NTK/KW/15/7443

Faculty of Engineering & Technology

Fifth Semester B.E. (Information Technology)

(C.B.S.) Examination

DESIGN AND ANALYSIS OF ALGORITHM

Time : Three Hours] [Maximum Marks : 80

INSTRUCTIONS TO CANDIDATES

(1) All questions carry marks as indicated.

(2) Due credit will be given to neatness and adequate dimensions.

(3) Assume suitable data wherever necessary.

(4) Illustrate your answers wherever necessary with the help of neat sketches.

1. (a) Find the exact time complexity of summation of array of size 'n' using iterative and recursive approach. 5

(b) Use Master's method to give tight asymptotic bound for the following recurrences :

(i) $T(n) = 3T(n/4) + n/gn$

(ii) $T(n) = 16T(n/4) + n^2$ 6

(c) Define algorithm in detail. 3

OR

2. (a) Solve the recurrence relation

$t_n = t_{n-1} + t_{n-2} \quad n > 1$

$= n \quad$ if $\quad n = 0$ or $n = 1$ 6

(b) Find the order of the function

$g(n) = 4n^2 + 2n + 1.$ 3

(c) Solve the recurrence relation

$T(n) = 2T(n/2) + n/gn \quad n > 1$

$= 1 \quad n = 1$ 5

3. (a) Show that if an INCREMENT operation were included in a 8-bit counter. The worst case time for a sequence of 'n' INCREMENT operations on an initially zero counter is 0(n). 7

(b) Write an algorithm to sort an array using insertion sort method. Obtain its best case and worst case time complexity. 6

OR

4. (a) Implement Biotonic sorting network for the following set of information :

A = (1, 5, 4, 8, 2, 3, 9, 7). 6

(b) Define amortized analysis. Explain the amortized complexity of 8-bit binary number from 0 to 16. Write algorithm for binary increment operation. 7

5. (a) Use Strassen's algorithm to compute the matrix product :

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

(b) Illustrate the stepwise operation of Merge sort for the input array :

A = < 5, 13, 2, 25, 7, 17, 20, 8, 3 >.

Also find the recurrence relation for the algorithm and discuss its complexity. 7

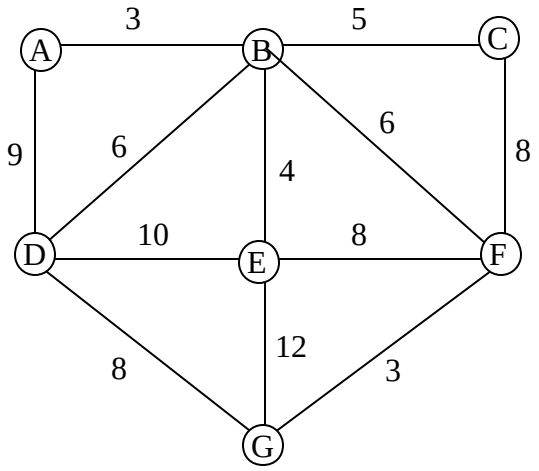
OR

6. (a) What are the optimal Huffman codes for following set of frequencies and discuss its complexity :

a : 14, b : 10, c : 8, d : 12, c : 6 6

(b) What is minimum cost spanning tree ? Show the snapshots of Kruskal's algorithm to find minimum

cost of spanning tree for the given graph :



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7. (a) Write a recurrence equation for LCS, and find the LCS of following sequences :

X = SOLUTION

Y = RECURSION 7

(b) Using matrix chain multiplication method, find out number of operations required to multiply following matrices, also find the best sequence :

A = 5 × 10 B = 10 × 3 C = 3 × 12

D = 12 × 5. 7

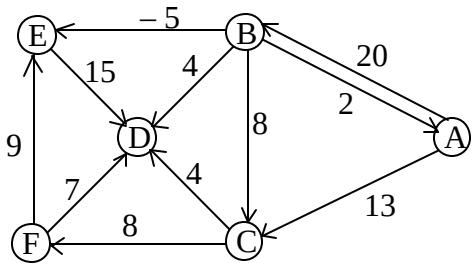
OR

8. (a) For the following set of objects implement 0/1 knapsack problem, with maximum capacity of 8 :

Objects	Profits	Weight
1	9	2
2	15	3
3	12	5
4	4	4

7

(b) Implement single source shortest path algorithm on following graph. Draw various distance trees. Consider vertex 'A' as source :



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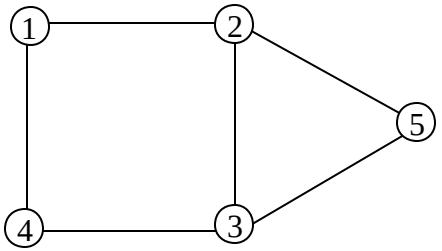
9. (a) Implement graph coloring on following graph and generate space tree if number of permitted colours = 3.



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(b) Explain how backtracking technique can be applied to solve 4-Queens problem. 6

OR

10. (a) Give an algorithm for breadth-first search. Explain with example. 6

(b) Design a solution for Hamiltonian path. Explain how the solution can be used to solve Hamiltonian Cycle problem. 7

11. (a) Explain in detail the relationship between P, NP, NP complete and NP hard with the help of diagram. 6

(b) Explain following terms (any **THREE**) :—

(i) Non deterministic algorithms

(ii) Decision and optimization problem

(iii) NP hard problem

(iv) NP complete problem. 7

OR

12. (a) Design a non-deterministic algorithm for the 0/1 knapsack problem and find its time complexity. 7

(b) "Every NP-hard problem is NP-complete." State whether this is true or false with justification. 6