagent Systems: a modern approach to distributed AI*, The MIT Press, 2001. • P. Jackson, *Introduction to Expert Systems*, 3rd edition, Addison-Wesley, 1999. • J. Giarratano και G. Riley, *Expert Systems: Principles and Programming*, 4th edition, International Thomson Publishing, 2004. • J-M. David, J-P. Krivine and R. Simmons (editors), *Second Generation Expert Systems*, Springer-Verlag, 2011. • J. Breuker και W. Van de Velde (editors), *CommonKADS Library for Expertise Modelling: Reusable Problem Solving Components*, IOS Press, 1994.
Assessment	Final exam, midterm exam and homework (theoretical and/or programming assignments).
Language	English

MAI646 Cognitive Programming for Human-Centric AI (8ECTS)
Instructor: A. Kakas (antonis@cs.ucy.ac.cy , (+357) 22892706)

Course Title	**Cognitive Programming for Human-Centric AI**				
Course Code	**MAI646**				
Course Type	**Elective**				
Level	**Master**				
Year / Semester					
Teacher's Name	A. Kakas				
ECTS	8	Lectures / week		Laboratories / week	
Course Purpose and Objectives	The introduction of students into the new framework for Cognitive Computing for the development of Cognitive Systems that serve the needs of Human-centric AI. The theoretical understanding of the challenges of such cognitive systems and the development of knowledge for their practical application.				

Learning Outcomes	The key learning outcomes of the course are: 1. Properties and Design of Cognitive Systems 2. Automated Cognitive Decision Making 3. Argumentation for Human Cognitive Reasoning 4. Computational Argumentation 5. Learning & Reasoning in Cognitive Systems 6. Software Methodology for Cognitive Assistants		
Prerequisites	AI Fundamentals	Co-requisites	
Course Content	Basic elements of cognitive science and the relation between logic and argumentation. Computation models for cognitive intelligence that follow representational models from cognitive psychology. The structure of knowledge and the human mechanism for reasoning and deciding. The architecture of cognitive systems and their dynamic development cycle. The course is divided into following thematic units: **Basic Elements of Cognitive Systems:** Reviews the requirements of cognitive systems and compares these with conventional computer systems. **Cognitive Architectures:** Presents the basic components for designing and implementing cognitive systems. **Psychology of Reasoning:** Review the basic knowledge of human reasoning from Cognitive Psychology/Science. requirements of cognitive systems **Automated Decision Making:** The central module of cognitive systems as a module of cognitive, human-like reasoning and decision making. **Computational Argumentation:** Theory of argumentative reasoning and its link to human reasoning. Representation frameworks of structured argumentation. The Gorgias framework of knowledge representation and programming environment. **Machine Learning for Cognitive Systems:** Machine learning methods to populate the knowledge component of Cognitive Systems. Learning by experience to dynamically adapt the knowledge. **Explainable AI & Cognitive Argumentation:** Basic tenets of Explainable AI and its realization through Cognitive Argumentation. **Building Cognitive Assistants:** Methodology for building Cognitive Assistants. Blueprint architectures for Cognitive Assistants based on argumentation technology.		
Teaching Methodology	Weekly lectures will introduce and provide overview of the course topics. In addition, there will be a running project throughout the course for the students to develop a Cognitive Assistant of their own application choice. The students will also undertake a bibliography assignment to review a topic related to Cognitive Computing from other disciplines. Small exercises help the student develop knowledge representation skills in argumentation form and programming skills in the Gorgias system of argumentation.		
Bibliography	David Vernon, Artificial Cogntive Systems, MIT Press, 2014. Antonio Lieto, Cognitive Designs for Artificial Minds, Routledge, 2021. Journal of Cognitive Systems Research, Elsevier.		

	Journal of Advances of Cognitive Systems. Journal of Computational Cognitive Science. Principles of Synthetic Intelligence, Oxford University Press, 2009. Research Documents on Cognitive Computing
Assessment	Two major projects, one on research study and one developing a Cognitive Assistant. Four small assignments and a Final exam.
Language	English

We expect students to use the Online Version of the Learning agreement created though the learning-agreement.eu platform. Person responsible are the Erasmus Departmental Coordinators below:

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