MARMARA UNIVERSITY - FACULTY OF ENGINEERING

2017-2018 Spring

CSE2046 Analysis of Algorithms

COURSE DESCRIPTION FORM

Offering Department	Department of Computer Engineering		Undergraduate must course (4th semester)
Course Code	CSE2046		
Course Name	Analysis of Algorithms		
Language of Instruction	English		
ECTS	6		
Contact Hours	Theoretical (T): 3	Practice (U): 0	Laboratory(L): 0
Pre-requisites	CSE2025 Data Structures		
Instructor	**Name**	Ömer KORÇAK	
	E-mail	omer.korcak@marmara.edu.tr	
Course Materials	**Mandatory**	A. Levitin, "Introduction to Design and Analysis of Algorithms", 3/e, Pearson. Other materials and announcements related to the course are published at the course web page: http://mimoza.marmara.edu.tr/~omer.korcak/courses/CSE246.html/	
	Recommended	"J. Kleinberg and E. Tardos, Algorithm Design, Addison-Wesley, 2005."	
Course Objectives	The understanding of running time analysis techniques. To show how to design correct and efficient algorithms by describing their steps precisely and understandably. To develop the notion of data structuring for algorithmic efficiency		
Course Content	Introduction: The notion of algorithm,fundamentals of algorithmic problem solving, important problem types, fundamental data structures. Fundamentals of analysis of algorithms efficiency, asymptotic notations and standard efficiency classes. Mathematical analysis of non-recursive and recursive algorithms, empirical analysis of algorithms. Brute Force and Exhaustive Search Algorithms. Decrease-and-Conquer Strategy. Divide-and-Conquer Strategy. Transform-and-Conquer Strategy. Space and Time Tradeoff in Algorithms. Dynamic Programming. Greedy Technique. Iterative improvement algorithms. Limitations of algorithm power, lower-bound arguments. P, NP, and NP-complete problems. Coping with the Limitations of Algorithm Power.		
Learning Outcomes	**LO1**	To be able to perform mathematical analysis of algorithms in terms of time and space compexity.	
	LO2	To be able to compare performance of different algorithms in emprical way.	
	LO3	To be able to apply various algorithm design techniques for different problems.	
	LO4	To be able to perform lower-bound analysis of problems and identify their hardness levels.	
	LO5	To be able to design efficient algorithms for hard problems.	

Program Outcomes		**LO1**	**LO2**	**LO3**	**LO4**	**LO5**
PO2	Ability to identify, formulate, and solve complex engineering problems (a); ability to select and apply proper analysis and modelling methods for this purpose (b).	b			a b	a b
PO5	Ability to design (a) and conduct experiments, gather data (b), analyze and interpret results for investigating engineering problems (c).	c	a b c			
PO13	Knowledge of mathematics, basic sciences (a), computer science (b) and engineering sciences (c) required for the design and analysis of complex electrical and electronic devices, software and systems including hardware and software.	a b		b	b	
PO14	Knowledge of data structures and algorithm analysis (a), database management systems (b), operating systems (c), software engineering (d), computer architecture (e) and automata theory (f) in computer engineering.	a	a	a	a	a

	No	**Week**	**Subjects**	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**
Subjects (Knowledge, Skills and Behaviours), **Contributions of Subjects to Learning Outcomes,** **Assessment Methods**	**S1**	1	Introduction: The notion of algorithm, fundamentals of algorithmic problem solving, important problem types, fundamental data structures.			MF		
	S2	1-2	Mathematical analysis of nonrecursive algorithms.	MF,H				
	S3	2-3	Mathematical analysis of recursive algorithms.	MF,H				
	S4	3	Emprical analysis of algorithms.		H			
	S5	4	Brute-force algorithms and exhaustive search.			MF,H		
	S6	5	Decrease and conquer strategy.			MF,H		
	S7	6	Divide and conquer strategy.			MF H		
	S8	7	Transform and conquer strategy.			MF,H		
	S9	8	Space and time trade-off in algorithms			MF,H		
	S10	9	Dynamic programming			MF		

	S11	10	Greedy technique			MF,H		
	S12	11	Iterative improvement strategy, Maximum flow problem			MF		
	S13	12	Lower bound arguments, problem reduction.				MF	
	S14	13	P, NP, NP-Complete classes				MF	
	S15	14	Coping with the Limitations of Algorithm Power: Branch&Bound, Approximation Algorithms					MF,H

Assessment Methods and Weights

No	**Type**	**Weight**	**Implementation Rule**	**Make-up Rule**
MF	Midterm, Final	70%	In the exams, students are allowed to bring one A4 sheet. They can write whatever they like in both sides of this sheet. Any type of calculators or communication equipments are not allowed during exams.	Marmara University regulations will be followed for make-up exams.
H	Homeworks	30%	Firs homework is a paper-work. Second homework is an experiment design and application project. Third homework is an algorithm design and coding project. In second and third homeworks students are allowed to work in groups of two.	-
TOTAL		100%		

Determining Letter Grades

- The letter grades will be determined based on the midterm and final exams and homeworks.
- In order to determine the letter grade, a curve or catalog based method will be followed based on the total average scores of the students.
- The final exam score and the total average score of the student must be at least 35 to pass the course.
- According to Marmara University Undergraduate regulations, the weight of the final exam must be at least 40 out of 100.

Assessment	Midterm	Homework 1	Homework 2	Homework 3	Final	TOTAL
Weight	30	7	11	12	40	100

Teaching Method, Student Work Load

Time Applied by the Instructor

No	**Method**	**Explanation**	**Hours**
1	Lectures	Lectures are given in class using the board or via presentations. Example questions are solved to enhance the concepts.	14x3=42
2	Problem Session/ Practice	Problems related to the course topics are solved on the board.	
3	Laboratory	Experiments are done in the laboratory or theoretical concepts covered during the lectures are practiced using computer exercises.	
4	Interactive Courses	Questions are asked to students during lectures and they are encouraged to guess the answers (peer learning is also in this category)	
5	Field Work	Students attend activities outside the campus.	
6	Midterm	Midterm exam is given during the midterm week.	2
7	Final	Final exam is given during the final exam week.	2
Estimated Time to be Allocated by a Student			
8	Project	The students carry out research about the problem given in the project, design and implement their solution and prepare a report.	
9	Homeworks	The students solve the problems given as homework.	7+15+20=42
10	Pre-class learning of Course Material	The students study and learn the new subjects from course materials.	13
11	Review of Course Material	Students review the course subjects from course materials to prepare for the exams and homeworks.	48
12	Office Hour	Students ask questions to the instructor or the assistant during office hours.	2
Total			151

Academic Honesty

Violations of scholastic honesty include, but are not limited to cheating, plagiarizing, fabricating information or citations, facilitating acts of dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students.

In case academic dishonesty is observed, the first authority is the instructor of the course. The instructor may decide to give the student zero for the homework(s)/lab(s)/exam(s), give the letter grade FF, or may take disciplinary action.