DIGITAL EDUCATION
MARTCOST

COMPUTER SCIENCE & ENGINEERING

INFORMATION TECHNOLOGY

Design and Analysis of Algorithms

Hand Notes For GATE, PSUs & Competitive Exam

Hand Notes

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Design & Analysis of Algorithm

1. Analysis of algorithm & Asymptotic notations.
2. Design Strategies
   - Divide & Conquer
   - Greedy methods
   - Dynamic programming.
3. Biconnected Components. Art point, Bridges
4. Graph technique
5. Heap & Heapsort.
6. P, NP, Hard, Np-complete Concepts.

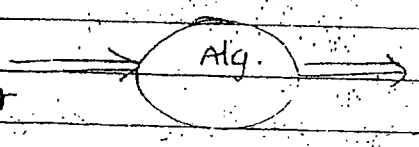
Text Books

1. fundamentals of Computer Algorithm — Sahani
2. Algorithm design — Tarmassia
3. Introd. to Algo — Corman

Algorithm:

Consists of finite set of steps to solve a prog.
may contain one or more operators
↳ definite (clear)
⇒ effective

Every algorithm takes 0 or more inputs
every algorithm expected to produce atleast 1 output.



* Approaches for Solving problems

1. problem (design) definition
2. Condition / Requirement specification
   └ Constraints
3. Design
4. express in the form of Algorithm / flowchart
5. validate (algo which is used to check the algo satisfying all requirements)
6. Analysis
7. program development.
8. Testing
9. Debugging.

Algorithm is procedure / mechanism which transforms given input to desired output

(3) Need of Analysis :

1. to determine Resource Consuption
   - → Time
   - → space
2. Making performance Comparision betn more than one algorithm to find best one

* Time of execution depends on architecture of processor, cpu speed

$x = x + y$

*) It also depends on the environment
- programming language
- operating system

$x = x + y$ -
↑ Fundamental opertn 1 time on

Time taken by instruction depends on 2 factors

Architechure — time of exc changes

enviroment — extract time, C, C++, (Java), Non uniform

Another ... its best case running time has lower order of Growth.

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Types of Analysis:

1. **Apriori Analysis:**
   Analysis depends on m/c and programming language
   - uniform output

2. **Postpriori Analysis:**
   Analysis depends upon OS and PL
   - Non uniform Result.

Apriori Analysis:

Its principle is to determining the order of magnitude of Statement / Construct

order of magnitude :-
means Frequency count of the fundamental operation in the statement

	order of magnitude
① $x = x + y$	$\Rightarrow 1$
② for i=1 to n x = x+y	$\Rightarrow n$
③ for i=1 to n for j=1 to n x = x+y	$\Rightarrow n^2$

$T(S) \propto n$

Time of statement is proportional to order of magnitude

$T(S) = cn$

$f(n) = 1 + n + n^2$

Time Complexity depends upon the power of 'n' whose magnitude is Not more than n^2

$O(f(n)) = O(n^2)$

either n^2 or less than n^2 (highest order of magnitude)

Asympotic Notations :-

* used for knowing the behaviour of the Algorithm
* purposes
  1) How does the function changes with respect to increase in the value of i/p
  - If f(n) is a function, how it changes with value of n → ∞

called Asympotic notation