

COURSE INFORMATION					
Course Title	Code	Semester	L+P Hour	Credits	ECTS
ADVANCED TOPICS IN ALGORITHMS AND COMPUTER SCIENCE	CSE 610		3 +0	3	10

Prerequisites	An introductory algorithms course and knowledge of a high level programming language are required.
----------------------	--

Language of Instruction	English
Course Level	PhD. Degree
Course Type	Technical Elective
Course Coordinator	
Instructors	Onur Demir
Assistants	
Goals	The goal of the course is to provide advanced techniques for algorithm analysis and advanced data structures. The students will have ability to design and analyze advanced algorithms and data structures for large scale data operations such as string search or packet classification.
Content	Advanced and recent research issues in Algorithms and Computer Science. Amortized and Probabilistic Analysis, Search Trees, Advanced Priority Queues, String Algorithms, Network Algorithms Design Principles, Packet Classification, Prefix Lookup algorithms and data structures.

Learning Outcomes	Program Outcomes	Teaching Methods	Assessment Methods
1. Knows advanced analysis techniques and is able to apply these techniques to analyze advanced data structures.	2,3,5	1,2,3	A,C,D
2. Can analyze data structures and algorithms using amortized analysis and probabilistic analysis techniques.	2,5	1,2	A,C,D
3. Knows network algorithms design principles.	2,5	1,2	A,C,D
4. Can customize data structures and algorithms for different	2,5	1,2,3	A,C,D

scenarios in networking domain.			
5. Can analyze scientific publications.	3	1,2,3	C,D

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Term Project

COURSE CONTENT		
Week	Topics	Study Materials
1	Review of Basics - Efficiency Analysis, Master Theorem, Algorithmic Techniques	Scientific Papers
2	Amortized Analysis	Scientific Papers
3	Probabilistic Analysis, B-Trees	Scientific Papers
4	Fibonacci Heaps, Relaxed Heaps	Scientific Papers
5	van Emde Boas Trees	Scientific Papers
6	String Search Algorithms 1 - Naive String Search Algorithm, Rabin-Karp	Scientific Papers
7	String Search Algorithms 2 - Knuth-Morris-Pratt, Boyer Moore, Bitap	Scientific Papers
8	Principles of Network Algorithms, Exact Lookup Algorithms	Scientific Papers
9	Prefix Lookup Algorithms Unibit, Multibit, Stride Tries,LC Tries	Scientific Papers
10	Classification Algorithms Grid of Tries, Decision Trees	Scientific Papers
11	Paper Presentations	Scientific Papers
12	Paper Presentations	Scientific Papers
13	Paper Presentations	Scientific Papers
14	Paper Presentations	Scientific Papers

RECOMMENDED SOURCES	
Textbook	Introduction to Algorithms, Cormen et.al., MIT Press, 3rd Edition Network Algorithmics, Varghese, Morgan Kaufman
Additional Resources	Scientific Papers

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	NUMBER	PERCENTAGE
Presentation	1	20
Term Project	1	80
Total		100
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		0
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		100
Total		100

COURSE CATEGORY	Expertise/Field Courses
------------------------	-------------------------

COURSE'S CONTRIBUTION TO PROGRAM						
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Ability to understand and use basic sciences, mathematics and engineering sciences in a high level.					
2	Possession of wide and deep knowledge in the field of Computer Science and Engineering, including the latest developments.					X
3	Ability to reach the new information in the field of Computer Science and Engineering and having high-level competence in necessary methods and skills to make the research by apprehending the new information.					X
4	Ability to bring an innovation that provides different initiatives to the field of Computer Engineering; develop a new approach, method, design, application or apply a present method in a different field.					
5	Ability to perceive an original research process independently, and design, implement, conclude and lead the process.					X
6	Ability to contribute to the literature by publishing the whole scientific research and development efforts he/she has carried out in the field of expertise.					

7	Ability to comprehend scientific, technological, social and cultural developments, and convey them to society with scientific impartiality and ethical responsibility.					
8	Ability to do critical analysis, synthesis and evaluation of ideas and developments in the field of Computer Engineering.					
9	Ability to communicate effectively in oral and written ways with the employees in the area of Computer Engineering and wider scientific and social communities, to communicate and discuss in advanced level of written, oral and visual ways by using a foreign language in at least European Language Portfolio C1 General Level.					
10	Ability to evaluate scientific, technological, social and cultural developments and to transmit these developments to society with scientific objectivity and a sense of ethic responsibility.					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Including the exam week: 16x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	5	70
Term Project	1	100	100
Paper Presentation	1	25	25
Total Work Load			237
Total Work Load / 25 (h)			9.48
ECTS Credit of the Course			10