CBCS Scheme

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15CS43

Fourth Semester B.E. Degree Examination, June/July 2018
Design and Analysis of Algorithms

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Write an algorithm to find the maximum element in an array of n element. Give the mathematical analysis of this non-recursive algorithm. **(06 Marks)**

b. Explain the asymptotic notations BigO, BigΩ and big theta used to compare orders of growth of an algorithm. **(06 Marks)**

c. Explain with an example how a new variable count introduced in a program can be used to find the number of steps needed by a program to solve a particular problem instance. **(04 Marks)**

OR

2 a. Write a recursive function to find and print all possible permutations of a given set of n elements. **(05 Marks)**

b. Solve the recurrence relation : $M(n) = 2M(n-1) + 1$. Take $M(1) = 1$, $M(n)$ is given for $n > 1$. **(05 Marks)**

c. Define algorithm. What are the criteria that an algorithm must satisfy? **(06 Marks)**

Module-2

3 a. Write a function to find the maximum and minimum elements in a given array of n elements by applying the divide and conquer technique. **(06 Marks)**

b. Explain the divide and conquer technique. Give the general algorithm DAndC(P)[Where P is the problem to be solve] to illustrate this technique. **(04 Marks)**

c. Apply source removal method to obtain topological sort for the given graph in Fig.Q3(c). **(06 Marks)**

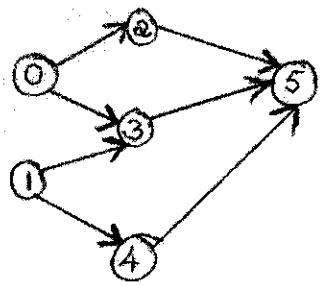

Fig.Q3(c)

OR

4 a. Explain the merge sort algorithm. Illustrate with an example and give the worst case efficiency of merge-sort. **(08 Marks)**

b. Apply quick sort algorithm to the following set of numbers.
65, 70, 75, 80, 85, 60, 55, 50, 45. **(08 Marks)**

Module-3

5 a. Apply greedy method to obtain an optimal solution to the knapsack problem given M = 60, $(w_1, w_2, w_3, w_4, w_5) = (5, 10, 20, 30, 40)$ $(p_1, p_2, p_3, p_4, p_5) = (30, 20, 100, 90, 160)$. Find the total profit earned. **(04 Marks)**

b. Explain Huffman algorithm. With an example show the construction of Huffman tree and generate the Huffman code using this tree. **(06 Marks)**

c. Apply Prim's algorithm to obtain a minimum spanning tree for the given weighted connected graph. [Fig.Q5(c)]. **(06 Marks)**

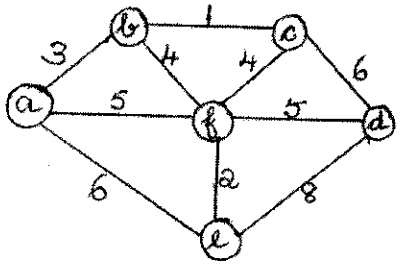

Fig.Q5(c)

OR

6 a. Explain the bottom up heap construction algorithm with an example. Give the worst case efficiency of this algorithm. **(08 Marks)**

b. Apply single source shortest path problem assuming vertex a as source.[Refer Fig.Q6(b)]. **(08 Marks)**

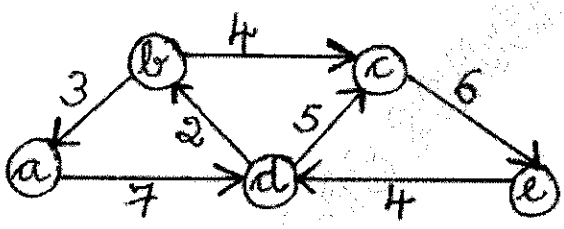

Fig.Q6(b)

Module-4

7 a. Explain multistage graph with an example. Write multistage graph algorithm using backward approach. **(08 Marks)**

b. Apply Floyd's algorithm to solve all pair shortest path problem for the graph given below in Fig.Q7(b). **(08 Marks)**

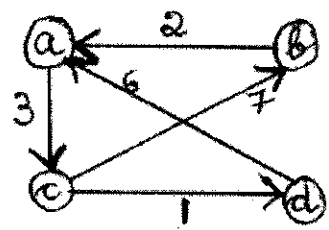

Fig.Q7(b)

OR

8 a. Explain Bellman Ford al to find shortest path from single source to all destinations for a directed graph with negative edge cost. **(08 Marks)**

b. Apply Warshall's algorithm to the digraph given below in Fig.Q8(b) and find the transitive closure. **(08 Marks)**

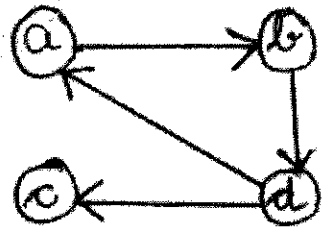

Fig.Q8(b)

