ENGINEERING & MANAGEMENT EXAMINATIONS, DECEMBER – 2007

DESIGN AND ANALYSIS OF ALGORITHMS

SEMESTER – 5

Time : 3 Hours] [Full Marks : 70

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

i) Time complexity for recurrence relation $T(n) = 2T(n/2) + n$ is

a) $O(\log n)$ b) $O(n \log n)$

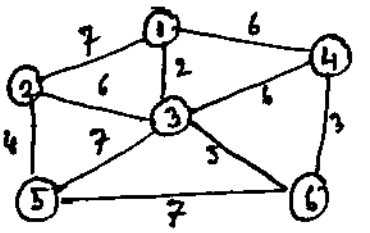
c) $O(n)$ d) $O(n^2)$.

ii) O-notation provides an asymptotic

a) upper bound b) lower bound

c) light bound d) none of these.

iii) Consider the graph :



The minimum cost spanning tree for the graph above has the cost

a) 18 b) 24

c) 20 d) 22.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Find out the worst case time complexity of merge sort.

3. Compare and contrast BFS vis-a-vis DFS.

4. Write down the difference between : $2\frac{1}{2} + 2\frac{1}{2}$

   a) Prim's algorithm and Kruskal's algorithm

   b) Linear search and binary search.

5. Solve the following recurrence relation using generating function :

   $a_n = 6a_{n-1} - 11a_{n-2} + 6a_{n-3}$ for $n >= 3$ with initial condition $a_0 = 1$, $a_1 = -1$ and $a_2 = 1$.

6. Prove that if $f(n) = a_m n^m + a_{m-1} n^{m-1} + ... + a_1 n + a_0$, then

   $f(n) = O(n^m)$.

GROUP – C

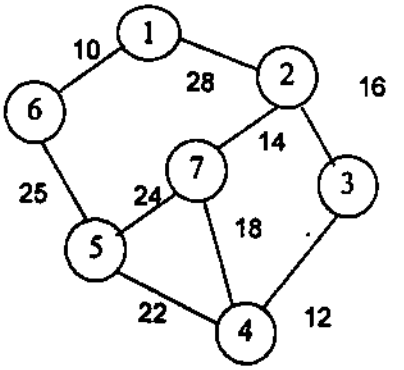
(Long Answer Type Questions)

Answer any *three* of the following questions. $3 \times 15 = 45$

7. Find the optimal solution using greedy criteria for a knapsack having capacity 100 kg for the following list of items having values and weights as shown in the table.

Item	*Value*	*Weight*
I_1	10	15
I_2	20	25
I_3	30	35
I_4	40	45
I_5	50	55

8. a) Find out the minimum cost spanning tree using any algorithm : 5



b) Find out Hamiltonian cycle of the above graph and also draw the permutation tree. 3 + 5

c) What is the Tail Recursion ? Give an example. 2

9. a) What do you mean by dynamic programming ? What is the difference between dynamic programming and greedy method ? 1 + 2

b) Discuss the procedure for Strassen's matrix multiplication to evaluate the product of n matrices. Find the resulting recurrence relation for the same and analyze its time-complexity. Is this method an improvement over the conventional matrix multiplication method ? If so, why ? 7 + 1 + 2 + 2

10. a) Establish the theoretical minimum lower bound of time complexity for any sorting algorithm where the sorting is performed by pairwise comparison. 6

b) What is union-find algorithm ? 4

c) State the 0/1 knapsack problem. 5

11. a) Explain the basic concept of a divide-and-conquer algorithm. 4

b) Prove that the average case time-complexity of quick sort is $O(n \log n)$. You should state clearly the reasons behind the design of the recurrence relation you use for establishing this complexity. 6 + 5

END