University/Academy: Arab Academy for Science and Technology & Maritime Transport
Faculty/Institute: College of Computing and Information Technology
Program: Computer Science

Form No. (12)
Course Specification

1- Course Data

Course Code:	Course Title:	Academic Year/Level:
CS461	Software Agents	Year 4 / Semester 8
Specialization: Computer Science	**No. of Instructional Units:** 2 hrs lecture 2 hrs lab	**Lecture:**

2- Course Aim	A basic introduction to the analysis and design of intelligent agents, software systems which perceive their environment and act in that environment in pursuit of their goals. The module builds on previous AI modules and acts as an introduction to the problems of combining the techniques covered in these modules into a single intelligent agent with broad competence.
3- Intended Learning Outcome:	
a- Knowledge and Understanding	**Students will be able to demonstrate knowledge of:** **K10.** Current developments in computing and information research. K15. Interpret and analyzing data qualitatively and/or quantitatively. K19. Select advanced topics to provide a deeper understanding of some aspects of the subject, such as hardware systems design, object-oriented analysis and design, and artificial intelligence, and parallel and concurrent computing. • Learn an overview of the main trends in computer science and challenging to solve them. • Know definitions and concepts of agents and multi agent system and the distinction between agent and similar topics in the literature. • Learn examples of current system using agent technology. • Know the current frameworks used for developing such systems. • List different agents' type and properties. • List environment properties and features. • Define abstract architecture of multi-agent system. • Learn agent architecture and history and designing approaches. • Understand symbolic model or reasoning for designing an agent. • Understand deductive model or reasoning for designing an agent. • Know how to plan an agent model and behavior. • Learn the two models AGENT0 and PLACA.

	• Understand different reasoning strategies "Practical reasoning" based on human practical reasoning. • Understand that implementation of "Practical reasoning" into agent is based on Beliefs, Desire and Intentions software model. • Understand reactive model is based on situation and action. • Know how Brooks's language represents the architecture of reactive reasoning for an agent. • List advantages and disadvantages of reactive agents. • Understand the diversity of multi-agent system. • Learn the concept of cooperation between agents. • Learn the Agent Communication Language (ACL). • Learn aspects of communication (syntax, semantics and pragmatic). • Explore speech act theory. • Learn different communication protocol levels (low, middle and top levels). • Learn the two current main languages used in ACL (KQML, KIF). • Explain the difference of ACL and FIPA-ACL as ACL is implementation of FIPA communication language. • Explain the message structure and how it is syntactically written in KQML. • Explain the ontology and its usage in communication. • Understand the concept of cooperation and coordination between agents. • Understand cooperation between agents in task sharing and problem decomposition. • Learn an application of agent technology and introduce problem-solving techniques to build this application.
b- Intellectual Skills	**By the end of the course, the student acquires high skills and an ability to understand:** **I10.** Define traditional and nontraditional problems, set goals towards solving them, and. observe results. **I11.** Perform comparisons between (algorithms, methods, techniques...etc). I19. Generate an innovative design to solve a problem containing a range of commercial and industrial constraints. • Study examples of agents based systems. • Use and compare nine tools for building agents. • Compare different types of agents (hardware and software). • Solve the tile world example with different algorithms. • Compare between each design model and its tradeoffs and implementation. • Review AGENT0 as one of the programming models developed for building agents systems; it is an extension of LISP. • Show how different strategies implemented in research projects Aero space and Unmanned vehicles. • Explore BDI model and how it is implemented in IRMA and HOMER. • Choose the best solution suited for the context of the problem. • Distinguish between communication in terms of network and communication in multi agent system. • Differentiate between regular message and agent's message as (Act message).

	• Differentiate between KQML and KIF. • Evaluate different multi agent systems.

c- Professional Skills	**By the end of the course the student will have the ability to:** **P14.** Specify, design, and implement computer-based systems. P15. Evaluate systems in terms of general quality attributes and possible tradeoffs presented within the given problem. P19. Deploy effectively the tools used for the construction and documentation of software, with particular emphasis on understanding the whole process involved in using computers to solve practical problems. • Use the JADE system and its framework. • Run a simple program on JADE. • Define agent and environment and its features on JADE platform. • Build an agent by using deductive reasoning or model in a vacuum world. • Plan the agent by building the knowledge representation and search plan. • Implement different techniques for building software models like IRMA and HOMER. • Create different solutions for the problem of designing an agent. • Use hybrid architecture in some cases. • Design and apply agent system for problem in hand (book store problem) • Design a smart negotiation system between agents. • Use and identify an ACL message between agents. • Construct an ACL message that serves their needs in the system. • Use XML Language semantics and syntax. • Implement messaging system on JADE platform. • Use perfomative acts on ACL messages. • Build a dialogue between agents. • Use KQML as message's language. • Build a fully functional multi agent system. • Design a scheme for coordination between agents. • Decompose the problem between agents. • Use JADE library with java programming language to build a multi agent system inspired from research.
d- General Skills	**Students will be able to:** **G1.** Demonstrate the ability to make use of a range of learning resources and to manage one's own learning. **G7.** Show the use of general computing facilities. **G8.** Demonstrate an appreciation of the need to continue professional development in recognition of the requirement for life-long learning. • Use of computing facilities to build fully functional agent system. • Use the Library to search for research papers and design models. • Acquire Research and reading skills.

	• Install and deploy JADE framework.
4- Course Content	<table><tr><td>1</td><td>Develop a basic understanding of the problems and techniques of building intelligent agents</td></tr><tr><td>2</td><td>Apply the trade-offs inherent in the design of agent-based systems.</td></tr><tr><td>3</td><td>Be involved in a project involving the construction of a simple agent-based system.</td></tr><tr><td>4</td><td>Apply analysis and design skills appropriate to more complex AI problems through small projects.</td></tr></table>
5- Teaching and Learning Methods	Lectures, Labs, Projects, Individual study & self-learning.
6- Teaching and Learning Methods for Students with Special Needs	• Students with special needs are requested to contact the college representative for special needs (currently Dr Hoda Mamdouh in room C504) • Consulting with lecturer during office hours. • Consulting with teaching assistant during office hours. • Private Sessions for redelivering the lecture contents. • For handicapped accessibility, please refer to program specification.
7- Student Assessment:	
a- Procedures used:	Exams and Individual Projects
b- Schedule:	Week 7 exam Week 12 exam Week 16 Final exam
c- Weighing of Assessment:	7^{th} week exam 30% 12^{th} week exam 20% Lab work 10% Final exam 40%
8- List of References:	
a- Course Notes	From the Moodle on www.aast.edu
b- Required Books (Textbooks)	Wooldridge, *An Introduction to Multi-Agent Systems*, 1st edition, John Wiley, 2002.
c- Recommended Books	Wooldridge, *Reasoning About Rational Agents*, 1^{st} edition, MIT Press, 2000.

d- Periodicals, Web Sites, ..., etc.	

Course Instructor: **Head of Department:**

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