CBCS SCHEME

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15CS43

Fourth Semester B.E. Degree Examination, Aug./Sept. 2020
Design and Analysis of Algorithm

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. What is an Algorithm? Explain any six properties to specify an algoirhtm. **(07 Marks)**

b. If $t_1(n) \in O(g_1(n))$ and $t_2(n) \in O(g_2(n))$ then prove that $t_1(n) + t_2(n) \in O(\max\{g_1(n), g_2(n)\})$ **(05 Marks)**

c. Design an Algorithm to find a largest of a given number and analyze its efficiency. **(04 Marks)**

OR

2 a. Define Asymptotic rotation, explain Big-Oh notation and show that $10n^3 + 5 \in O(n^3)$. **(07 Marks)**

b. Consider a recurrence relation $T(n) = T(n-1) + n$, with initial condition $T(0) = 0$. Solve it using subsituational method. **(04 Marks)**

c. Compare the order of growth of $\log_2(n)$ and $\sqrt{n}$ using limits. **(05 Marks)**

Module-2

3 a. Design Binary search algorithm and derive its time complexity by applying Master Theorem. **(07 Marks)**

b. Apply quick sort to sort the list E, X, A, M, P, L, E and draw the recursive calls tree. **(06 Marks)**

c. Derive Strassen's matrix multiplication time complexity by applying substitutional method. **(03 Marks)**

4 a. Design Merge sort algorithm. Apply it to sort the list of elements 70, 20, 30, 40, 10, 50, 60. **(07 Marks)**

b. Write two advantages and disadvantages of Divide and conquer. **(04 Marks)**

c. Apply source removal algorithm to solve topological sorting problem for the following graph. (Ref. Fig Q No.4 (c)).

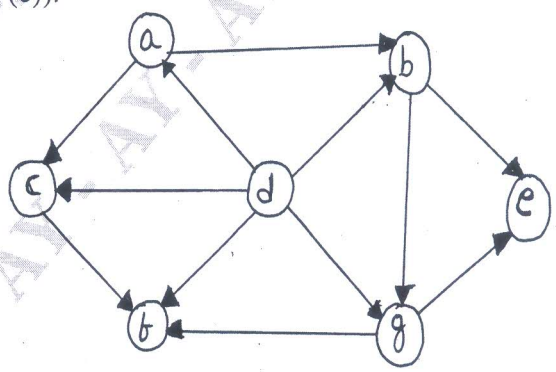

Fig Q4(c) **(05 Marks)**

Module-3

5 a. Define Greedy technique, feasible solution and optimal solution. Write general algorithm of greedy method. **(05 Marks)**

b. What is Knapsack problem? Find a feasible solution considering maximum profit, minimum weight and profit by weight ration to the Knapsack instance n = 7, m = 5, (P_1, P_2, P_3, P_4, P_5, P_6, P_7) = (10, 5, 15, 7, 6, 18, 3) and (w_1, w_2, w_3, w_4, w_5, w_6, w_7) = (2, 3, 5, 7, 1, 4, 1) **(05 Marks)**

c. i) Construct a Huffman tree for the following data and obtain in Huffman code.

Character	A	B	C	D	E	_
Probability	0.5	0.35	0.5	0.1	0.4	0.2

ii) Encode the text DAD_BE using the code of Question (i)

iii) Decode the text whose encoding is 1100110110 in the code of question (i) **(06 Marks)**

OR

6 a. Define a Heap and list the important properties of Heap. **(03 Marks)**

b. Compute a minimum cost spanning tree for the graph shown below in Fig Q6(b). Using i) Prim's and ii) Kruskal algorithm.

