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:
CS425	Distributed Systems	Year 4 / Semester 7
Specialization: Computer Science	**No. of Instructional Units:** 2 hrs lecture 2 hrs lab	**Lecture:**

2- Course Aim	This course presents an introduction to distributed systems principles and paradigms. Key principles in the distributed systems arena are presented including: communication, processes, naming, synchronization, consistency and replication, and fault tolerance. In addition, different paradigms are outlined including object-based systems, distributed file systems, and document-based systems. A practical component of the course will allow students to experiment with a simple distributed system including modification of some of its components.
3- Intended Learning Outcome:	
a- Knowledge and Understanding	**Students will be able to demonstrate knowledge of:** **K16.** Know and understand the principles and techniques of a number of application areas informed by the research directions of the subject, such as artificial intelligence, natural language processing, data mining, databases and computer graphics. **K18.** Understand the fundamental topics in Computer Science, including hardware and software architectures, software engineering principles and methodologies, operating systems, compilers, parallel and distributed computing, systems and software tools. **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. • Define a distributed system (K18) • Identify distributed systems goals (K18) • Identify types of distributed systems (K18) • Identify system architectures for distributed systems(K16) • Define self-management in distributed systems (k16) • Explain threads implementation in distributed systems(K16) • Define the role of virtualization in distributed systems (K16) • Explain types of communication in distributed systems (K16, K19)

	• Describe RPC operation (K18) • Describe RMI operation (K18) • Identify naming schemes (K18) • Describe DNS operation(K18) • Describe LDAP operation(K18) • Identify the use physical clocks and logical clocks (K19) • Define Lamport's logical clocks(K19) • Define mutual exclusion(K19) • Describe mutual exclusion techniques(K19) • Define consistency in distributed systems(K19) • Describe data-centric consistency models(K19) • Describe client-centric consistency models(K19) • Explain replica management(K19) • Define fault tolerance(K19) • Define agreement in faulty systems(K19) Identify architectures for distributed file systems(K19)
b- Intellectual Skills	**By the end of the course, the student acquires high skills and an ability to understand:** **I9.** Evaluate research papers in a range of knowledge areas **I17.** Identify a range of solutions and critically evaluate and justify proposed design solutions. **I19.** Generate an innovative design to solve a problem containing a range of commercial and industrial constraints. • Differentiate between types of distributed systems (I17) • Evaluate system architectures for distributed systems(I17) • Analyze self-management techniques in distributed systems(I17) • Evaluate different thread implementation techniques(I17) • Compare between architectures of virtual machines (I9) • Contrast types of communication in distributed systems(I17) • Compare between RPC and RMI(I17) • Compare between naming schemes(I17) • Compare between DNS and LDAP as naming systems(I17) • Evaluate a clock synchronization algorithm (I9) • Compare physical clocks versus logical clocks(I17) • Evaluate a mutual exclusion algorithm (I19) • Contrast consistency models(I17) • Contrast replica placement techniques(I17) • Illustrate byzantine agreement and when can be reached (I19) • Compare system architectures for distributed file systems (I9)
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. • Design a distributed system application using RPC (P14,P19) • Implement a distributed system application using RPC (P15) • Design a distributed system application using RMI (P14,P19) • Implement a distributed system application using RMI(P14,P19) • Design distributed system services using Jini (Apache River) (P14,P19) • Implement distributed system services using Jini (Apache River) (P14,P19) • Experiment with DNS resolution services (P15)

	• Design an application using logical clocks (P14,P19) • Implement an application using logical clocks(P14,P19) • Experiment with synchronization using network time servers(P14,P19) • Implement a mutual exclusion algorithm(P14,P19) • Implement a scenario of byzantine agreement(P14,P19)
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. **G2.** Demonstrate skills in group working, team management, time management and organizational skills. **G7.** Show the use of general computing facilities.
4- Course Content	1 Identify the fundamental concepts of distributed systems and design principles 2 Understand distributed process communication using RPCs and RMIs 3 Design and Implement client-server based systems using RPCs 4 Understanding the design and implications of distributed file systems and naming 5 Understanding distributed system synchronization and logical clocks
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 2 Projects through the semester Week 12 exam Week 16 Final exam
c- Weighing of Assessment:	7^{th} week exam 30% Project 10% 12^{th} exam 20% Lab work 5% Project 5% Final exam 30%
8- List of References:	

a- Course Notes	From the Moodle on www.aast.edu
b- Required Books (Textbooks)	Andrew S. Tanenbaum and Maarten van Steen, Distributed Systems Principles and Paradigms , 2nd Edition, Prentice Hall, 2006
c- Recommended Books	George Coulouris, Jean Dollimore, and Tim Kindberg, Distributed Systems Concepts and Design, 4th Edition, Addison-Wesley, 2005
d- Periodicals, Web Sites, …, etc.	

Course Instructor: **Head of Department:**

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