BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI, HYDERABAD CAMPUS
SECOND SEMESTER 2021-2022
COURSE HANDOUT (PART-II)

Date: 09/01/2024

In addition to Part I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No. : **CS F364**
Course Title : **Design and Analysis of Algorithms**
Instructor-in-charge : Tathagata Ray
Instructor : Venkatakrishnan Ramaswamy and Apurba Das

1. Scope and Objective

This course is the next logical step after the course on Data Structures and Algorithms. This course introduces students to different paradigm of algorithms and various techniques to analyze them. The analysis is of the correctness of the algorith09m and the time complexity (also space complexity). They will also learn about the computational intractability; a class of NP-complete problems and techniques to prove NP-completeness. They will learn major techniques to deal with such computationally intractable set of problems.

The objective of the course is to impart students with different algorithmic paradigm and its characteristics. The students at the end of the course will be able to

- To identify suitable algorithms or data structure to apply for a given problem.
- Will be able to argue about the time complexity of algorithms.
- Will be able to write the proof of correctness of algorithms.
- Will be able to understand the intricacies involved in choosing the right data structures to implement algorithms.
- Will be able to implement computational geometric algorithms.

2. Text Books

(T1) Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein. Introduction to Algorithms. Third Ed. MIT(2010)

3. Reference Books:

(R1) Jon Kleinberg, Eva Tardos. Algorithm Design. First Ed. Pearson (2012)
(R2) E. Horowitz, S. Sahni, S. Rajsekaran. Fundamentals of Computer Algorithms. Second Ed. University Press.
(R3) R. Motwani, P. Raghavan. Randomized Algorithms CUP, 1995.
(R4) G. Auseiello, et.al. Complexity and Approximation, Springer.
(AR) Additional Reading assignments

4. Lecture Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
01-04	• Introduction to algorithms • Revision of asymptotic notations. • Revision of any datastructure • Nderstand UAverage Case Analysis.	**Revision of Basics**	T1-Chapter-1,2,3
05-20	• Learn Basic principle of Divide and Conquer. • Learn Recursion of Divide and Conquer. • Understand what is Greedy Strategy and how to prove the correctness of Greedy Algorithm. • Understand difference between Greedy and Dynamic programming. • Learn implementing Memoization. • Learn writing recursion for Dynamic	**Basic Design Techniques:** *Divide and conquer, Greedy, Dynamic Programming.*	T1-Chapter-4,15,16,23,24,25, R1, R2, AR
21-26	• Understand Network Flow Problem • Learn Ford-Fulkerson Algorithm • Learn Applications of Network flow. • Understand Difference between deterministic and Randomized algorithm • Learn how to analyze Randomized Algorithm	**Specialized design techniques :** *Network flow, Randomization (Examples, Analysis, Limitation)*	T1-chapter 26, 5, R1, R2, R3, AR
27-33	• Introduction to decision problems. • Understand difference between P and NP. • Learn the complexity classes NP-complete and NP-Hard • Understand the significance of SAT. • Learn to prove reduction for proving NP-completeness.	**Complexity Classes and Hardness of problems:** *P, NP, Reductions, NP hardness and NP Completeness, reduction techniques, Some standard NP complete problems*	T1-Chapter-34, R4, AR
34-37	• Introduction Famous N-Queen Problem. • Introduction to Backtracking and Branch and Bound • Introduction to Approximation algorithm and Approximation class	**Design techniques for Hard Problems:** *Backtracking, branch and Bound, Approximation algorithms*	T1-Chapter-35, R2, R4, AR
38-40	• Understand significance of Linear Programming • Learn applications of LPP • Understand geometric understanding of LPP and extrema Theorem. • Learn the Simplex Algorithm.	**Linear Programming:** *LP Problems and Simplex algorithms.*	T1-Chapter-29, AR
41-42	• Understand analysis of parallel programs. • Learn basic approaches towards parallel programming	*Introduction to design and analysis of parallel and multithreaded programming*	T1-Chapter-27, R1, R2, AR

5. Evaluation Scheme:

S. No.	Evaluation Component	Duration	Date and Time	Weightage (%)	Nature of Component
1.	Assignment (at least 5% will be covered before the Mid-Sem grading)	Take Home	TBA	25	Open Book
2.	Continuous Assessment in	-	Weekly	10	Open Book

	Tutorials				
3.	Midterm	90 Mins	14/03 - 9.30 - 11.00AM	30	Closed Book
4.	Comprehensive	3 Hours	13/05 FN	35	Closed Book

Chamber Consultation Hour: TBA

Notices: All notices pertaining to this course will be displayed on the CMS. Specific instructions will be often given in the class only.

Make-Up Policy:
No makeups will be given for Assignments and Continuous Assessments
Makeup for the Midsemester Exam can be given only for genuine cases and that too with prior approval from the instructor in charge. Makeup for the comprehensive exam will be decided as per instructions issued by AUGSD.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-in-charge
Tathagata Ray