

B.E. (Information Technology) Fifth Semester (C.B.S.)
Design & Analysis of Algorithms

P. Pages : 4

Time : Three Hours



NRT/KS/19/3439

Max. Marks : 80

- 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. Solve Question 11 OR Questions No. 12.
 8. Assume suitable data whenever necessary.
 9. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) Explain different design strategies of an algorithm. 7
- b) Solve the recurrence 6
- $$t_n = \begin{cases} 0 & \text{if } n = 0 \text{ or } n = 1 \\ t_{n-1} + t_{n-2} & \text{if } n > 1 \end{cases}$$

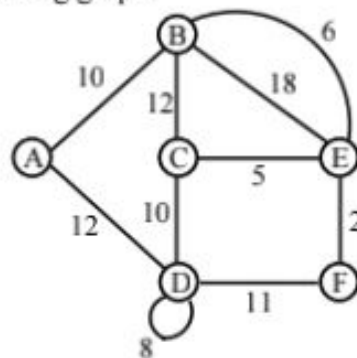
OR

2. a) Use master method to give tight asymptotic bound for the following recurrence. 6
- i) $T(n) = T\left(\frac{9n}{10}\right) + n$
 - ii) $T(n) = 4T\left(\frac{n}{2}\right) + n^2$
 - iii) $T(n) = 9T\left(\frac{3n}{5}\right) + n^3$
- b) Solve the following recurrence 7
- $$T(n) = \begin{cases} 1 & \text{if } n = 1 \\ 4T\left(\frac{n}{2}\right) + n \log_2 n & \text{if } n \text{ is power of } 2. \end{cases}$$
3. a) Define asymptotic notation. Find upper, lower and tight bound for the following :- 8
- i) $300n + 4$
 - ii) $10n^2 + 6n + 8$
 - iii) $2^{5n} + n^2$
- b) Explain the method of a mortised analysis along with 8-bit binary increment operation. 6

OR

4. a) Sort the given array using Heap sort algorithm. Write its algorithm and also give complexity.
40, 35, 70, 45, 90, 50, 25 9
- b) What is sorting network? Explain Half cleaner (Bitonic sorting) and apply half cleaner circuit (Bitonic sorting) on following sequence
(01001000) 5

5. a) Explain the characteristic of greedy algorithm. 3
- b) What is spanning tree? Obtain a minimum cost spanning tree using KRUSKAL and PRIM's algorithm for the following graph. 10



OR

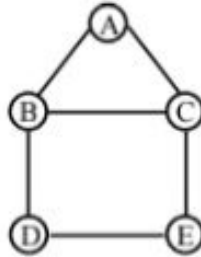
6. a) Find optimal solution to knapsack instance $n = 7, m = 15$ 6
 $(P_1, P_2, \dots, P_7) = (15, 20, 10, 7, 6, 18, 3)$
 $(w_1, w_2, \dots, w_7) = (2, 3, 5, 7, 1, 4, 1)$
- b) Write an algorithm for Huffman code? Implement it on the following data and variable length encoding. 7
 $a: 25, b: 10, c: 12, d: 30, e: 35$
7. a) Differentiate between Divide and conquer, Greedy algorithm and Dynamic programming. 6
- b) What is LCS? Write an algorithm to find LCS and print LCS for following sequence. 7
 $A = \text{CONDITION}$
 $B = \text{RECURSION}$

OR

8. a) What is TSP? Implement TSP for the following matrix representing complete graph using dynamic programming 6
- $$\begin{bmatrix} 0 & 10 & 15 & 20 \\ 5 & 0 & 9 & 10 \\ 6 & 13 & 0 & 12 \\ 8 & 8 & 9 & 0 \end{bmatrix}$$

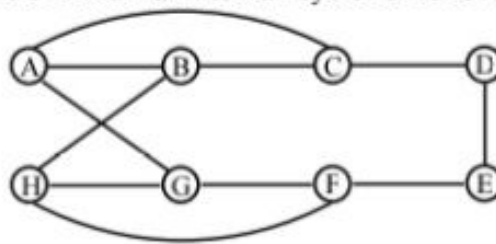
- b) Using chained matrix multiplication method find out minimum no. of operation required to multiply. Following matrices and also find the best sequence. 7
- $A = 6 \times 10$
 $B = 10 \times 12$
 $C = 12 \times 5$
 $D = 5 \times 8$

9. a) What is backtracking? Explain how backtracking is applied to 4-Queen's problem. 5
- b) What is planar graph? Draw solution space tree to color the following graph using 3 colors. 9

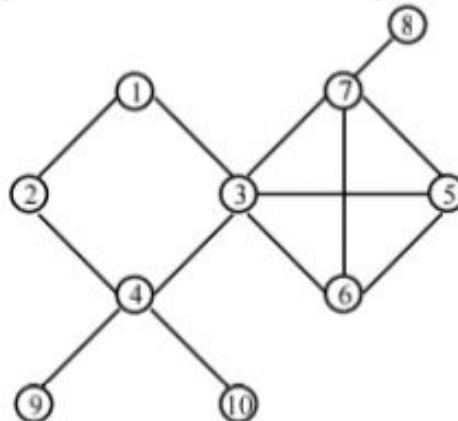


OR

10. a) What is Hamiltonians cycle? Find Hamiltonian cycle for following graph. 7



- b) Write an algorithm for Depth first search. Find DFS sequence for the following graph. 7



11. a) Explain in detail the relationship between P, NP, NP-Hard and NP-complete problem with the help of diagram. 8
- b) What do you mean by decision and optimization problem? Explain. 5

OR

12. Write short notes on solve **any three**.

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- i) CLIQUE
- ii) Graph Partitioned into triangle.
- iii) Independent Set Problem.
- iv) Non Deterministic Searching.
- v) Non Deterministic Sorting.
