T.C.
RECEP TAYYİP ERDOĞAN ÜNİVERSİTESİ
MÜHENDİSLİK VE MİMARLIK FAKÜLTESİ - Bilgisayar Mühendisliği

Lesson Information			
Semester	**Course Unit Code**	**ECTS**	**Course Name**
Bahar	CE100	5.00	Algorithms and Programming II

Lesson Information	
Department / Program	
Type of Course Unit	
Prerequisities and co-Requisities	Algorithms and Programming I
Objectives of the Course	This course is a continuation of the Algorithms and Programming I course. In this course learned programming skills in Algorithms and Programming I course met with common problems and their solution algorithms. This lecture is about analyzing and understanding how algorithms work for common issues. The class will be based on expertise sharing and guiding students to find learning methods and practice for algorithm and programming topics. By making programming applications and projects in the courses, the learning process will be strengthened by practicing rather than theory.
Course Content	? Algorithms Basics, Pseudocode ? Algorithms Analysis for Time Complexity and Asymptotic Notation ? Sorting Problems (Insertion and Merge Sorts) ? Recursive Algorithms ? Divide-and-Conquer Analysis (Merge Sort, Binary Search) ? Matrix Multiplication Problem ? Quicksort Analysis ? Heaps, Heap Sort and Priority Queues ? Linked Lists, Radix Sort and Counting Sort ? Convex Hull ? Dynamic Programming ? Greedy Algorithms ? Graphs and Graphs Search Algorithms o Breadth-First Search o Depth-First Search and Topological Sort ? Graph Structure Algorithms o Strongly Connected Components o Minimum Spanning Tree ? Disjoint Set Operations ? Single-Source Shortest Path Algorithm ? Q-Learning Shortest Path Implementation ? Network Flow and Applications ? Hashing and Encryption
Recommended Optional Programme Components	During this course, you should have a laptop for programming practices. You will have your development environment, and you will use this for examination and assignments also classroom practices.
Recommended or Required Reading	? Paul Deitel and Harvey Deitel. 2012. C How to Program (7th. ed.). Prentice Hall Press, USA. ? Intro to Java Programming, Comprehensive Version (10th Edition) 10th Edition by Y. Daniel Liang ? Introduction to Algorithms, Third Edition By Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein ? Problem Solving and Program Design in C, J.R. Hanly, and E.B. Koffman, 6th Edition. ? Robert Sedgewick and Kevin Wayne. 2011. Algorithms (4th. ed.). Addison-Wesley Professional. ? Harvey M. Deitel and Paul J. Deitel. 2001. Java How to Program (4th. ed.). Prentice-Hall PTR, USA. ? Paul Deitel and Harvey Deitel. 2016. Visual C# How to Program (6th. ed.). Pearson.
Internship Status	Not Exist
Name of Lecturers	Asst. Prof. Dr. Uğur CORUH

Learning Outcomes	
1	Interpret a computational problem specification and algorithmic solution and implement a C/C++, Java or C# application to solve that problem.
2	Argue the correctness of algorithms using inductive proofs and invariants.
3	Understand algorithm design steps
4	Argue algorithm cost calculation for time complexity and asymptotic notation
5	Analyze recursive algorithms complexity
6	Understand divide-and-conquer, dynamic programming and greedy approaches.
7	Understand graphs and graph related algorithms.
8	Understand hashing and encryption operations input and outputs.

Weekly Course Contents			
Week	**Subjects**		
	Theoretical	**Practice**	**Laboratory**
1	Course Plan and Communication Grading System, Assignments and Exams. Algorithms Basics, Pseudocode Algorithm Cost Calculation for Time Complexity. Worst, Average and Best Case Summary Sorting Problem (Insertion and Merge Sort Analysis)	N/A	Programming Workshop
2	Solving Recurrences (Recursion Tree, Master Method and Back-Substitution) Divide-and-Conquer Analysis (Merge Sort, Binary Search) Recurrence Solution	N/A	Programming Workshop
3	RAM (Random Access Machine Model) Asymptotic Notation (Big O, Big Teta, Big Omega,Small o,Small omega) Matrix Multiplication (Traditional,Recursive,Strassen)	N/A	Programming Workshop
4	Quicksort and Analysis (Hoare and Lomuto Partitioning, Recursive Sorting) Randomized Quicksort and Selection (Recursive,Medians) Heaps (Max / Min Heap, Heap Data Structure, Iterative and Recursive Heapify, Extract-Max, Build Heap) Heap Sort, Priority Queues, Linked Lists, Radix Sort,Counting Sort	N/A	Programming Workshop
5	Convex Hull (Divide & Conquer) Dynamic Programming (Fibonacci Numbers) Divide-and-Conquer (DAC) vs Dynamic Programming (DP) Development of a DP Algorithms Matrix-Chain Multiplication and Analysis	N/A	Programming Workshop
6	Elements of Dynamic Programming Recursive Matrix Chain Order Memoization (Top-Down Approach, RMC, MemoizedMatrixChain, LookupC) Dynamic Programming vs Memoization Longest Common Subsequence (LCS) Most Common Dynamic Programming Interview Questions	N/A	Programming Workshop
7	Greedy Algorithms and Dynamic Programming Differences Greedy Algorithms (Activity Selection Problem, Knapsack Problems)	N/A	Programming Workshop
8	Midterm	N/A	Midterm
9	Heap Data Structure Heap Sort Huffman Coding	N/A	Programming Workshop
10	Introduction to Graphs Graphs and Representation BFS (Breath-First Search) DFS (Depth-First Search) Topological Order SCC (Strongly Connected Components) MST Prim Kruskal	N/A	Programming Workshop
11	Disjoint Sets and Kruskal Relationships Single-Source Shortest Paths (Bellman-Ford,Dijkstra) Q-Learning Shortest Path Max-Flow Min-Cut (Ford-Fulkerson,Edmond's Karp,Dinic)	N/A	Programming Workshop
12	Crypto++ Library Usage Hashing and Integrity Control Cryptographic Hash Functions (SHA-1,SHA-256,SHA-512,H-MAC) Checksums(MD5,CRC32)	N/A	Programming Workshop
13	Symmetric Encryption Algorithms (AES, DES, TDES) Symmetric Encryption Modes (ECB, CBC) Asymmetric Encryption Key Pairs (Public-Private Key Pairs) Signature Generation and Validation	N/A	Programming Workshop
14	OTP Calculation(Time-based, Counter-based) File Encryption and Decryption and Integrity Control Operations	N/A	Programming Workshop
15	Review	N/A	Programming Workshop
16	Final	N/A	Final

Course Assessment

Yarıyıl (Yıl) İçi Etkinlikleri	**Number**	**Percentage of Contribution**
Project Preparation	3	100
Sum		**100**

Yarıyıl (Yıl) Sonu Etkinlikleri	**Number**	**Percentage of Contribution**
Project Preparation	3	100
Sum		**100**

Contribution of the in-term activities and final exam grade to the final success grade	**Percentage of Contribution**
End of Semester(Year) Learning Activities	60
Semester(Year) Learning Activities	40
Sum	**100**

Activities	**Number**	**Hour**	**Total Work Load (Hours)**
Project Preparation	6	9	54
Attending Lectures	14	5	70
Total Work Load (Hours)			124