

Reg. No. :

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Question Paper Code : 70384

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Third / Fourth Semester

Computer Science and Engineering

CS 6402 – DESIGN AND ANALYSIS OF ALGORITHMS

(Common to Information Technology)

(Regulations 2013)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write an algorithm to find the number of binary digits in the binary representation of a positive decimal integer.
2. Write down the properties of asymptotic notations.
3. Give the mathematical notation to determine if a convex direction is towards left or right and write the algorithm.
4. Prove that any comparison sort algorithm requires $\Omega(n \log n)$ comparisons in the worst case.
5. What is meant by principle of optimality?
6. How to calculate the efficiency of Dijkstra's Algorithm?
7. What is a state space graph?
8. State Extreme Point Theorem.
9. What is an articulation point in a graph?
10. Define 'P' and 'NP' problems.

PART B — (5 × 13 =65 marks)

11. (a) (i) Use the most appropriate notation to indicate the time efficiency class of sequential search algorithm in the worst case, best case and the average case. (7)
- (ii) State the general plan for analyzing the time efficiency of nonrecursive algorithms and explain with an example. (6)

Or

- (b) Solve the following recurrence relations

- $x(n) = x(n-1) + 5$ for $n > 1$ $x(1) = 0$
- $x(n) = 3x(n-1)$ for $n > 1$ $x(1) = 4$
- $x(n) = x(n-1) + n$ for $n > 0$ $x(0) = 0$
- $x(n) = x(n/2) + n$ for $n > 1$ $x(1) = 1$ (solve for $n = 2^k$)
- $x(n) = x(n/3) + 1$ for $n > 1$ $x(1) = 1$ (solve for $n = 3^k$) (13)

12. (a) (i) Solve the following using Brute-Force algorithm: (8)
- Find whether the given string follows the specified pattern and return 0 or 1 accordingly.

Examples:

- (1) Pattern: “abba”, input: “redblueredblue” should return 1
 - (2) Pattern: “aaaa”, input: “asdasdasdasd” should return 1
 - (3) Pattern: “aabb”, input: “xyzabcxzyabc” should return 0
- (ii) Explain the convex hull problem and the solution involved behind it. (5)

Or

- (b) A pair contains two numbers, and its second number is on the right side of the first one in an array. The difference of a pair is the minus result while subtracting the second number from the first one. Implement a function which gets the maximal difference of all pairs in an array (using Divide and Conquer method). (13)

13. (a) Solve the following instance of the 0/1, knapsack problem given the knapsack capacity in $W = 5$ using dynamic programming and explain it. (13)

Items	Weight	Value
1	4	10
2	3	20
3	2	15
4	5	25

Or

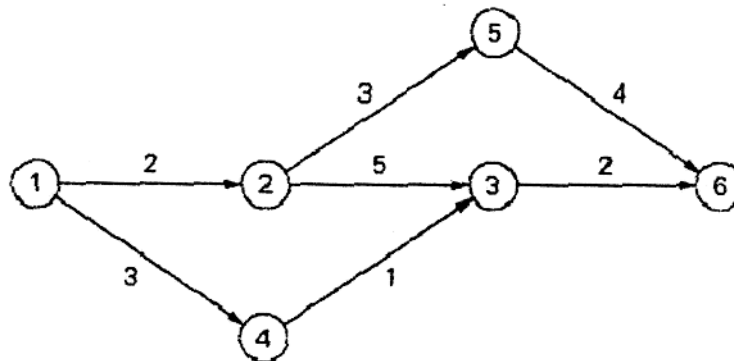
- (b) Write the Huffman's Algorithm. Construct the following data and obtain its Huffman's Code. (13)

Character	A	B	C	D	E	-
Probability	0.5	0.35	0.5	0.1	0.4	0.2

14. (a) (i) Summarize the simplex method. (7)
(ii) State and prove Max-Flow Min-Cut Theorem. (6)

Or

- (b) Apply the shortest-augmenting-path algorithm to the network shown below. (13)



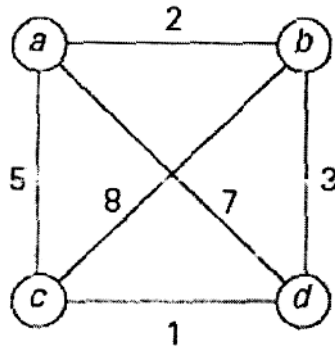
15. (a) (i) Using an example prove that, satisfiability of boolean formula in 3-Conjunctive Normal Form is NP — complete. (10)
(ii) State the relationships among the complexity class algorithms with the help of neat diagrams. (3)

Or

- (b) (i) Show that the Hamiltonian Path problem reduces to the Hamiltonian Circuit Problem and vice versa. (8)
(ii) What is an approximation algorithm? Give example. (5)

PART C — (1 × 15 = 15 marks)

16. (a) Apply Branch and Bound algorithm to solve the Travelling Salesman Problem for (15)



Or

- (b) Write an algorithm for quick sort and write its time complexity with example list are 5, 3, 1, 9, 8, 2, 4, 7. (15)
