CS & IT ENGINEERING

Algorithms

Introduction to Algorithms and Analysis

Lecture No.- 01

By- Dr. Khaleel Khan Sir

Topics to be Covered

Topic Introduction to the Course

ABOUT ME

Hello, I'm Dr. Khaleel Ur Rahman Khan.

1. Ph.D. in Computer Science.
2. Professor in Computer Science.
3. Has more than 28 Years of Experience in Teaching at Engineering Colleges.
4. Published more than 50 journal articles in the areas of Wireless Networks.
5. Seven candidates have been awarded Ph.D. under his Supervision.
6. Has more than 22 years of Educating and Mentoring the GATE Aspirants.

By- Dr. Khaleel

My PW Official Telegram Channel

https://t.me/KhaleelSirPw

Slide

Topic : Lecture Schedule

Design & Analysis of Algorithms
(1) (2)

1. Analysis of Algorithms

- 1.1 Algorithm Concept and Lifecycle
- 1.2 Analysis of Algorithms
- * 1.3 Methodology & Types of Analysis
- * 1.4 (Asymptotic Notations) ASN 2/3 Q's
- * 1.5 Framework for Analysing Recursive Algorithms
- 1.6 Apriori analysis of Non-Recursive Algorithms
- * 1.7 Analysing Loops (loop Complexities)
- 1.8 Space Complexity
- 1.9 Mathematical Background

Topic : Lecture Schedule

Design Strategies

2. Divide & Conquer

- 2.1 General Method
- 2.2 Max-Min Problem
- * 2.3 Merge Sort
- 2.4 Binary Search
- * 2.5 Quick Sort
- 2.6 Matrix Multiplication
- (*) 2.7 Long Integer Multiplication (LIM)
- (*) 2.8 * Master Method for D and C Recurrences
- 2.9 * Recursion Tree

Case. Studies / Applications

Topic : Lecture Schedule

3. Greedy Method

- 3.1 General Method
- 3.2 Knapsack Problem
- 3.3 Job Sequencing with Deadlines
- 3.4 Optimal Merge Patterns
  - 3.4.1 Huffman Coding
- 3.5 Minimum Cost Spanning Trees
  - 3.5.1 Prims Method
  - 3.5.2 Kruskal's Method
- 3.6 Dijkstras Shortest Paths Problem

Topic : Lecture Schedule

4. Dynamic Programming (DP)

4.1 The Method

4.2 Difference between DP, Greedy Method and DandC

4.3 Multistage Graphs

4.4 Travelling Salesperson Problem

4.5 Binary Knapsack Problem

4.6 All Pairs Shortest Paths

4.7 Bellman-Ford Single Source Shortest Paths

4.8 Longest Common Subsequence (LCS)

4.9 Matrix Chain Multiplication (MCP)

4.10 Sum of Subsets (SoS)

4.11 Reliable System Design

4.12 Optimal Cost Binary Search Tree

Applications

Topic : Lecture Schedule

5. Graph Algorithms

5.1 Representation of Graphs

5.2 Graph Traversals

DFS

- 5.2.1 Undirected Connected Graphs
- 5.2.2 Undirected Disjoint Graphs: DFT
- 5.2.3 Directed Graphs & Types of Edges
- 5.2.4 DAG

BFS

- 5.2.5 FIFO BFS
- 5.2.6 LIFO BFS
- 5.2.7 LC BFS

5.3 Parenthesization Theorem

Topic : Lecture Schedule

6. Heap Algorithms

6.1 Operations : Create, Insert, Delete, Modify

6.2 Applications : Heapsort

Topic : Lecture Schedule

7. Sets

7.1 Representations

7.2 Operations

Topic : Lecture Schedule

8. Soring Algorithms

- 8.1 Basic terminology
- 8.2 Methods
  - 8.2.1 Bubble Sort
  - 8.2.2 Selection Sort
  - 8.2.3 Insertion Sort
  - 8.2.4 Radix Sort

Topic : Lecture Schedule

Weightage : 8-10 M
(12-14 M)

