BRAINWARE UNIVERSITY

Course – MCA

Algorithm Analysis (MCA302)

(Semester – 3)

Time allotted: 3 Hours **Full Marks: 70**

[The figure in the margin indicate full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group –A

(Multiple Choice Type Questions)

10 x 1 = 10

1. *Choose the correct alternative from the following*

(i) Which of the following algorithm design technique is used in quick sort algorithm?

a. Dynamic programming
b. Backtracking
c. Divide and Conquer
d. Greedy method

(ii) Kruskal's algorithm uses_____.

a. edge
b. vertex
c. edge, edge
d. none of these

(iii) Complexity of the recurrence relation $T(n) = 8T(n/2)+n^2$ is

a. $O(n)$
b. $O(n^2)$
c. $O(\lg n)$
d. $O(n^3)$

(iv) Ω-notation provides an asymptotic

a. upper bound
b. lower bound
c. one that is sandwiched between the two bounds
d. none of these

(v) If $f(n) = 2n^2+3n+1$ then

a. $f(n) = O(n^2)$
b. $f(n) = \Theta(n^2)$
c. $f(n) = \Omega(n^2)$
d. none of these

(vi) If $f(n) = \Theta(g(n))$ and $g(n) = \Theta(h(n))$, then

a. $f(n) = \Theta(h(n))$ b. $f(n) = O(h(n))$

c. $f(n) = \Omega(h(n))$ d. none of these

(vii) Which of the following standard algorithm is not a greedy algorithm?

a. Dijkstra's algorithm b. Prim's algorithm

c. Kruskal's algorithm d. Bellmen Ford Shortest path algorithm

(viii) The time complexity of Strassen's algorithm for matrix multiplication is

a. $\Theta(n)$ b. $\Theta(n^3)$

c. $\Theta(n^2)$ d. $\Theta(n^{2.81})$

(ix) In $T(n) = a\,T(n/b) + f(n)$, a refers to

a. Size of sub problem b. No. of sub problems

c. Time to combine solutions d. none of these

(x) Time complexity for the Floyd's algorithm to find all pairs shortest path of a graph G with V vertices and E edges using dynamic programming method is

a. $O(V^2)$ b. $O(E^2)$

c. $O(V^3)$ d. $O(E^3)$

Group – B

(Short Answer Type Questions)

(Answer any *three* from the following)

3 x 5 = 15

2. Apply backtracking technique to solve N-queen's problem. Explain the procedure with required algorithm considering a suitable value of N. [5]

3. Solve the knapsack problem using greedy strategy for given condition: number of objects (n) = 3, knapsack capacity (m) = 20, profits (p1, p2, p3) = (25, 24, 15) and weights (w1, w2, w3) = (18, 15, 10).
Which type of knapsack problem cannot be solved using greedy strategy? [4 + 1]

4. Explain 15-puzzle problem using branch and bound method. Draw a portion of the state space tree generated by it. [5]

5. Define Big-O notation.
   Show that log n! = O (n log n). [2+3]

6. Discuss Bellman-Ford algorithm to solve single source shortest path problem on a weighted directed graph. [5]

Group – C

(Long Answer Type Questions)
(Answer any *three* from the following)

3 x 15 = 45

7. (a) Find the optimal number of scalar multiplications needed to compute the following matrix chain product using dynamic programming.
   A(4×10) * B(10×3) * C(3×12) * D(12×20) * E(20×7) [7]

   (b) Find the optimal parenthesization for the above matrix chain product. Write down the algorithm for the above procedure. [8]

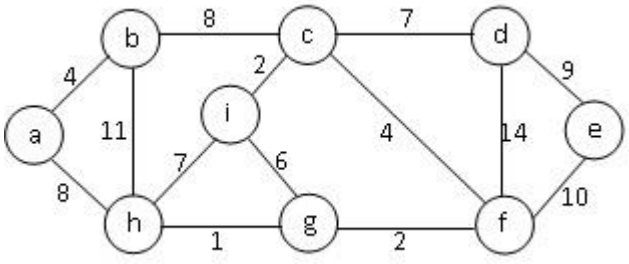
8. (a) State the Master theorem. [5]

   (b) Solve the following recurrences using Master theorem:

   (i) T(n) = T(2n/3) + 1

   (ii) T(n) = 3T(n/4) + n log n [5+5]

9. (a) Using Prim's algorithm find out the minimum spanning tree from the given graph.



[8]

   (b) Analyze the complexity of the above algorithm. [2]

(c) Differentiate between dynamic programming and divide and conquer approaches. [5]

10. (a) Write the Knuth-Morris-Pratt algorithm for pattern matching. [5]

(b) Apply KMP algorithm for the pattern p =”abababa” and string s=”bacbababababacaab”. Show each step. [7]

(c) What is the difference between Naïve algorithm and KMP algorithm? [3]

11. Write the short notes on *any three* of the following: [3 x 5]

(a) Recursion tree

(b) Strassen’s matrix multiplication

(c) Relation between P class, NP class, co-NP class, NP hard and NP complete class.

(d) Merge sort

(e) Graph coloring problem