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B.E. (Computer Science Engineering) Fifth Semester (C.B.S.)

Design & Analysis of Algorithms

P. Pages : 3 **NRT/KS/19/3437**

Time : Three Hours * 0 1 4 1 * 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. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) Solve the following recurrence : **7**

$T(n) = T(n/4) + \sqrt{n} + 4$ for $n >= 4$ $T(1) = 4$

b) Explain principles of designing algorithm in brief. **6**

OR

2. a) Differentiate between **6**
i) Recursion & Iteration
ii) Homogenous & Non – Homogeneous Recurrences

b) Solve the following recurrence **7**

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

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

3. a) What are different Asymptotic notations? Explain them briefly. Find upper bound, lower bound and tight bound range for following. **7**

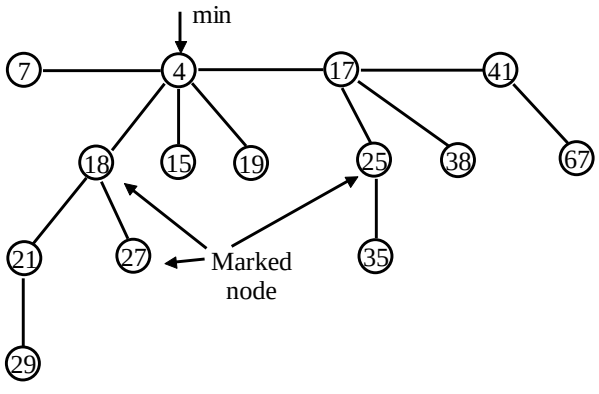
i) $5n + 11$ ii) $21n^2 + 9n + 6$

b) What is sorting Network? Explain half cleaner circuit. Design a 8 bit bitonic sorting network and explain its operation for 1, 7, 5, 8, 2, 6, 9, 3. **7**

OR

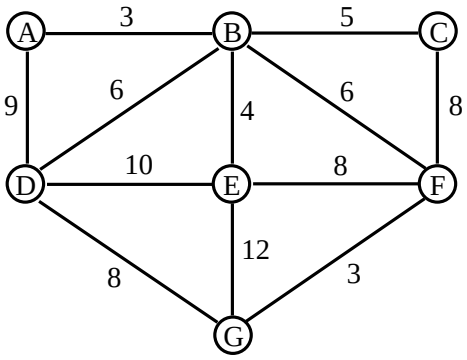
4. a) What is Amortized Analysis? Explain the methods of Amortized Analysis for 4 – bit binary increment operation. **7**

b) Perform the following operation on Fibonacci Heap. **7**



i) Delete the min node ii) Calculate potential function of given heap
iii) Decrement 35 by 5. iv) Insert 21 in the given Fibonacci Heap.

5. a) What is minimum cost spanning tree? Find minimum cost spanning tree for the following graph using Prim's algorithm. **7**



b) Find optimal solution for knapsack problem. Using greedy strategy for following instances $n = 7,\ m = 15$. **7**

Object	1	2	3	4	5	6	7
Weight	2	3	5	7	1	4	1
Profit	10	5	15	7	6	18	3

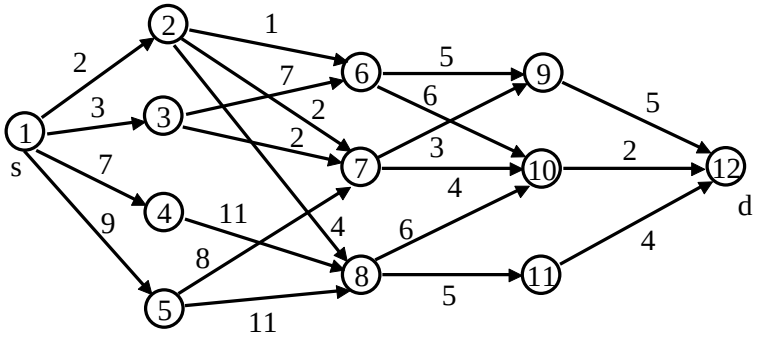
OR

6. a) Explain Analysis of binary search for following elements and calculate average no. of successful and average no. of unsuccessful comparisons. **7**

– 12, 23, 31, 45, 56, 78, 90, 103, 113, 126, 157.

b) Draw the merge and split tree using Merge sort for array of size 15. Write recurrence equation for merge sort algorithm. **7**

7. a) What is multistage graph? For the following graph find shortest path from source to destination. **6**



b) Determine LCS of **7**

X = (AGGTABZ)

Y = (GXTXAYB)

Write the recurrence equation for LCS.

OR

8. a) Determine the cost and structure of optimal Binary search tree for set of $n = 7$ keys with the following probabilities. **7**

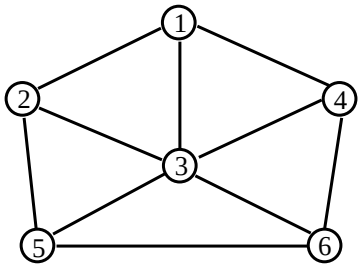
i	0	1	2	3	4	5
P_i	--	0.15	0.10	0.05	0.10	0.20
Q_i	0.05	0.10	0.05	0.05	0.15	0.10

b) What is Travelling salesman problem? Implement it for the following matrix : **6**

$$\begin{bmatrix} 0 & 8 & 16 & 15 \\ 14 & 0 & 9 & 12 \\ 7 & 10 & 0 & 6 \\ 11 & 13 & 10 & 0 \end{bmatrix}$$

9. a) What is 8 – queen problem? Explain implicit and explicit constraints associated with this problem. Give at least two solutions for the problem. **7**

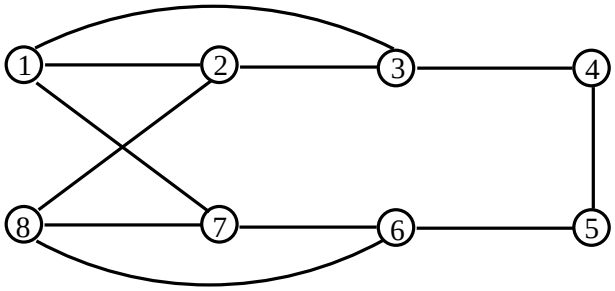
b) What is Backtracking? Obtain the BFS tree and DFS tree for the following graph. **6**



OR

10. a) What is Graph Coloring? Implement on following graph and generate solution space tree if number of permitted colors is 3. **6**

b) What are Hamiltonian cycles? For the following graph generate Hamiltonian cycles. **7**



11. a) i) Prove that $P \subseteq NP$. **4**

ii) Write note on Polynomial reduction. **3**

b) Write non – deterministic algorithm to generate CLIQUE of size k from graph of n vertices. **6**

OR

12. Write short notes on : **13**

i) P Class Problem

ii) NP – Hard

iii) NP – Complete

iv) Deterministic Algorithm

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All our dreams can come true if we have the courage to pursue them.

~ Walt Disney