Design and Analysis of Algorithms CSE2012

Dr. Ramesh Ragala

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- **Course Objectives:**
  - To provide a mathematical foundation for analyzing and proving the efficiency of an algorithm.
  - To focus on the design of algorithms in various domains of computer engineering.
  - To provide familiarity with main thrusts of work in algorithms sufficient to give some context for formulating and seeking known solutions to an algorithmic problem.

- **Expected Course Outcome:** On completion of this course, student should be able to
  - Ability to use mathematical tools to analyze and derive the running time of algorithms and prove the correctness.
  - Explain and apply the major algorithm design paradigms.
  - Explain the major graph algorithms and their analyses.
  - Explain the major String Matching algorithms and their analysis.
  - Explain the major Computational Geometry algorithms and their analysis.
  - Provide algorithmic solutions to real-world problem from various domains.
  - Explain the hardness of real world problems with respect to algorithmic efficiency and learning to cope with it.

- **Algorithm Development**
  - Stages of algorithm development for solving a problem:
    - Describing the problem
    - Identifying a suitable technique
    - Design of an algorithm
    - Proof of Correctness of the algorithm

Syallbus: MODULE - II

- **Algorithm Design Techniques**
  - Brute force techniques:
    - Travelling Salesman Problem
  - Divide and Conquer:
    - Finding a maximum and minimum in a given array
    - Strassen'sMatrix multiplication
  - Greedy techniques:
    - Huffman Code and Data Compression
    - Fractional Knapsack problem
  - Dynamic programming
    - 0/1 Knapsack problem
    - Matrix chain multiplication
    - LCS
    - Travelling Salesman Problem
  - Backtracking Technique:
    - N-Queens Problem
    - Knights Tour on Chess Board

Syallbus: MODULE - III

- **String Matching Algorithms**
  - Naïve String matching Algorithms
  - KMP algorithm
  - Rabin-Karp Algorithm

Syallbus: MODULE - IV

- **Computational Geometry Algorithms**
  - Line Segments
    - properties
    - intersection
  - Convex Hull finding algorithms
    - Graham's Scan Algorithm
    - Jarvis's March Algorithm

- **Graph Algorithms**
  - All pair shortest path
    - Floyd-Warshall Algorithm
  - Network Flows
    - Flow Networks
    - Maximum Flows
    - Ford-Fulkerson Algorithm
    - Push Re-label Algorithm
    - Minimum Cost Flows
    - Cycle Cancelling Algorithm

Syallbus: MODULE - VI

- **Complexity Classes**
  - P and NP Class
  - Reducibility
  - NP-completeness
  - SAT (without proof)
  - 3-SAT
  - Vertex Cover
  - Independent Set
  - Maximum Clique

Syallbus: MODULE - VII

- **Approximation and Randomized Algorithms**
  - Approximation Algorithms
    - set-covering problem
    - Vertex cover problem
    - K-center clustering
  - Randomized Algorithms
    - Hiring problem
    - Finding the global Minimum Cut

Syallbus: MODULE - VIII

- **Recent Trends**
  - Guest Lecture by Industry Expert

Text Book

- Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms, Third edition, MIT Press, 2009.