9. Backtracking & Branch and Bound

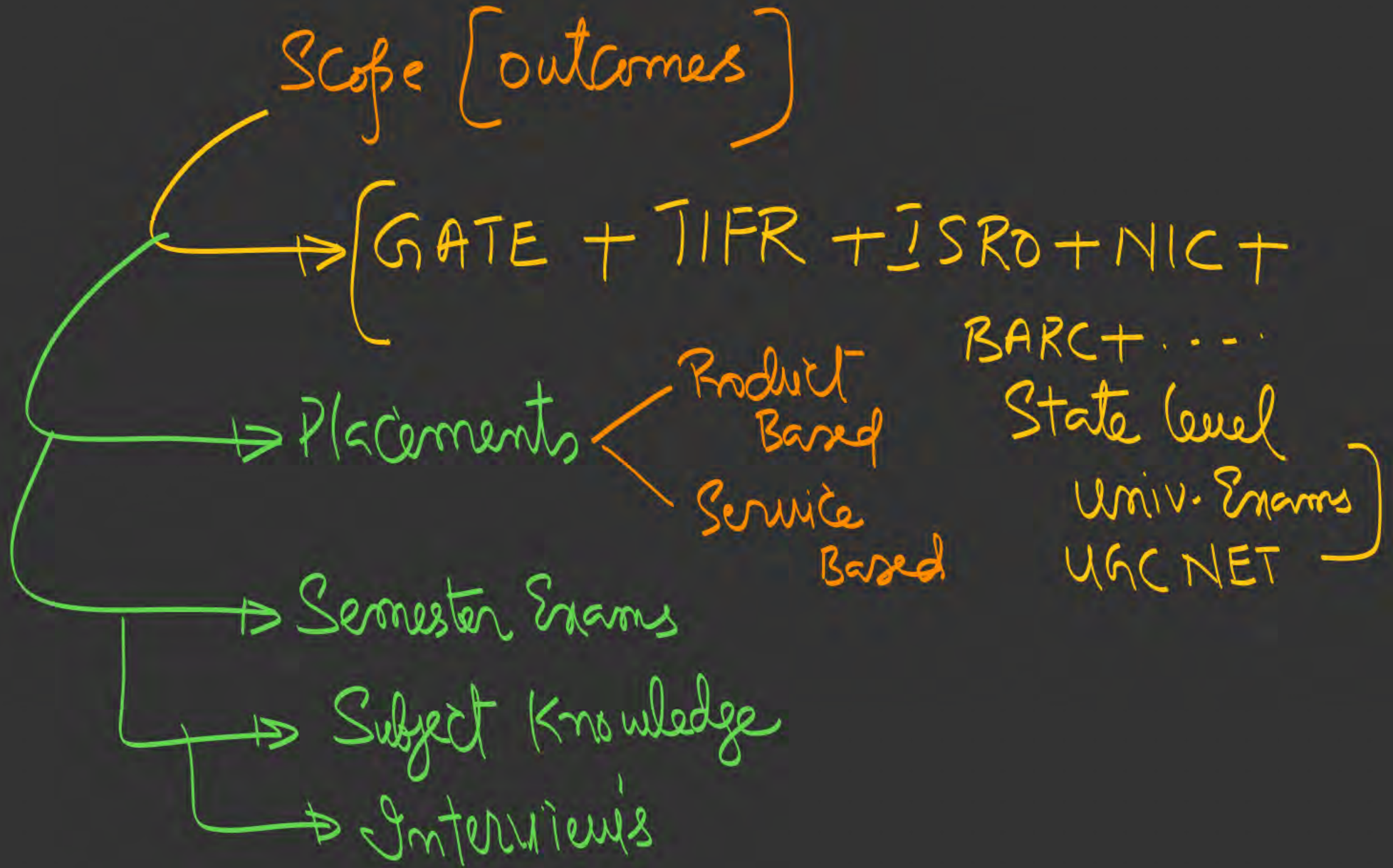
Text – Books :

