

### National Computing Education Accreditation Council NCEAC



NCEAC.FORM.001-D

#### **COURSE OUTLINE**

**INSTITUTION** University of Management & Technology, Lahore

#### PROGRAM (S) TO BE EVALUATED BS Computer Science

#### **Course Description:**

Course Code	CS3044
Course Title	Analysis of Algorithms
Credit Hours	3
Prerequisites by Course(s) and Topics	Discrete Structures, Data Structures and Algorithms
Assessment Instruments with Weights (quizzes, assignments, midterms, final, etc.)	Assignments 20 % Quiz 20 % Midterm 25 % Final Term 35 %
Course Moderator	Amjad Ali
Current Catalog Description	
Textbook (s)	<b>T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein</b> : Introduction to Algorithms, MIT Press, 2 <sup>nd</sup> Edition 2002.
Reference Material	<ul> <li>Anany Levitin: Introduction to the Design and Analysis of Algorithms, 3<sup>rd</sup> Edition, PEARSON</li> <li>Richard Neapolitan: Foundations of Algorithms, Fourth Edition 2011.</li> <li>Parag Himanshu Dave, Design and Analysis of Algorithms, PEARSON, 2<sup>nd</sup> Edition.</li> </ul>
Course Goals	The major objective of this course is providing comprehensive knowledge of modern computer algorithms and solving scientific and engineering problems efficiently and accurately. The students will be motivated to think about procedures solving real world problems optimally and correctly. Real world problem will be taken as examples to create feelings about the usefulness of this course.



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**Course Learning Outcomes (CLOs):** 

Measurable Learning	CLOs	Description	Domain & Level
Outcomes	CLO 1	<b>ARGUE</b> and <b>PROVE</b> the correctness of algorithms using rigorous mathematical techniques taught in this course.	C4
	CLO 2	ANALYZE the time complexity of different algorithms.	C3
	CLO 3	COMPARATIVE analysis of different algorithm's design techniques.	C4
	CLO 4	<b>DESIGN</b> algorithms for different kind of problems using efficient algorithm design techniques for real life problems.	C4

**Mapping of CLOs to Program Learning Outcomes (PLOs):** 

CLOs/PLOs	CLO 1	CLO 2	CLO 3	CLO 4
PLO 1: Academic Education				
PLO 2: Knowledge for Solving Computing Problems				<b>√</b>
PLO 3: Problem Analysis	✓	<b>√</b>	<b>✓</b>	
PLO 4: Design and Development of Solutions				<b>√</b>
PLO 5: Modern Tool Usage				
PLO 6: Individual and Teamwork				
PLO 7: Communication				
PLO 8: Computing Professionalism and Society				
PLO 9: Ethics				
PLO 10: Life Long Learning				✓

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#### **Tentative Lecture Plan:**

