

7. a) Generate a Huffman coding scheme for a file containing the following characters and their given frequencies. Show the total number of bits required for encoding a file of 60,000 bits using the generated code. [4]

Character	B	E	A	D	C
Frequency	24	8	10	12	6

- b) Build a heap for the elements 20, 30, 90, 70, 60, 50, 45, 55 and delete two maximum elements. [4]
8. Write short notes on (any two)- [4 × 2]
- NP-hard problems with example
 - Binary Search algorithm and its complexity
 - TSP approximation algorithm

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SUPPLEMENTARY EXAMINATION-2016

5th Semester B.Tech & B.Tech Dual Degree

DESIGN & ANALYSIS OF ALGORITHM

CS-3001

Full Marks: 60

Time: 3 Hours

Answer any SIX questions including Question No.1 which is compulsory.

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable and all parts of a question should be answered at one place only.

- Answer all the questions. [2 × 10]
 - Given $f(n) = 3n + 2$, and $g(n) = n$, find values of c_1 , c_2 and n_0 for which $f(n) = \theta(g(n))$.
 - Find the worst case time complexity of the given summation.

$$\sum_{i=1}^n \sum_{j=1}^i 1$$

- What will be the time complexity if the array is already in sorted order? Justify.
- A spanning tree of a graph has 100 vertices. By how much will the cost of the spanning tree be reduced if the weight of each edge of the graph is reduced by 5 units?
- In a binary max heap, what is the asymptotic time required to search for the minimum element? Justify.
- Which if the following sorting algorithms has the lowest worst-case complexity?
 - Merge Sort

(1)

(ii) Bubble Sort

(iii) Quick Sort

(iv) Selection Sort

g) Define the recursive formula for solving the 0/1 knapsack problem using dynamic programming, for “n” objects having weights “ w_1, w_2, \dots, w_n ” and a knapsack of capacity “m”.

h) Find the contents of the array after 4 iterations of insertion sort on the following array:

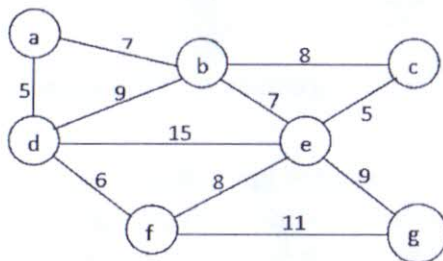
34, 21, 30, 50, 25, 10, 40

i) Provide an optimal storage pattern for files of lengths 12, 34, 56, 73, 24, 11, 34, 56, 78, 91, 34, 91, 45 on 3 tapes - t_0 , t_1 and t_2 .

j) Define P and NP problems.

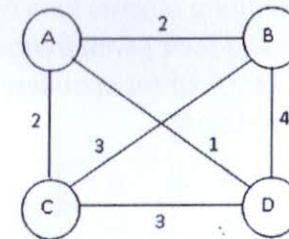
2. a) Find a longest common subsequence and its length for the given strings – HUMAN and CHIMPANZEE. [4]

b) Write the Prim’s algorithm for finding the minimum cost spanning tree of a graph. Find a minimum cost spanning tree of the following graph using Prim’s algorithm. [4]



3. a) Find a tour of the given map of cities incurring the least cost that a travelling salesman starting from vertex A should follow. Use the dynamic programming approach. [4]

(2)



b) Write the algorithms for the *find()* and *weighted_union()* operations on disjoint sets. [4]

4. a) Solve the given recurrence. [4]

$$T(n) = \begin{cases} 2T(\sqrt{n}) + \log n, & n > 4 \\ 2, & n \leq 4 \end{cases}$$

b) Find an optimal parenthesization for multiplication of the given chain of matrices $\langle A_1, A_2, A_3, A_4 \rangle$ having dimensions $\langle 5 \times 4, 4 \times 6, 6 \times 2, 2 \times 7 \rangle$. [4]

5. a) Define the branch and bound method for algorithm design. Write an algorithm for performing depth-first search on a graph. [4]

b) Schedule the set of jobs given in the table to obtain maximum profit. Find the total profit. Assume each job takes 2 hours for completion. [4]

Job	a	b	c	d	e	f	g	h
Deadline	10	3	2	4	7	6	5	9
Profit	200	400	600	300	500	800	700	100

6. a) Write the insertion sort algorithm and find its best and worst case time complexities. [4]

b) Write a backtracking algorithm for placing N queens on an $N \times N$ chessboard so that no two queens can attack each other. Show the solution for $N=5$. [4]

(3)