
COURSE INTRODUCTION

This course provides insight into design and analysis of an algorithm. An algorithm is a well defined computational procedure that takes some inputs and transforms into desired outputs in finite amount of time. An algorithm is a finite sequence of instructions or steps to achieve some particular output. An overall goal of making an analysis of an algorithm is to have an understanding of the complexity of algorithm in terms of time complexity. In general the complexity simply refers to running time of an algorithm. There are three cases in general to find the complexity: Best case, Worst case, Average case. There are few fundamental techniques which are used to design efficient algorithms: Divide and Conquer, Greedy Technique, Dynamic Programming, Backtracking and Branch & Bound. The course describes all these techniques with appropriate examples.

This course is divided into two blocks. In Block-1, basic characteristics of an algorithm and recurrence are explained. A recurrence is an equation or inequality that describes a function in terms of its value on smaller inputs. Further asymptotic notations are discussed that provides how to compare two algorithms and study the behavior of an algorithm in respect of input size. Few problems like Euclid's algorithm to compute GCD, Matrix Multiplication etc. and their complexity analysis are explained. Some basic sorting algorithms like Bubble sort, Insertion sort etc. and their complexity are analyzed in terms of best case, worst case and average case. In Block-2, few approaches to solve the problem like Greedy Techniques, Divide & Conquer Strategy and Basic graph algorithm are discussed. Greedy algorithm explores optimization problems. In graph algorithms, two different approaches for search in the graph and their analysis is discussed i.e Depth first search (DFS) and Breadth first search (BFS).

Reference Books:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest, Clifford Stein, "Introduction to Algorithms", 2nd Ed., PHI, 2004.
2. Robert Sedgewick, "Algorithms in C", 3rd Edition, Pearson Education, 2004
3. Ellis Horowitz, Sartaj Sahani, Sanguthevar Rajasekaran, "Fundamentals of Computer algorithms", 2nd Edition, Universities Press, 2008
4. Anany Levitin, "Introduction to the Design and Analysis of Algorithm", Pearson Education, 2003.