1. Introduction to Algorithms – Cormen (LCS Book)
2. Fundamentals of Algorithms – Horowitz and Sahni

Prerequisites:

1. Programming [Constructs: if-then-else, loops (loop-Complexities)]
2. Data Structures: [Stack + Queue + L.L + Trees + Graphs]
3. Mathematics:
   - → Functions
   - → Series: (AP + GP + H.P)
   - → Matrices
   - → Logarithms
   - → Exponents
   - → Calculus
   - → Probability

Algo → Theory (Maths, Logic)


Scope [outcomes
GATE + TIFR + ISRO + NIC +
BARC + ...
Placements
Product Based
Service Based
State level
Univ. Exams
UGC NET
Semester Exams
Subject Knowledge
Interviews

Algorithm →

other Courses :

1) A.I
2) Machine Learning
3) Deep "
4) N.L.P

+ 5) Research

Algorithm Concept: Consists of Finite Set of Steps / Statements to solve a given Problem;

(Solution)

Persian: Md. Musa **Al Khwarizmi**

(Algorithm)

Consists of one/more Fundamental operations

- Addition (+)
- Assignment (=)

Ex: (x ← y + z;)

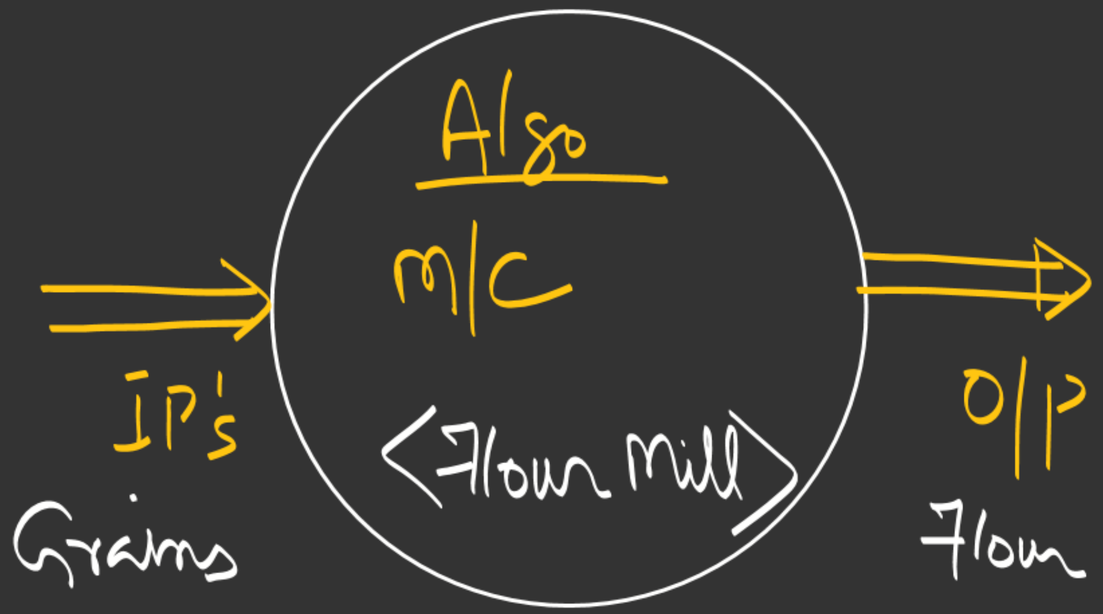
- definiteness (clear)
- effective (Finite Time)

(a+b*)

→ Every Algorithm may take zero/more Inputs;

→ Every Algo. Must Produce atleast one O/P

Algorithm ~ Abstract Machine / Processing Logic



Every Algo. Should Terminate in, finite amount Time;

Algorithm Lifecycle Steps

1. Problem definition
2. Requirements (conditions) [SRS]
3. Logic / design
4. Develop Algorithm [Express]
5. Validation [Prove Correctness]
6. Analysis
7. Implementation [Program development]
8. Testing & Debugging

DAA
(Design & Analysis of Algorithm)

THANK - YOU