Exam No: _____

GANPAT UNIVERSITY
M. TECH. SEMESTER – II INFORMATION TECHNOLOGY
REGULAR EXAMINATION JUN - 2012
3IT202: ANALYSIS OF ALGORITHMS

TIME:-3 HOURS] **[TOTAL MARKS: 70**

Instructions:

1. Figures to the right indicate full marks.
2. Each section should be written in a separate answer book.
3. Be precise and to the point in your answer.

SECTION – I

Q – 1 (A) If $T_1(n) = O(h(n))$ & $T_2(n) = O(h(n))$ then prove that $T_1(n) + T_2(n) = O(h(n))$. **[4]**

(B) Express complexity of following functions using theta (Θ) notation. Clearly indicates value of constants C_1, C_2 and n_0. **[8]**

1. $f(n)= (1/2)n^2 - 3n$
2. $f(n) = 2^{(n+1)} + 6n^2$
3. $f(n) = 8*2^n + n^{7.5}$
4. $f(n) = 5\ n^3 + 10\ n + 3$

OR

Q – 1 (A) If $T_1(n) = O(f(n))$ & $T_2(n) = O(g(n))$ then prove that $T_1(n) + T_2(n) = \max(O(g(n)), O(f(n)))$. **[3]**

(B) Construct the 5-way B-tree on following data: **[3]**
10,20,15,24,6,12,35,69,1,50,25

(C) Explain the following terms with graph: **[6]**
1. Big-oh notation. 2. Omega notation. 3. Theta notation.

Q– 2 Solve following recurrence relations and express your answer using big-oh (O) notation.

(A) $T(n) = T(n/3) + T(2n/3) + \Theta(n)$ **[3]**

(B) $T_n = 1$, if n=0
$= 4T_{n-1} + n + 2^n$, n>0 **[4]**

(C) $T(n) = 4T(n/2) + n^2$ **[4]**

OR

Q – 2 Solve following recurrence relations and express your answer using big-oh (O) notation.

(A) $T(n) = T(1/10) + T(9n/10) + \Theta(n)$ **[3]**

(B) $T(n) = T(3n/4) + 1$ **[4]**

(C) $T(n) = \begin{cases} 1/3 & \text{, if } n=1 \\ n\,T^2(n/2) & \text{, n is a power of 2, } n>1 \end{cases}$ **[4]**

Q – 3 **(A)** Consider we want to calculate M^n and normal algorithm require O(n) complexity. Design an algorithm that has complexity less than O(n). Also indicates it's time complexity. [5]

(B) Solve the following Assignment Problem (i.e. find the optimal assignment value) using Branch and Bound technique. [7]

	1	2	3	4
A	5	8	7	9
B	8	7	6	2
C	3	2	8	1
D	10	9	11	4

SECTION – II

Q – 4 **(A)** Count the number of inversions on following data using divide and conquer method. Also indicates the time complexity of algorithm. [6]
10,15, 4, 7 ,9, 2, 6, 14, 3, 17

(B) Prove that comparison based sorting algorithm has complexity of Ω (n lg n) in worst case. [6]

OR

Q – 4 **(A)** Illustrate the working of the quick sort on the following i/p instance: [6]
25,30,35,10,24,20,54,2
Comment on the nature of i/p i.e. best case, average case or worst case. Write recurrence relation for behavior of quick sort on above data and give it's time complexity.

(B) Prove that greedy algorithm for interval selection problem with strategy minimum finish time first returns optimal answer. [6]

Q – 5 **(A)** Write a greedy algorithm for making change problem and show the instance where greedy algorithm fails. [5]

(B) Apply **Prim's** Algorithm on graph given in fig A and give minimum spanning tree. Also write the time complexity of **Prim's** algorithm. [6]

OR

Q – 5 **(A)** Write topological sort order of graph given in fig B. using source removal method. [5]

(B) Consider thirsty baby problem where A_i denotes the available quantity of liquid i , S_i denotes the satisfaction baby can get after drinking liquid i, baby has capacity of drinking total T quantity of liquids. [6]

A_i = [5, 10, 30, 50, 60]
S_i = [15, 20, 60, 60, 80]
T=100

apply

1. Minimum quantity liquid first criterion
2. Maximum satisfaction criterion
3. Maximum S/A criterion to the above inputs & give vital conclusion based on answer.

Q – 6 Find the optimal way of multiplying following matrices using dynamic programming. [12]
A: 40 x 30, **B:** 30 x 5, **C:** 5 x 40, **D:** 40 x 6, **E:** 6 x 20.

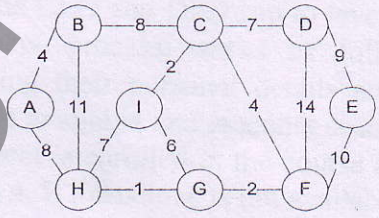

Fig A.

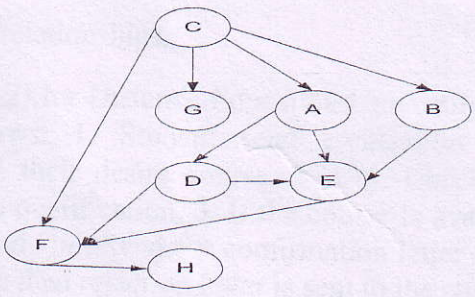

Fig B.

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