In the Course    1-2	Topics Covered	Week	Topics	Assessments	CLOs			
1-2   What is Algorithm? Properties of Algorithm.   Analysis: Correctness   3-4   Correctness of Algorithms: Iterative and Recursive   Algorithms   Analysis: Time Complexity   5-6   Time Complexity of Iterative Algorithms   Quiz-3   CLO2   Time Complexity of Recursive Algorithms   Quiz-3   CLO2   Analysis: Time Complexity   Solving Recurrence Relations by   7   Substitution Method   Assignment-1   CLO2   Recursion Tree Method   Mater Theorem   Analysis: Asymptotic Analysis   Orders of Growth   8   Big O   Mid Term   CLO2   Big Omega   Big Theta   Algorithm Design: Brute Force Technique (Exhaustive Search)   Quiz-4   CLO3   Assignment -2   CLO4   CLO4   CLO4   CLO5   CLO4   CLO5		- III	•	. 13553311161163	3203			
Analysis: Correctness Correctness of Algorithms: Iterative and Recursive Algorithms  Analysis: Time Complexity Time Complexity of Iterative Algorithms  Analysis: Time Complexity Solving Recurrence Relations by  7		1-2		Quiz-1	CLO1			
3-4   Correctness of Algorithms: Iterative and Recursive Algorithms   Analysis: Time Complexity	_							
Algorithms Analysis: Time Complexity Time Complexity of Iterative Algorithms Time Complexity of Recursive Algorithms  Analysis: Time Complexity Solving Recurrence Relations by  7		2.4		Oui- 2	CLO1			
S-6   Time Complexity of Iterative Algorithms   Quiz-3   CLO2		3-4		Quiz-2	CLOI			
Time Complexity of Recursive Algorithms  Analysis: Time Complexity Solving Recurrence Relations by  Recursion Tree Method Recursion Method Recurs			Analysis: Time Complexity					
Analysis: Time Complexity Solving Recurrence Relations by 7		5-6	. ,	Quiz-3	CLO2			
Solving Recurrence Relations by  Substitution Method Recursion Tree Method Mater Theorem  Analysis: Asymptotic Analysis Orders of Growth  Begin Companies Big Onega Big Onega Big Onega Big Theta  Algorithm Design: Brute Force Technique (Exhaustive Search) CLO4  Algorithm Design: Brute Force Technique (Exhaustive Search) CLO4  Algorithm Design: Divide and Conquer Paradigm Merge Sort Quiz-5 Quiz-5 CLO4  Algorithm Design: Dynamic Programming Algorithm Design: Dynamic Programming Shapent On (in  Algorithm Design: Dynamic Programming Assignment -3 CLO3, CLO4  Algorithm Design: Dynamic Programming Assignment -3 CLO4  Assignment -3 CLO4  CLO3 CLO4  CLO3 CLO4  CLO4  CLO4  Assignment -3 CLO4  Assignment -3 CLO4  Assignment -3 CLO4  Assignment -3 CLO4			Time Complexity of Recursive Algorithms					
7 Substitution Method PRECURSION Tree Method Nater Theorem  Analysis: Asymptotic Analysis Orders of Growth  8 Big O Pation Big Omega Big Theta  Algorithm Design: Brute Force Technique (Exhaustive Search) Clo4 Clo4 Clo3 Assignment -2 Clo4  Algorithm Design: Brute Force Technique (Exhaustive Search) Clo4 Clo4 Clo3 Assignment -2 Clo4  Algorithm Design: Doubled and Conquer Paradigm Algorithm Design: Divide and Conquer Paradigm Clo4  Algorithm Design: Divide and Conquer Paradigm Algorithm Design: Dynamic Programming Algorithm Design: Dynamic Programming Clo3 Clo4  Algorithm Design: Dynamic Programming Algorithm Design: Dynamic Programming Algorithm Design: Dynamic Programming Algorithm Design: Oynamic Programming Algorithm Design: Oynamic Programming Assignment -3 Clo4  Algorithm Design: Greedy Algorithms Activity Selection  Class Time Spent on (in								
Recursion Tree Method  Mater Theorem  Analysis: Asymptotic Analysis Orders of Growth  8 Big O Big Omega Big Theta  Algorithm Design: Brute Force Technique (Exhaustive Search) CLO4  CLO3, Assignment -2 CLO4  Algorithm Design: Divide and Conquer Paradigm CLO4  Algorithm Design: Divide and Conquer Paradigm CLO4  Algorithm Design: Dynamic Programming CLO4  Algorithm Design: Dynamic Programming CLO3, CLO4  Algorithm Design: Dynamic Programming Algorithm Design: Dynamic Programming CLO3, CLO4  Algorithm Design: Dynamic Programming Algorithm Design: Dynamic Programming CLO3, CLO4  Algorithm Design: Greedy Algorithms Algorithm Design: Greedy Algorithms Algorithm Design: Greedy Algorithms Algorithm Design: Greedy Algorithms Activity Selection  Class Time Spent on (in			•					
Mater Theorem      Analysis: Asymptotic Analysis     Orders of Growth      Big O     Big Omega     Big Theta      Algorithm Design:     Brute Force Technique (Exhaustive Search)     O-1 Knapsack Problem     O-1 Knapsack Problem      Algorithm Design: Divide and Conquer Paradigm      11-12     Merge Sort     Quiz-5     Quiz-5     Algorithm Design: Dynamic Programming     Assembly Line Scheduling  Algorithm Design: Greedy Algorithms     Activity Selection		7		Assignment-1	CLO2			
