هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA

2024
TP-153

Course Specification
(Bachelor)

Course Title:	Algorithm Design and Analysis
Course Code:	424CCS-3
Program:	Bachelor of Science in Computer Science
Department:	Department of Computer Science
College:	Computer Science and Information Systems
Institution:	Najran University
Version:	2.0
Last Revision Date:	August 2022

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
3 (3, 0, 1) [Theory, Lab, Tutorial]					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (Level 7/Year 4)					
4. Course General Description:					
This course introduces various algorithm design paradigms and the basics of computational complexity analysis using different models of computations with an overview of mathematical essentials, space and time complexities, and asymptotic notations. Design and analysis of algorithms covers linear programming, greedy algorithms, divide-and-conquer, backtracking, branch-and-bound, search methods, graph algorithms and introduction to NP-completeness.					
5. Pre-requirements for this course (if any)**:**					
321CCS-3					
6. Co-requisites for this course (if any)**:**					
None					
7. Course Main Objective(s):					

Upon the successful completion of this course, students will be able to:

- Describe important algorithmic problem types.
- Measure the efficiency of algorithms by evaluating the time complexity of an algorithm using the asymptotic notation (Big-O(O), Omega(Ω), Theta(θ))
- Analyze the expected performance of a particular algorithm in a particular context.
- Utilize mathematical techniques to analyze the efficiency of an algorithm and demonstrate the algorithmic correctness.
- Evaluate how to deal with problems for which no fast algorithms exist (NP-Completeness).

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	15
5.	**Others (specify)**	
Total		75

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Describe important algorithmic problem types.	K_1	Lectures, active learning, collaborative and cooperative learning and independent study assignments are used as teaching strategies. - Showing and delivering PPT presentations in the class. - Using a whiteboard to explain important points in more detail. - Motivating students to be active during class by asking questions regularly during lectures.	- Class Quizzes. - Midterm exam (Each exam consists of multiple choice questions, true/false, fill in the blanks, and theoretical questions.) - Final Exam

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
			- Giving students tutorials to solve examples.	
2.0	**Skills**			
2.1	Measure the efficiency of algorithms by evaluating the time complexity of an algorithm using the asymptotic notation (Big-O(O), Omega(Ω), Theta(θ))	S_1	- Showing and delivering PPT presentation in the class. - Using white board to explain important points in more detail. - Motivating students to be active during class by asking questions regularly during lecture. - Motivating students to work in home, to search from internet, to read related reference books by giving them assignments related to algorithm design and analysis techniques. - Compose more real life examples in the lecture relating to the surroundings of the students to draw attention that certainly helps them to concentrate more on the specific topic. - In some cases, pick one student who understood best a specific topic and let him describe in front of the class in his own manner. - Represent more easily understandable graphs/pictures in the class to describe certain topic and in that process use interesting words or interactive sounds to help students to improve their receptive memory. - Recall the topics of last lecture and the critical issues based on different topics, which certainly	Following methods are used to assess student's skills in this course. - Class quizzes. - Assignment. - Midterm exam - Final Exam
2.2	Analyze the expected performance of a particular algorithm in a particular context.	S_2		
2.3	Use mathematical techniques to analyze the efficiency of an algorithm and demonstrate the algorithmic correctness	S_1 , S_4		
2.4	Evaluate how to deal with problems for which no fast algorithms exist (NP-Completeness).	S_2 , S_5		

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
			helps students to recall memory frequently and store that topic in their memory for the long term. - Before starting a new topic or at the end of each topic, students are given a couple of minutes to imagine the real-life scenarios relating to that topic including implementation, advantages, deficiencies etc. to improve their logical thinking	
3.0	**Values, autonomy, and responsibility**			
3.1				
3.2				

C. Course Content

No	List of Topics	Contact Hours
1.	Fundamentals of algorithmic problem solving, important problem types and fundamental data structures	6
2.	Asymptotic notations and mathematical analysis	6
3.	Brute force	6
4.	Divide and conquer	6
5.	Dynamic Programming	6
6.	Greedy Algorithms	6
7.	Graph Algorithms	3
8.	NP-completeness and reducibility	3
9.	Coping with the Limitations of Algorithm Power: Backtracking, Branch and bound	3
Total		**45**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quiz # 01	3rd week	5%
2.	Quiz # 02	7th week	5%
3.	Assignment or mini project (presentation)	3th week	10%
4.	Assignment	8th week	10%
5.	Mid Term Exam	9th week	20%
6.	Final Exam	16th or 17th week	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	1. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition Publication date 13 Jan 2022, Pearson-Addison Wesley,
Supportive References	1. T.H. Cormen, C.H. Leiserson, R.L. Rivest and C. Stein, Introduction to Algorithms, Fourth Edition Publication date 05 Apr 2022, The MIT Press(ISBN 0-262-03293-7) & McGraw-Hill Book Company(ISBN 0-07-013151-1). Note: Handouts will be distributed in class, when appropriate, to cover some of the course topics.
Electronic Materials	N/A
Other Learning Materials	N/A

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Lecture Rooms with 20 seats and a whiteboard or a smart board.
Technology equipment (projector, smart board, software)	Desktop/ Laptop computer Multimedia Projector.
Other equipment (depending on the nature of the specialty)	A File cabinet to keep Class Stuff, Markers, papers and student Files, and a printer to print program screenshots.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Collecting students' suggestions to facilitate more during the class.	Students	Verbal discussion
Student's questionnaire once during the semester about course learning outcomes.	Students	Indirect Survey
Achievement percentage of course learning outcomes, direct evaluation using CLO assessment sheet	Course Instructor	Direct evaluation using CLO achievement calculation
Teaching strategies	Quality unit	Indirect
Assessment methods	Quality unit	Indirect
Instructor performance	Quality unit	Indirect
Course content	Quality unit	Indirect

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Computer Science Departmental Council
REFERENCE NO.	14440203-0185-00002
DATE	1st Sep, 2022