UG/PG (CBCS) ODD SEMESTER EXAMINATION, 2022

COMPUTER SCIENCE

7th Semester / 1st Semester

Course No. : MCS-502

(Design and Analysis of Computer Algorithm)

Full Marks : 70

Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks for the questions

(Answer any five questions, taking one from each unit)

UNIT-I

1. (a) What is the difference between big-oh (O) and small-oh notation (o)? Which one is a tight notation and why? 5

   (b) Prove that the running time of an algorithm is $\Theta(9(n))$ iff its worst case running time is $O(9(n))$ & its best case running time is $\Omega(9(n))$. 3

   (c) State, with reasons, whether the following qualities are correct or not

   (i) $5n^2-6n= \Theta(n^2)$, (ii) $n!=O(n^n)$,

   (iii) $n^2\log n=\Theta(n^2)$. 2x3=6

2. (a) Solve the following by the Master method :

   (i) $T(n)= 2T(n/2) + n\log n$ 4x2=8

(ii) $T(n)= 7T(n/2) + \Theta(n^2)$

(b) State, with reasons, whether the following equations are correct or not 2x3=6

(i) $n^2 + 10^6 n^2 = (n^2)$

(ii) $33n^3 + 4n^2 = \Omega(n^2)$

(iii) $n^2/\log n= \Theta(n^2)$

UNIT-II

3. (a) Show that there one at most $[n/2^{h+1}]$ nodes of height h in any n-element heap. 5

(b) Show that an n element heap has height $\lfloor \lg n \rfloor$. 4

(c) Illustrate the operation of HEAPSORT on the away A= <5, 13, 2, 25, 7, 17, 20, 8, 4> 5

4. (a) How can we say that merge sort falls under the divide and conquer paradigm of algorithms? 3

(b) Show that the running time of Merge Sort is 0 (nlogn). 6

(c) Using Merge Sort, sort the following nos 310, 285, 179, 652, 351, 861, 679, 215. 5

UNIT-III

5. (a) Show that depth-first search works on the graph shown in Fig-1. Assume that the DFS procedure consider the vertices in alphabetical order and assume that each adjacency list is ordered alphabetically. Show that discovery and finishing time for each vertex. 5

(c) What is an optional Huffman code for the following set of frequencies bared on the first 8 fibanacci nos. 5

UNIT-V

9. (a) What is the difference between polynomial time algorithms and non polynomial time algorithms? 3

(b) What are reductions? 5

(c) Discuss the problem of finding Hamiltonian cycle in an undirected graph. Does it run in Polynomial time? Explain. 6

10. Write short notes on the following :

(i) Pand NP class of problems 5

(ii) Verification algorithms 4

(iii) Optimal substructure property 5

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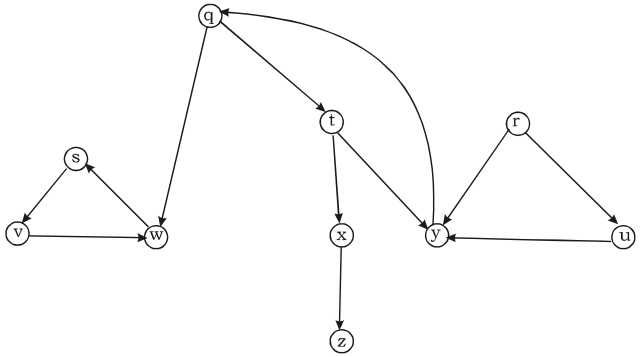

Fig-1

(b) What is Topological sort? Show how Topological sort works by taking a suitable example. 2+3=5

(b) Show how the procedure STRONGLY CONVECTED-COMPONENTS works on the graph of Fig-1. Assume that DFS considers vertices in alphabetical order & that the adjacency list is ordered alphabetically. 4

6. (a) What are the properties of shortest paths in a graph? 5

(b) Runn Dijkstra's algorithm on the directed graph of Fig-2 using vertex Z as the source. Show the d, π values and the vertices in set S after each iteration. 4

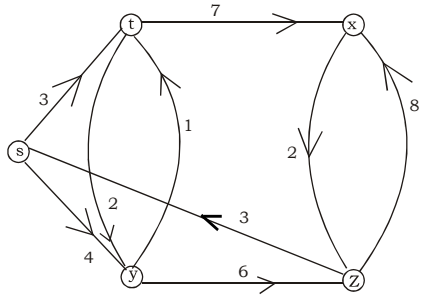

Fig-2

(c) Compute the minimum cost spanning tree for the graph given in Fig-3 using Kruskal's algorithm. 5

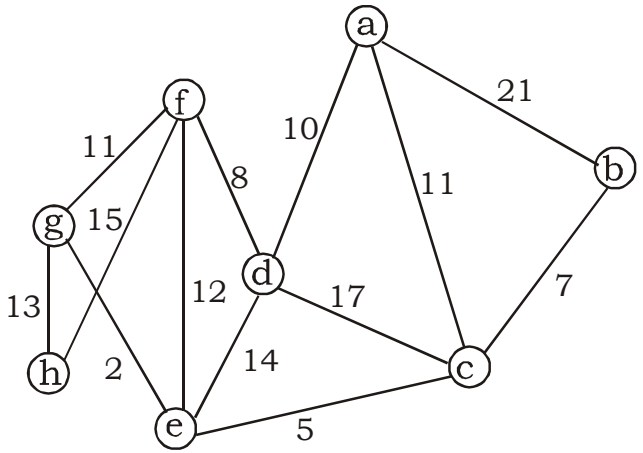

Fig-3

UNIT-IV

7. (a) What is dynamic programming? How is it different from the Divide and Conquer Paradign? 2+2=4

(b) What is the memoized recursive algorithm? Taking an example show that it is more efficient than the conventional recursive procedure. 5

(c) Enumerate the sequence of steps needed to develop a dynamic programming algorithm. 5

8. (a) What is a greedy algorithm? What are its properties? 4

(b) Discuss Huffman code by taking a suitable example. What is the running time of Huffman code? 5