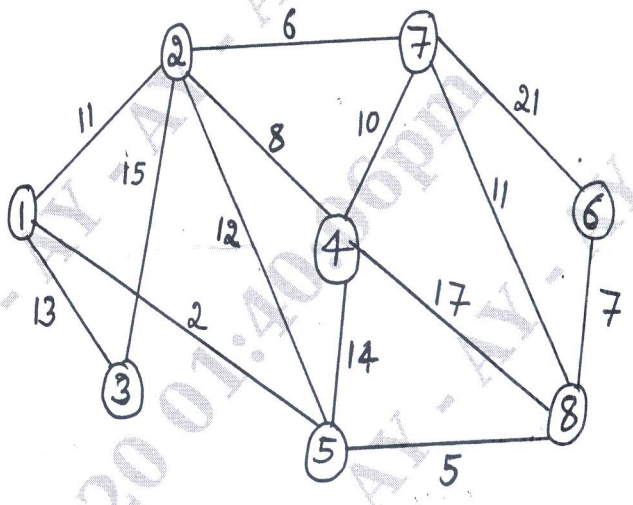

Fig Q6(b) **(08 Marks)**

c. Solve the following instances of the single source shortest paths problems with vertex a as the source. (Ref Fig Q No 6(c)).

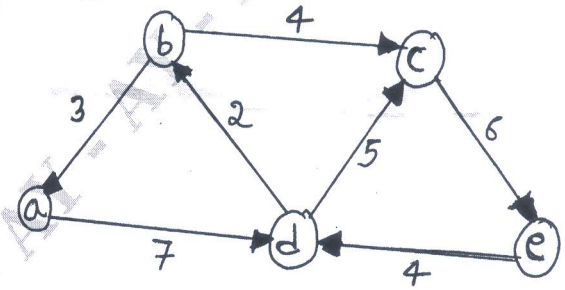

Fig Q6(c) **(05 Marks)**

Module-4

7 a. Design Warshall Algorithm. Apply Warshalls to find the transitive closure of the graph defined by the following adjacency matrix.

	a	b	c	d
a	0	1	0	0
b	0	0	0	1
c	0	0	0	0
d	1	0	1	0

(08 Marks)

b. Design Floyd's Algorithm, write one difference between FLOYD's and Dijkstra's algorithm. Apply Floyd's algorithm to the following graph. Ref Fig Q7(b)).

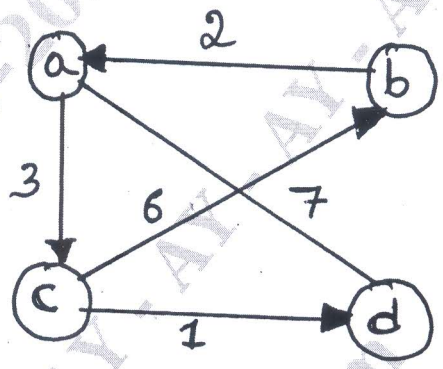

Fig Q7(b) **(08 Marks)**

OR

8 a. Write the recurrence relation to find the optimal solution for the Knapsack problem using Dynamic programming and find the optimal solution for the following instance.

Item	Weight	Value
1	2	$12
2	1	$10
3	3	$20
4	2	$15
Capacity w = 5		

(08 Marks)

b. Find shortest path from node 1 to every other node in the graph as given below in Fig Q8(b). Using Bellamn Ford Algorithm.

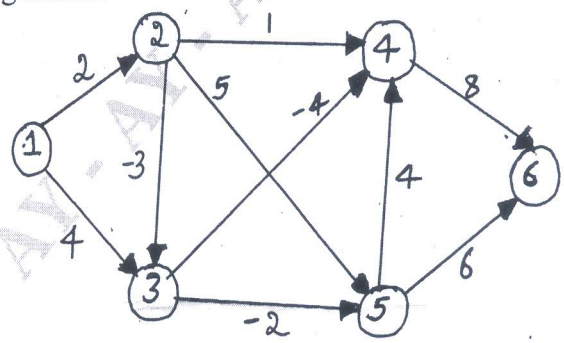

Fig Q8(b) **(08 Marks)**

Module-5

9 a. Design and implement in Java to find a subset of a given set $S = \{S_1, S_2, S_3 \ldots\ldots S_n\}$ of n positive integers whose sum is equal to a given positive integer d. **(08 Marks)**

b. Explain Backtracking concept and generate atleast 4 solutions for 5 Queen's problem. **(08 Marks)**

OR

10 Explain the following :

a. NP problems

b. NP – Complete problems

c. Graph coloring

d. Hamilton cycles. **(16 Marks)**

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