UNIVERSITI TEKNOLOGI MARA

CSC752: ADVANCED ALGORITHM & ANALYSIS

Course Name (English)	ADVANCED ALGORITHM & ANALYSIS APPROVED
Course Code	CSC752
MQF Credit	3
Course Description	Algorithmic problems form the core of computer science, and thus algorithm design and analysis is among its most fundamental elements. This course focuses on the clean mathematical modeling of real-world problems, identifying the appropriate advanced algorithm design techniques to these problems, and analyzing these algorithms. This is done by exploring a variety of real-world problems in various applications, including optimization and combinatorial problems. The algorithm design techniques topics and applications include divide and conquer, greedy algorithms, dynamic programming, network flow, NP-complete, approximation and other advanced algorithms.
Transferable Skills	Demonstrate ability to apply creative, imaginative and innovative thinking and ideas to problem solving. Demonstrate ability to investigate problems and provide effective solutions. Demonstrate ability to analyse issues/problems from multiple angles and make suggestions.
Teaching Methodologies	Lectures, Blended Learning
CLO	CLO1 Formulate algorithmic problems using mathematical modeling to form an organized value system CLO2 Design efficient algorithms to solve algorithmic problems by Identifying the appropriate design techniques for a particular algorithmic problem CLO3 Compute algorithms' efficiency using algorithm analysis techniques
Pre-Requisite Courses	No course recommendations

Topics
1. Introduction 1.1) Algorithm Analysis 1.2) Fundamentals of Algorithm Analysis 1.3) Asymptotic Notation 1.4) Basic Asymptotic Efficiency Classes 1.5) Algorithmic Problem Solving & Problem Modeling 1.6) Overview of Algorithm Design Techniques - Six Representative Problems 1.7) Analysis of Iterative & Recursive Algorithms
2. Divide and Conquer 2.1) Divide and Conquer Sorting 2.2) Closest Pair of Points / Huffman Codes
3. Greedy Algorithms 3.1) Coin Changing 3.2) Minimum Spanning Tree 3.3) Single Source Shortest Path / The Continuous Knapsack Problem
4. Dynamic Programming 4.1) Coin Changing Revisited 4.2) Weighted Interval Scheduling / Longest Common Subsequence 4.3) All Pair Shortest Path / Transitive Closure 4.4) 0-1 Knapsack

5. Approximation Algorithms 5.1) Traveling Salesman Problem 5.2) Knapsack Problem 5.3) Other Applications
6. Network Flow 6.1) Network Flow Problem 6.2) Ford-Fulkerson's Algorithm and Max-Flow / Min-Cut Problem 6.3) Network Flow Applications
7. Other Advanced Algorithms & Problems 7.1) Local Search 7.2) Randomized Algorithms 7.3) Parallel Algorithms
8. Case Studies 8.1) Problem Modeling 8.2) Algorithm Design 8.3) Algorithm Analysis

Assessment Breakdown	%
Continuous Assessment	100.00%

Details of Continuous Assessment

Assessment Type	Assessment Description	% of Total Mark	CLO
Assignment	Written Report	10%	CLO2
Assignment	Written Report	10%	CLO2
Group Project	Group Project (work in group)	40%	CLO1
Online Quiz	Online quiz	5%	CLO3
Online Quiz	Online quiz	5%	CLO3
Test	Test I	15%	CLO3
Test	Test 2	15%	CLO3

Reading List

Reference Book Resources

- **Goodrich, M.t., Tamassia, R. & Goldwasser, M.H. 2014, *Data Structures and Algorithms in Java*, 6 Ed., John Wiley**
- **Cormen, T.H 2013, *Algorithms Unlocked*, MIT Press**
- **Kleinberg, J. & Tardos, E. 2013, *Algorithm Design*, Pearson New International Edition. Pearson Higher Ed,**
- **Sedgewick, R. & Flajolet, P. 2013, *An Introduction to the Analysis of Algorithms*, 2 Ed., Addison-Wesley Professional**
- **Anany Levitin 2014, *Introduction to the Design and Analysis of Algorithms*, Pearson Higher Ed**

Article/Paper List: This Course does not have any article/paper resources

Other References: This Course does not have any other resources