Module-5

9 a. Apply backtracking method to solve subset–sum problem for the instance d = 30 and S = {5, 10, 12, 13, 15, 18}. Give all possible solutions. **(08 Marks)**

b. Explain how travelling salesman problem can be solved using branch and bound technique. **(06 Marks)**

c. Define deterministic and non deterministic algorithms. **(02 Marks)**

OR

10 a. What is Hamiltonian cycle? Explain the algorithm to find the Hamiltonian cycle in a given connected graph. Write the functions used for generating next vertex and for finding Hamiltonian cycles. **(09 Marks)**

b. Apply the best-first branch-and-bound algorithm to solve the instance of the given job assignment problem. **(07 Marks)**

Job1	Job2	Job3	Job4	
9	2	7	8	Person a
6	4	3	7	Person b
5	8	1	8	Person c
7	6	9	4	Person d

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15CS43

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Design and Analysis of Algorithms

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define an algorithm. Discuss the criteria of an algorithm with an example. **(06 Marks)**

b. Prove that : If $t_1(n) \in 0(g_1(n))$ and $t_2(n) \in 0(g_2(n))$ then

$$t_1(n) + t_2(n) \in 0\ (\max\{g_1(n), g_2(n)\})$$ **(06 Marks)**

c. Explain the two common ways to represent a graph with an example **(04 Marks)**

OR

2 a. Consider the following algorithm

```
Algorithm GUESS (A[ ] [ ])
for i ← 0 to n – 1
    for j ← 0 to i
        A [i] [j] ← 0
```

i) What does the algorithm compute?
ii) What is basic operation?
iii) What is the efficiency of this algorithm? **(03 Marks)**

b. List and explain important problem types that are solved by computer. **(07 Marks)**

c. Design an algorithm for checking whether all elements in a given array are distinct or not. Derive its worst complexity. **(06 Marks)**

Module-2

3 a. Explain divide and conquer technique. Write a recursive algorithm for finding the maximum and minimum element from a list. **(08 Marks)**

b. Apply quick sort to sort the list E, X, A, M, P, L, E in alphabetical order. Draw the tree of the recursive calls made. **(08 Marks)**

OR

4 a. Discuss Strassen's matrix multiplication and derive its time complexity. **(08 Marks)**

b. Design merge sort algorithm and discuss its best-case, average-case and worst-case efficiency. **(08 Marks)**

Module-3

5 a. Solve the greedy knapsack problem where
m = 10, n = 4, P = (40, 42, 25, 12), W = (4, 7, 5, 3). **(06 Marks)**

b. What is job sequencing with deadlines problem? Let n = 5, profits [10, 3, 33, 11, 40] and deadlines [3, 1, 1, 2, 2] respectively. Find the optimal solution using greedy algorithm. **(05 Marks)**

c. Define minimum cost spanning tree (MST). Write Prim's algorithm to construct minimum cost spanning tree. **(05 Marks)**

OR

6 a. Design Dijkstra's algorithm and apply the same to find the single source shortest path for graph taking vertex 'a' as source of Fig. Q6(a). **(08 Marks)**

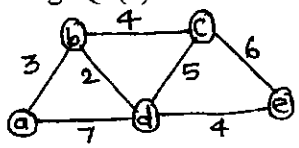


Fig. Q6(a)

b. Construct a Huffman code for the following data :

Character	A	B	C	D	-
Probability	0.4	0.1	0.2	0.15	0.15

Encode the text ABACABAD and decode the text 100010111001010, using the above code. **(04 Marks)**

c. Construct the heap for the list 2, 9, 7, 6, 5, 8 by the bottom-up algorithm. **(04 Marks)**

Module-4

7 a. Define transitive closure. Write Warshall's algorithm to compute transitive closure. Find its efficiency. **(08 Marks)**

b. Apply Floyd's algorithm to find all pair shortest path for the graph of Fig. Q7(b). **(08 Marks)**

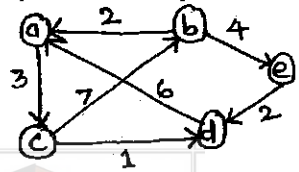
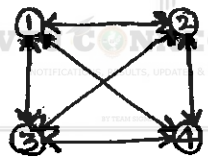


Fig. Q7(b)

OR

8 a. For the given cost matrix, obtain optimal cost tour using dynamic programming. **(08 Marks)**



$$\begin{bmatrix} 0 & 10 & 15 & 20 \\ 5 & 0 & 9 & 10 \\ 6 & 13 & 0 & 12 \\ 8 & 8 & 9 & 0 \end{bmatrix}$$