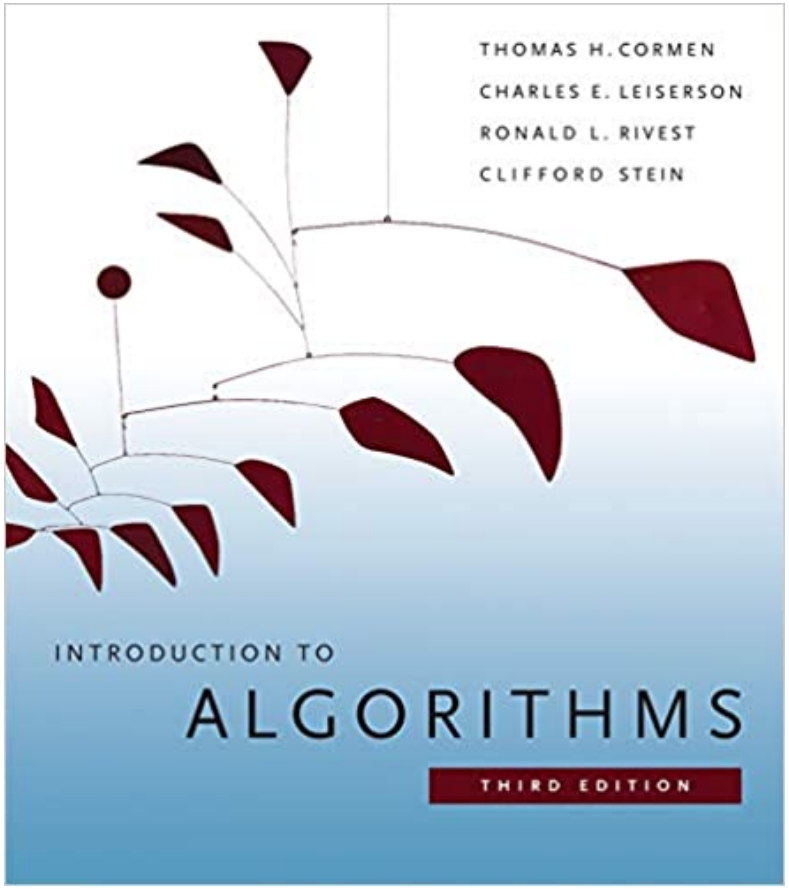

Figure: Front cover of the book

Reference Book

- Jon Kleinberg, ÉvaTardos ,Algorithm Design, Pearson education, 2013

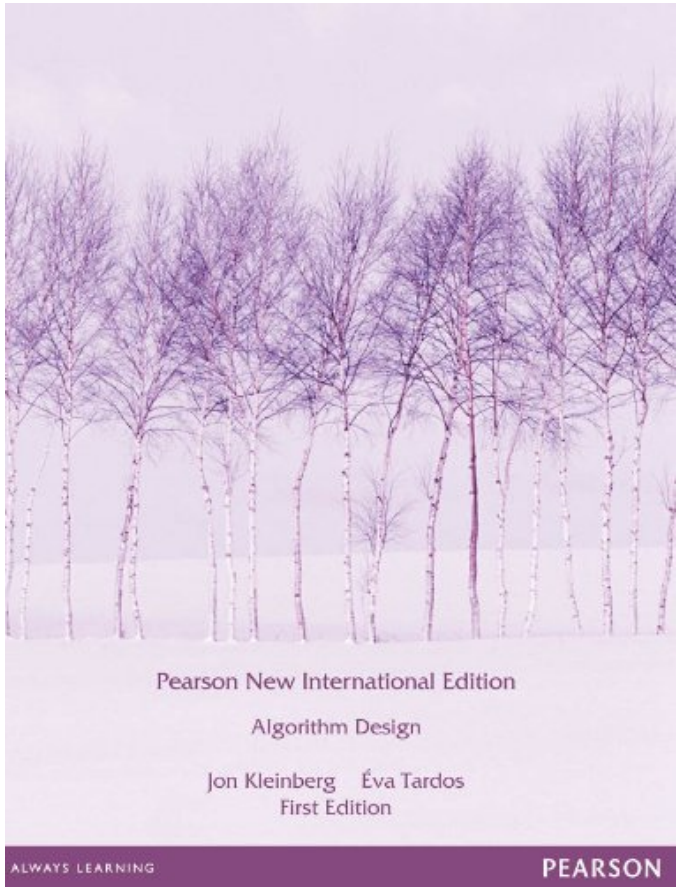

Figure: Front cover of the book

Reference Book

- Ravindra K. Ahuja, Thomas L. Magnanti, and James B. Orlin, "Network Flows: Theory, Algorithms, and Applications", Pearson Education, 2014

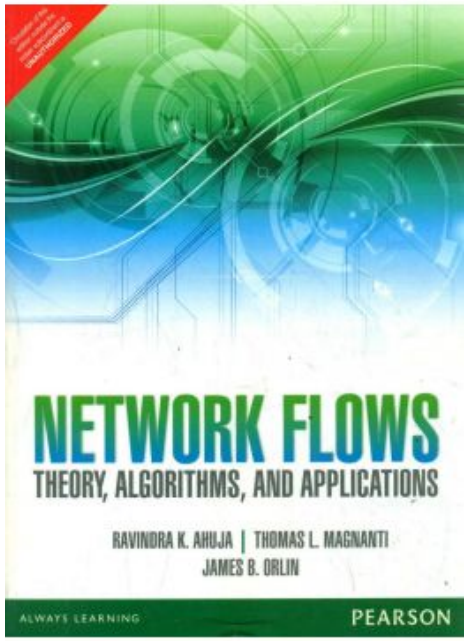

Figure: Front cover of the book

Assessment	Marks
CAT - 1	15
CAT - 2	15
Quiz - 1	10
Quiz - 2	10
Oral Presentation	10
FAT	40
Total	100