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CSE303 Enrol. No. A2305221 0069

[ET]

END SEMESTER EXAMINATION : NOV-DEC 2022

ANALYSIS AND DESIGN OF ALGORITHMS

Time : 3 Hrs. *Maximum Marks : 60*

Note: ***Attempt questions from all sections as directed.***

SECTION – A (24 Marks)

Attempt any **four** *questions out of* **five.**

Each question carries **06** *marks.*

1. Consider the following two conditions (i) and (ii) for asymptotic positive function f(n), g(n) and h(n)

(i) $f(n) = \Omega(g(n)$ and $g(n) \neq \Omega(f(n))$

(ii) $f(n) = \Omega(h(n))$ and $h(n) = \Omega(f(n))$

Find which of the following statement are TRUE/ FALSE based on (i) and (ii) conditions.

(a) $f(n) * h(n) = O(g(n) * h(n))$

P.T.O.

(b) $Max\{f(n), g(n)\} = \theta(f(n) + g(n))$

(c) $g(n) * h(n) = \Omega(h(n))$

2. (a) Draw the tree of recursive calls made to sort the elements {C,O,M,P,U,T,I,N,G} in alphabetical order using Quick Sort method. (3)

(b) When and how dynamic programming approach is applicable? Explain it with example? (3)

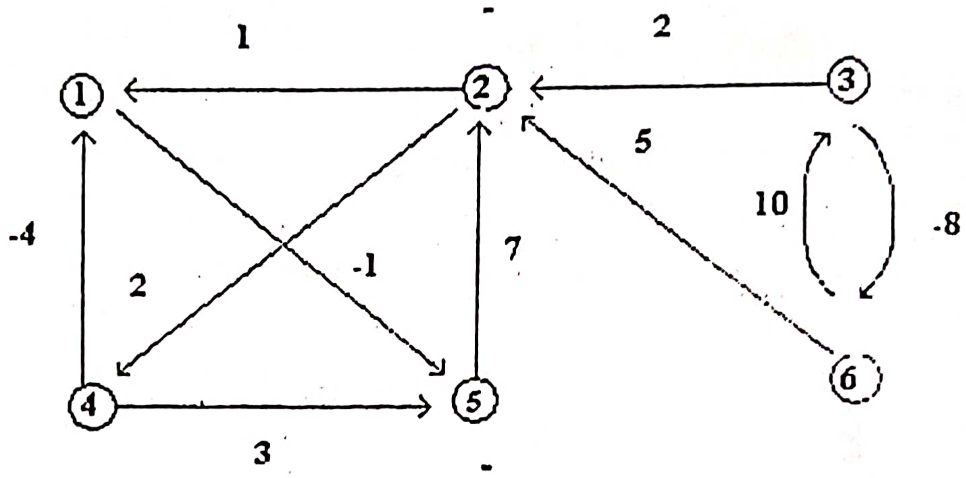
3. Solve the following recurrences :

(a) $T(n) = 2T\left(\frac{n}{2}\right) + n^2 \log^2 n$ (3)

(b) $T(n) = \begin{cases} 1 & n = 0 \\ T\left(\frac{n}{2}\right) + T\left(\frac{2n}{5}\right) + 7n & n > 0 \end{cases}$ (3)

4. Show that Hamiltanian Path is a NP complete problem.

5. For the graph (Weighted, directed)-



Apply Floyd-Warshall Algorithm for constructing shortest path. Show the matrix that results each iteration.

SECTION – B (20 Marks)

Attempt any **two** *questions out of* **three**.

Each question carries **10** *marks.*

6. Let G be an undirected connected graph with distinct edge weight. Let emax be the edge with maximum weight and emin the edge with minimum weight. Justify, which of the following statements is (are) TRUE/FALSE?

(a) Every minimum spanning tree of G must contain emin (1)

(b) If emax is in a minimum spanning tree, then its removal must disconnect G (1)

(c) No minimum spanning tree contains emax (1)

(d) G has a unique minimum spanning tree (1)

(e) Consider an undirected graph G has n nodes. Its adjacency matrix is given by an n × n square matrix whose diagonal elements are 0's and non-diagonal elements are 1's, then Graph G has multiple distinct MSTs, each of cost n-1. Justify your answer with example. (3)

(f) Consider a complete graph G = (V, E), where V = {v1, v2, ..., v100}, and E = {(vi, vj) | 1 ≤ i ≤ j ≤ 100}, and weight of the edge (vi, vj) is |i – j|. The weight of minimum spanning tree of G is 98. Justify your answer with example. (3)

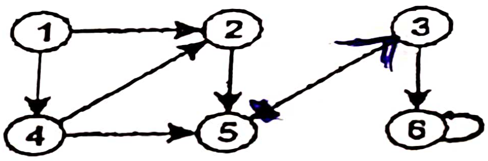
7. (a) With the help of state space tree, solve the following instance of the knapsack problem by branch and bound algorithm.

ITEM	WEIGHT	VALUE	N=4, W=16
1	10	100	
2	7	63	
3	8	56	
4	4	12	

(6)

(b) Explain LC branch and bound and FIFO branch and bound method with example. (4)

8. (a) Consider the graph as shown in Fig. Describe the whole process of Bredth first Search using vertex 1 ~~3~~ as source. (5)



(b) State N-Queen Problem and draw state space tree for 4 Queen problem. 2,4,1,3. (5)

SECTION – C **(16 Marks)**

(Compulsory)

9. (a) Discuss the matrix chain multiplication with reference to dynamic programming technique and also apply it on the following matrices.

A1:(1x6)

A2:(6x3)

A3:(3x5) (6)

P.T.O.

(b) Discuss the relationship between the class P, NP, NP-complete and NP- hard problems with suitable examples of each class. (6)

(c) The recurrence T(n) = 7T(n/2) + n2 describe the running time of an algorithm A, a competing algorithm A' has a running time T'(n)= aT'(n/4) + n2. What is the largest integer value for A such that A' is asymptotically faster than A. (4)

$$T(n) = 7T(n/2) + n^2$$

$$T'(n) = aT'(n/4) + n^2$$