Fig. Q8(a)

b. Write a pseudocode to find an optimal binary search tree by dynamic programming. **(08 Marks)**

Module-5

9 a. Write the pseudocode for backtracking algorithm. Let w = {3, 5, 6, 7} and m = 15. Find all possible subsets of w that sum to m. Draw the state space tree that is generated. **(09 Marks)**

b. Draw the portion of the state space tree for m – colorings of a graph when n = 4 and m = 3. **(07 Marks)**

OR

10 a. With the help of a state space tree, solve the Travelling Salesman Problem (TSP) of Fig.Q10(a), using branch-and-bound algorithm. **(08 Marks)**

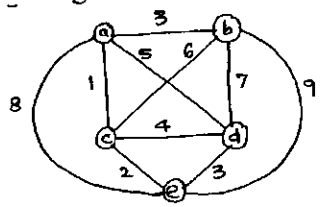


Fig. Q10(a)

b. Explain the classes of NP – Hard and NP – complete. **(08 Marks)**

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15CS43

Fourth Semester B.E. Degree Examination, June/July 2017
Design and Analysis of Algorithms

Time: 3 hrs. Max. Marks: 80

Note: Answer FIVE full questions, choosing one full question from each module.

Module-1

1 a. Define algorithm. Explain asymptotic notations, Big O, big Omega, big theta notations. **(08 Marks)**

b. Explain general plan of mathematical analysis of nonrecursive algorithms with example. **(08 Marks)**

OR

2 a. Define time and space complexity. Explain important problem types. **(08 Marks)**

b. Illustrate mathematical analysis of recursive algorithm for towers of hanoii. **(08 Marks)**

Module-2

3 a. Explain concept of divide and conquer. Write merge sort algorithm. **(08 Marks)**

b. Write a recursive algorithm for binary search and also bring out its efficiency. **(08 Marks)**

OR

4 a. Illustrate the tracing of quick sort algorithm for the following set of numbers:
25, 10, 72, 18, 40, 11, 64, 58, 32, 9 **(08 Marks)**

b. List out the advantages and disadvantages of divide and conquer method and illustrate the topological sorting for the following graph.

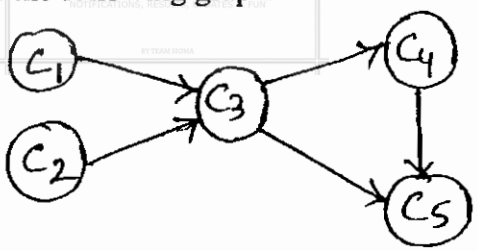

Fig.Q4(b) **(08 Marks)**

Module-3

5 a. Explain Greedy criterion. Write a Prim's algorithm to find minimum cost spanning tree. **(08 Marks)**

b. Sort the given list of numbers using heap sort: 2, 9, 7, 6, 5, 8. **(08 Marks)**

OR

6 a. Write an algorithm to find single source shortest path. **(08 Marks)**

b. Construct a Huffman tree and resulting code word for the following:

Character	A	B	C	D	-
Probability	0.35	0.1	0.2	0.2	0.15

Encode the words DAD and ADD. **(08 Marks)**

Module-4

7 a. Explain the concept of dynamic programming, with example. **(08 Marks)**

b. Trace the following graph using Warshall's algorithm.

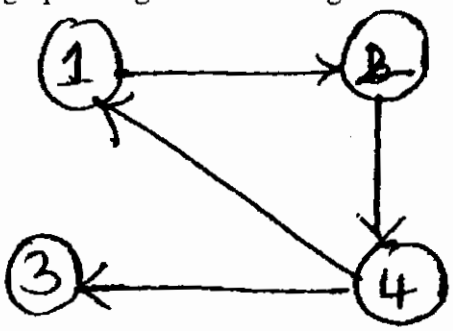

Fig.Q7(b) **(08 Marks)**

OR

8 a. Explain Multistage graphs with example. Write multistage graph algorithm to forward approach. **(08 Marks)**

b. Solve the following instance of Knapsack problem using dynamic programming. Knapsack capacity is 5.

Item	Weight	Value
1	2	$12
2	1	$10
3	3	$20
4	2	$15

(08 Marks)

Module-5

9 a. Explain backtracking concept. Illustrate N queens problem using backtracking to solve 4-Queens problem. **(08 Marks)**

b. Solve subset sum problem for the following example, s = {3, 5, 6, 7} and d = 15. Construct a state space tree. **(08 Marks)**

OR

10 a. Explain the concept of branch and bound and solve assignment problem for the following and obtain optimal solution.

Person	Job1	Job2	Job3	Job4
a	9	2	7	8
b	6	4	3	7
c	5	8	1	8
d	7	6	9	4

(08 Marks)

b. Explain LC Branch and Bound and FIFO branch and bound. **(08 Marks)**

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