

(Following Paper ID and Roll No. to be filled in your Answer Book)

Paper ID :110512

Roll No. *uptuonline.com*

B.Tech.

(SEM. V) THEORY EXAM. 2015-16

DESIGN AND ANALYSIS OF ALGORITHMS

[Time:3 hours]

[MaximumMarks:100]

Section-A

1. Attempt all parts. All parts carry equal marks. Write answer of each part in short. (10x2=20)

- (a) Why should we do asymptotic analysis of algorithms? Explain.
- (b) Order the following expressions by their asymptotic growth and justify your answer

$$2^n, n!, (\log n)!, n^3, 2^{\log^2 n}, 2^{2n}, n^{\log \log n}, e^n$$

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- (c) How can you modify Quick sort algorithm to search an item in a list?
- (d) What are all pairs shortest path?
- (e) Define Convex Hull.
- (f) Discuss various properties of Binomial Tree
- (g) What are the steps to design an algorithm?
- (h) Prove that red-black tree with n internal nodes has height at most $2\log^2(n+1)$
- (i) Prove that the maximum degree of n - node in a binomial tree is $\log_2 n$.
- (j) What do you understand by 'stable' sort? Name two stable sort algorithms.
- (k) Define Greedy Approach.

Section-B

Attempt any five questions from this section. (5x10=50)

2. Explain insertion in Red Black Tree. Show steps for inserting 9,8,7,6,5,4,3,2, & 1 into empty RB tree.

3. Show all the steps of Strassen's matrix Multiplication algorithm to multiply the following matrices

$$x = \begin{bmatrix} 3 & 2 \\ 4 & 8 \end{bmatrix} \text{ and } y = \begin{bmatrix} 1 & 5 \\ 9 & 6 \end{bmatrix}$$

4. Define Dynamic programming. How Dynamic Programming approach is used to find the shortest path? Illustrate with an example.
5. Find optimal solution to the Fractional Knapsack instances $n=7$ and Knapsack capacity $M=15$ Where profits and weights are as follows $(p_1, p_2, \dots, p_7) = (10, 5, 15, 7, 6, 18, 3)$ & $(w_1, w_2, \dots, w_7) = (2, 3, 5, 7, 1, 4, 1)$ respectively
6. Construct the string-matching automaton for the pattern **P=a a b a b** and illustrate its operation on the text string **T=a a a b a b a a b a a b**.
7. Illustrate the operation of heap sort on the array $A=(6,1,2,4,3,5,7,9,8,0)$
8. Find an LCS for the sequences. $X=\{x_1, x_2, \dots, x_m\}$ and $Y=\{y_1, y_2, \dots, y_n\}$. Also show that it requires $O(m+n)$ time.

9. Write short note on Fast Fourier Transform (FFT).

Section-C

Attempt **any two** questions from this section. (2x15=30)

10. Attempt both : *uptuonline.com*

- (a) Why the statement "The running time of algorithm A is at least $O(n^2)$ is meaningless"? Explain.
- (b) What is the procedure of partition (A, p, r) in Quick Sort and also define the complexity of Quick Sort.

11. What do you mean by Branch & Bound? How TSP can be solve using this approach.

12. Attempt both :

- (a) Discuss the relationship between the class P, NP, NP-complete and NP-hard with suitable example of each class.
- (b) Define Approximation algorithms. What is Approximation ratio? Give an Approximation algorithm for the Travelling Salesman