School of Engineering and Natural Sciences / Electrical and Electronics Engineering (English)

2024 - 2025 Academic Year

ALGORITHM ANALYSIS

Syllabus

Course Description						
Name		**Code**	**Semester**	**T+A Hour**	**Credit**	**ECTS**
ALGORITHM ANALYSIS		EEE3233890	Spring Semester	3+0	3	6
Prerequisites Courses	VERİ YAPILARI; OLASILIK VE RASSAL DEĞİŞKENLER					
Recommended Elective Courses	Data Structures					
Language of Instruction	English					
Course Level	First Cycle (Bachelor's Degree)					
Course Type	Elective					
Course Coordinator	Prof.Dr. Reda ALHAJJ					
Name of Lecturer(s)	Prof.Dr. Reda ALHAJJ					
Assistant(s)						
Aim	Introduce fundamental techniques for designing algorithms and analyzing the time and space requirements of these algorithms in a formal way. Mathematical background for algorithm analysis, sorting, searching, basic algorithms design and graph algorithms will be covered.					
Course Content	This course contains; Week 1: Introduction: analysing algorithms, designing algorithms.,Week 2: Asymptotic Notation.,Week 3: Divide and Conquer Design Paradigm.,Week 4: Solving Recurrences.,Week 5: Analysis of Quicksort, Randomized Quicksort.,Week 6: Heapsort.,Week 7: Quicksort.,Week 8: Sorting in Linear Time.,Midterm,Week 10: Medians and Order Statistics.,Week 11: Dynamic Programming.,Week 12: Greedy Algorithms.,Week 13: Amortized Analysis, Dynamic Tables.,Week 13: Graphs, Breadth-first Search (BFS)..					

Course Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) At the end of this course the students will be able to describe the fundamentals of algorithm analysis.	12, 14, 16, 9	A, E
2) At the end of this course the students will be able to construct complex algorithms using the data structures that they have learned.	12, 14, 16, 9	A, E
3) At the end of this course the students will be able to develop complex algorithms and advanced data structures that are using trees and will be able to apply them to real world problems.	10, 12, 14, 17, 9	A, E, F
4) At the end of this course the students will be able to develop complex algorithms and advanced data structures that are using graphs and will be able to apply them to real world problems.	10, 12, 14, 17, 9	A, E, F
5) At the end of this course the students will be able to systematically look at a given computational problem and design a novel algorithm using techniques like dynamic programming, divide and conquer and greedy algorithms.	12, 14, 16, 19, 9	A, E

Teaching Methods	10: Discussion Method, 12: Problem Solving Method, 14: Self Study Method, 16: Question - Answer Technique, 17: Experimental Technique, 19: Brainstorming Technique, 9: Lecture Method
Assessment Methods	A: Traditional Written Exam, E: Homework, F: Project Task

Lecture Schedule

Sequence	**Topics**	**Preliminary Preparation**
1	Week 1: Introduction: analysing algorithms, designing algorithms.	Lecture Slides and textbook chapters 1 & 2
2	Week 2: Asymptotic Notation.	Lecture Slides and textbook chapter 3
3	Week 3: Divide and Conquer Design Paradigm.	Lecture Slides and textbook chapter 4
4	Week 4: Solving Recurrences.	Lecture Slides and textbook chapter 4
5	Week 5: Analysis of Quicksort, Randomized Quicksort.	Lecture Slides and textbook chapter 5
6	Week 6: Heapsort.	Lecture Slides and textbook chapter 6
7	Week 7: Quicksort.	Lecture Slides and textbook chapter 7
8	Week 8: Sorting in Linear Time.	Lecture Slides and textbook chapter 8
9	Midterm	Lecture Slides and textbook chapters from 1 to 9, inclusive.
10	Week 10: Medians and Order Statistics.	Lecture Slides and textbook chapter 9
11	Week 11: Dynamic Programming.	Lecture Slides and textbook chapter 15
12	Week 12: Greedy Algorithms.	Lecture Slides and textbook chapter 16
13	Week 13: Amortized Analysis, Dynamic Tables.	Lecture Slides and textbook chapter 17
14	Week 13: Graphs, Breadth-first Search (BFS).	Lecture Slides and textbook chapter 22

Evaluation Methods	**Weight(%)**
Midterm Exam	30
General Exam	70

Resources
T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms, Mit Press and McGraw-Hill, 2009. The notes and the presentations will be delivered during the lectures.