Lecture Notes

on

Introduction- Algorithms

06 July 2020
(Be safe and stay at home)

Syllabus-BCSE3031

Table: Tentative course plan

Unit	Topics	Duration
1	Introduction of algorithms	9
2	Advanced Data Structures	9
3	Greedy Algorithms	9
4	Dynamic Algorithms	9
5	Computations	9
Additional	Discussion on some of the latest products available	2

References:

1. Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, Introduction to Algorithms, The MIT Press, 3rd edition, 2009.

2. Horowitz E, Sahni S. Fundamentals of computer algorithms. Computer Science Press; 1978.

Course Objective Outcomes

Course Objective:

The primary objective of this course is to introduce the topic of algorithms as a precise mathematical concept, and study how to design algorithms, establish their correctness, study their efficiency and memory needs. The course consists of a strong mathematical component in addition to the design of various algorithms.

Course Outcomes:

- CO1-BCSE3031:Analyze the complexity of the algorithms and use technique divide and conquer to solve the problems
- CO2-BCSE3031:Identify feasible solutions for different problems through greedy method and minimize the solutions space and to solve the problems through dynamic programming.
- CO3-BCSE3031:Solve the problems through graph algorithms.
- CO4-BCSE3031:Justify that a certain problem is NP-Complete
- CO5-BCSE3031:Understand and apply linear programming concepts to real time applications.

Introduction

- Algorithm comes from the author named *Abu Ja'far Mohammed ibn Musa al Khowarismi*

- He was a Parsian mathamatician who wrote a book on Calculation with Hindu Numerals. around 825 AD.

- **An algorithm is a finite set of instructions that, if followed, accomlishes a particular task.**
  or

- **It is a well defined procedure which will take a set of values as an input and produce a set of values as an output.**

Properties of an algoritm:

There are five properties of any algorithm:

1. **INPUT:**
   It should take zero or more no. of input.

2. **OUTPUT:**
   It should produce atleast one output.

3. **DIFINITENESS:**
   It should not be ambigious. (e.g. d=a+b-c)

4. **FINITENESS:**
   It should produce the output with in the finite amount of time.

5. **EFFECTIVENESS:**
   It should produce the same output for the given input at any instance of time.

Why we study "ALGORITHMS"

The study of an algorithm includes many important and active area of research. There are four distinct area of study one can identify:

1. How to devise an algorithm?
2. How to validate an algorithms?
3. How to analyse an algorithm?
4. How to test a program?
   i) Debugging
   ii) Profiling

Steps to construct an Algorithm:

There are total six steps to construct any algorithm.

1. Problem Defination
2. Design Algorithm
3. Flow-chart
4. Verification & Testing
5. Implementation
6. Analysis