Analysis: Asymptotic Analysis Orders of Growth  8								
Orders of Growth Big O Big Omega Big Theta  Algorithm Design: Brute Force Technique (Exhaustive Search) CLO3, Assignment -2 CLO4  Algorithm Design: Divide and Conquer Paradigm CLO3, CLO4  Algorithm Design: Divide and Conquer Paradigm CLO3, CLO4  Algorithm Design: Divide and Conquer Paradigm CLO3, CLO4  Algorithm Design: Dynamic Programming CLO3, CLO4  Algorithm Design: Dynamic Programming CLO3, CLO4  Algorithm Design: Dynamic Programming Assignment -3 CLO4  Algorithm Design: Opnamic Programming Assignment -3 CLO4  Algorithm Design: Greedy Algorithms Assignment -3 CLO4  Class Time Spent on (in	_							
8 Big O Big Omega Big Theta  Algorithm Design: Brute Force Technique (Exhaustive Search) CLO3 CLO4  Algorithm Design: Brute Force Technique (Exhaustive Search) CLO4 CLO3, Assignment -2 CLO4  Algorithm Design: Divide and Conquer Paradigm CLO3, Assignment -2 CLO4  Algorithm Design: Divide and Conquer Paradigm CLO3, CLO3, CLO4  Algorithm Design: Dynamic Programming Rod Cutting Problem Chain Matrix Problem  15 Algorithm Design: Dynamic Programming Assignment -3 CLO4  Algorithm Design: Greedy Algorithms Assignment -3 CLO4  Algorithm Design: Greedy Algorithms Activity Selection  Class Time Spent on (in								
Big Omega Big Theta  Algorithm Design: Brute Force Technique (Exhaustive Search) CLO3, Assignment -2 CLO4  Algorithm Design: Divide and Conquer Paradigm 11-12 Merge Sort Quiz-5 Quiz-5 Quiz-5 CLO3, CLO3, CLO4  Algorithm Design: Dynamic Programming 13-14 Rod Cutting Problem Chain Matrix Problem  15 Algorithm Design: Dynamic Programming CLO3, CLO4  Algorithm Design: Dynamic Programming Assignment -3 CLO4  Algorithm Design: Greedy Algorithms 16 Dijkstra's algorithm Activity Selection  Abours per week  Algorithm Design: Greedy Algorithms Activity Selection				Mid Term	CLOO			
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## Chain Matrix Problem ## O-1 Knapsack Problem ## Algorithm Design: Divide and Conquer Paradigm ## 11-12  ## Merge Sort ## Quick Sort ## Quick Sort ## Algorithm Design: Dynamic Programming ## Rod Cutting Problem ## Chain Matrix Problem ## Assignment -2  CLO4 ## CLO3, CLO4 ## CLO3 ## CLO4 ## CLO4 ## Assignment -3  CLO4 ## Assignment -3  CLO4 ## Algorithm Design: Dynamic Programming ## Assignment -3  CLO4 ## Algorithm Design: Greedy Algorithms ## Algorithm Design: Greedy Algorithms ## Activity Selection ## Class Time Spent on (in				Ouiz-4	CLO3			
O-1 Knapsack Problem		9-10	• •					
Algorithm Design: Divide and Conquer Paradigm  11-12  Merge Sort Quiz-5  Quiz-5  CLO3, CLO4  Algorithm Design: Dynamic Programming 13-14 Rod Cutting Problem Chain Matrix Problem  15  Algorithm Design: Dynamic Programming CLO3, CLO4  Algorithm Design: Dynamic Programming Assignment -3  CLO4  Algorithm Design: Greedy Algorithms 16 Dijkstra's algorithm Activity Selection  Class Time Spent on (in				Assignment -2	CLO4			
11-12								
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Algorithm Design: Dynamic Programming  13-14  Rod Cutting Problem Chain Matrix Problem  15  Algorithm Design: Dynamic Programming Assignment -3  CLO4  Algorithm Design: Greedy Algorithms 16  Dijkstra's algorithm Activity Selection  Class Time Spent on (in		11112		Quiz 3	CLO4			
13-14								
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Algorithm Design: Dynamic Programming Assignment -3 CLO4  Algorithm Design: Greedy Algorithms 16 Dijkstra's algorithm Quiz-8 CLO4 Activity Selection  Class Time Spent on (in		15 14		Quiz 0, Quiz 7	CLO4			
Assignment -3 CLO4  Algorithm Design: Greedy Algorithms  16 Dijkstra's algorithm Activity Selection  Class Time Spent on (in	_							
Algorithm Design: Greedy Algorithms  16 Dijkstra's algorithm Quiz-8 CLO4  Class Time Spent on (in		15		Assignment -3	CLO4			
16 Dijkstra's algorithm Activity Selection  Class Time Spent on (in								
Class Time Spent on (in								
Class Time 3 hours per week Spent on (in		16	,	Quiz-8	CLO4			
Spent on (in		2 1-	<u> </u>					
		3 N	ours per week					



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**Mapping of CLOs to Direct Assessments** 

CLOs	Quiz 1	Quiz 2	Quiz 3	Quiz 4	Assignment 1	Assignment 2	project	Mid Term	Final Term
1	✓	✓							
2			✓		✓			✓	✓
3				✓		✓			✓
4				✓		✓	✓		✓

Instructor Signature		

**Instructor Name: Rana Marwat Hussain**