

CS-302 Design and Analysis of Algorithms

Spring 2021

National University of Computer and Emerging Sciences – FAST, Lahore

Credit Hours: 3

Prerequisites: Data Structures

Instructors: Sarim Baig (sarim.baig@nu.edu.pk)

Course Website: <https://classroom.google.com>

Class code: go2rrrom

Class Meet Link: <https://meet.google.com/lookup/c2km7ltfof>

Office Hours: Tuesday and Thursday 01:10 – 02:10

Texts:

- *Introduction to Algorithms* by Cormen, Leiserson, Rivest, and Stein, 3rd Ed., MIT Press, 2001.
- Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, *Algorithms*, McGraw-Hill Education
- **Plus:** material on the web shared through the course website, etc.

Objectives:

To study canonical algorithms design techniques; the methods of analyses required to evaluate design; proofs of correctness of algorithms, the span and style of algorithms in today's computing.

Grading Policy:

We will use absolute grading scheme. Specific marks brackets and the corresponding grades are available on course website.

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| • Quizzes (3-4) | 10% (announced, <i>based on</i> homeworks) |
| • Homeworks (5) | 30% |
| • Mid term I | 10% |
| • Mid term II | 10% |
| • Final exam | 40% |

Homeworks may be done in groups of 2. Cross-group work will be considered cheating. The group must remain the same throughout the course. If you're working alone, there'll be no compensation for that.

Outline and Distribution:

Following is a **tentative break-down**. It is the bare minimum content that we will cover. There will be other topics building on these ones which we shall discuss as they come.

Lectures	Description	Chapters of Text
Week -1	The role of algorithms in computers,	1, 2, 3

	Asymptotic functions and notations (Big-oh, big-omega, theta) best and worst case time complexity	
Week – 2, 3, 4	Divide and Conquer (maximum subarray, quicksort, merge sort, large integer multiplication) + Solving recurrences	2, 3, 6
Week – 5	Lower bound for comparison based sorting, Sorting in linear time: Count Sort, Radix Sort, Bucket Sort	8
	Midterm – I	
Week – 6	Introduction to graphs (revision of BFS, DFS) and their application (Bridges and articulation point, topological sort, strongly connected components)	22
Week – 7, 8	Dynamic Programming (maximum subarray, rod cutting, edit distance, longest increasing/decreasing subsequence)	15
Week – 9, 10	Greedy Algorithms (Activity selection, fractional knapsack and Huffman codes) proof of correctness	16
	Midterm – II	
Week – 11	Minimum Spanning Trees (MST)(Prim's Algorithm and Kruskal's Algorithm)	23
Week – 12	Shortest Path Algorithms (dijkstra's Algorithm, BellmanFord and Warshall Algorithm)	24
Week – 13, 14	B-Trees/Hashing/Exhaustive Search intractable problems	
	Final Exam	Comprehensive