Department of Computer science

College of Science

University of Salahadden

Subject: Design and Analysis of Algorithms

Course Book: Year 4

Lecturer's name: (MSc) Kanar Yassin Qader

Academic Year: 2021/2022

Course Book

1. Course name	**Design and Analysis of Algorithms**
2. Lecturer in charge	**Kanar Yassin Qader**
3. Department/ College	**Computer Science / Collage of Science**
4. Contact	**e-mail: kanar.y.qader@gmail.com**
5. Time (in hours) per week	**Theory: 2** **Practical: 2**
6. Office hours	**4 hours a week**
7. Course code	
8. Teacher's academic profile	I was born in 1988 in Erbil, Completed Primary, Middle and Junior high schools in Erbil. I have finished BSc degree in computer science Department - college Education of science - Salahaddin University 2009. I was get MSc degree in Computer Science in University of Duhok in 2016. I am currently teaching 4th grade students.
9. Keywords	

10. Course overview:

The course covering both theoretical and practical issues in designing and analyzing algorithms. Topics to be covered include introduction to algorithms, and there degree of strength depending to their time complexity as well as the difference between search and sort algorithms.
Design and algorithm analyses is used as a master key in all programming project because as it is find the optimal algorithm for specific problem if there is any; otherwise it suggested a heuristic method to find a good approach for solving the problem.
The course will cover each item in detail for example after studding the algorithm the students will know the difference between programs and algorithms, how to write a general algorithm for problems, how to choose between algorithms for specific type of data and how to find weak points in algorithms and programs.
All types of time complexity like big O theta and Omega notation will be covered beside in this course that make the student to analyze programs and find the best algorithms.

11. Course objective:

This course will help the students to understand and analyze problems and to propose an optimal algorithms depending to the data style and available resources, the students will learn

- what is algorithms and how to design one;
- using abstract data structure;
- the difference between all sort type and which one is the best depending to the data;
- the difference between all search types and which one is the best according to the data
- Graph theory and how to represent in computer
- Hashing functions ;
- Scheduling algorithms and how to reach minimum time consumption

In the Practice lab. They analyse each item of algorithm independently and reassemble to create a real projects.

12. Student's obligation

There will be two main theoretical and practical exams plus a number of quizzes in the lab. The quizzes will be calculated as one exam mark.

13. Forms of teaching

The lectures will be created by Power point presentation viewed to students through data projector and the explanation will be done on the white board.

14. Assessment scheme

Student marks will be as follow

- Course 1 Theoretical exam will be out of 20
- Course 2 Theoretical exam will be out of 20
- Course 1 Practical exam will be out of 30
- Course 2 Practical exam will be out of 30
- The Lab quizzes calculated out off 30

The total over 50 marks then calculated as:
(Average of theoretical course 1 and 2) + (Average of practical course 1, practical course 2 and quizzes)
The final exam will take 50% of the theoretical exam.

15. Student learning outcome:

After the course taken by the student, the student must able to create an algorithm for any new problem and knows how to design, enhance and analyze algorithms for the projects and decide which type of algorithm must be using in a specific data style or situation.

16. Course Reading List and References:

Introduction to the design and analysis of algorithm, Anany Levitin 2011, Addison-Wesley Professional.

Introduction to algorithms, Thomas H. Cormen, Charles E. Leiserson Cambridge, Massachusetts London, England, 2009 Massachusetts Institute of Technology.

http://www.tutorialspoint.com/data_structures_algorithms/

http://online.stanford.edu/course/algorithms-design-and-analysis-part-1

17. The Topics:	Lecturer's name

Introduction to Algorithms, efficiency of algorithms. Basic Data Structure, array, linked list, stack queue and abstract data structure	Week 1 Week 2,3
Sorting algorithms, selection sort, bubble sort, insertion sort, merge sort and their algorithms and complexity	Week 4, 5 Week 6
Depth first search and breadth first search with their algorithms and applications	Week 7
Simple search and sort, sequential search, binary search and its complexity, graph theory search and graph implementation in computer	Week 8 and 9
Best, worst and average case analyze, Big O notation, O(1), O(N), $O(N^2)$, $O(2^N)$, O(log N), O(n log N)	Week 10, 11 and 12
Advanced search and sort methods, Interpolation search, Jump search, B-Tree, B^+ Tree	Week 13 and 14
Exam	Week 15
Optimization problems, Traveling salesman problem, Knapsack, Heuristic technique, Greedy algorithm, Heap Algorithm, Dynamic Programming	Week 16, 17 and 18
Big-Ω (Big-Omega) notation, Big-Theta Θ notation	Week 19
Job scheduling, preemptive vs. none preemptive scheduling, First come first serve, priority scheduling, Round-robin scheduling	Week 20 and 21
Hash function, Hash Table, Additive hash function, XOR Hash function, Bernstein hash, FNV hash, JSW hash,	Week 22 and 23
SHA-1 algorithm step by step Exam	Week 24 and 25 Week 26
18. Practical Topics (If there is any)	
Review C# Programing Generate random numbers and measure the time execution Implement problems using Divide –and-Conquer ,Dynamic Programing, Greedy Algorithms in C# Implementing Sort and Search algorithms Exam Implement Skip Lists, Binary Trees, Heaps, Hash Tables, perfect	Week 1-3 Week 4 Week 5-8 Week 9-14 Week 15 Week 16-20

Hashing , Cuckoo Hashing in C# Implement Minimum-cost Spanning Tree, Connected Components, and Shortest Paths (Depth-First-Search and Breadth-First-Search) in C# Exam	Week 21-25 Week 26

19. Examinations:

Q) Give formal definitions for the Big-Oh (O) asymptotic notations. Illustrate the definition using appropriate figures.

Q) State True or false.

1. The optimal size of a block to be jumped is n/2

2.The height of B-tree is O(n log n).

Q) What is the best time complexity of bubble sort?

A- n^2 B- n log n C- n D- n (log n) ^2

20. Extra notes:

21. Peer review