B.Tech. (Computer Science & Engineering) Fifth Semester (C.B.C.S.) Winter 2022
Design & Analysis of Algorithms

P. Pages : 3

Time : Three Hours

Max. Marks : 70

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Assume suitable data whenever necessary.
8. Diagrams and chemical equations should be given whenever necessary.
9. Due credit will be given to neatness and adequate dimensions.

1. a) Solve the following recurrence relation using the technique of characteristic equation   7

   $T(n) = 3$ if $n = 0$

   $= 2t_{n-1} + 2^n + 5$ otherwise

   b) Explain principles of designing an algorithm in brief.   7

OR

2. a) Solve the following using master method   8

   i) $T(n) = 9T(n/3) + n$ ii) $T(n) = T(2n/3) + 1$

   iii) $T(n) = 4T(n/2) + n$ iv) $T(n) = 3T(n/4) + n\log n$

   b) What is sorting network? Explain bitonic sorting network for the following set of information 1, 5, 7, 2, 8, 6, 2, 9. Explain its advantages.   6

3. a) Write an algorithm for Binary search. Find its complexity. Also find out average number of successful and unsuccessful comparisons on following array: 7
   -12, 23, 31, 45, 56, 78, 90, 103, 113, 126, 157.

   b) Using Strassen's algorithm for matrix multiplication solve the following   7

 $A\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ $B\begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$

OR

4. a) Find optimal solution to knapsack instance $n = 7$, $m = 15$ 7

   $(P_1, P_2 ---, P_7) = (15, 20, 10, 7, 6, 18, 3)$

   $(w_1, w_2, ---, w_7) = (2, 3, 5, 7, 1, 4, 1)$

b) Write an algorithm for Huffman code? Implement it on the following data and variable length encoding
a:25, b:10, c:12, d:30, e:35.

7

5. a) What is TSP? Implement TSP for the following matrix representing complete graph using dynamic programming

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

7

b) Write algorithm for LCS. Find the LCS of following sequence
X=a,a,b,a,a,b,a,b,a,a
Y=b,a,b,a,a,b,a,b

OR

6. a) Write an algorithm for Floyd Warshall and calculate distance and path matrix of following.

7
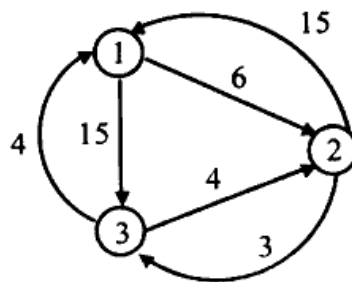
b) Using chained matrix multiplication method find out minimum no. of operation required to multiply. Following matrices and also find the best sequence
A = 6×10
B = 10×12
C = 12×5
D = 5×8

7

7. a) Write the algorithm for Breadth First Search (BFS). Also perform BFS on the given graph, showing operations using stack. State the output sequence generated.
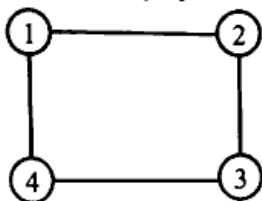
7
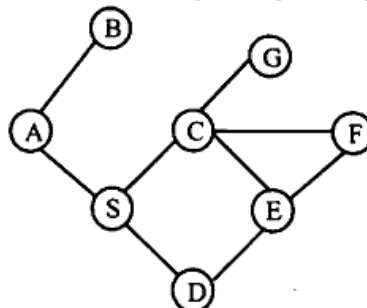
b) Find the Hamiltonian cycle in the given graph. Also draw the solution tree showing all possible paths. **7**
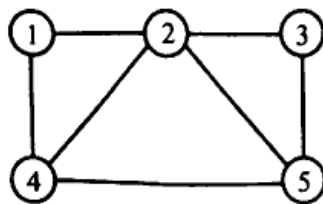
OR

8. a) What is graph coloring? Color the following graph using graph coloring algorithm. **7**

b) Place 8 Queens in 8*8 matrix such that no two queens are in same row, same column or diagonally opposite. **7**

9. a) Explain in detail the relationship between P, NP, NP-Hard and NP-complete problem with the help of diagram. **7**

b) What do you mean by decision and optimization problem? Explain. **7**

OR

10. Write an algorithm for following graph reduction method. **14**
   i) Clique
   ii) Graph partition into trangee
   iii) Independent set problem.

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