Reg. No. : | | | | | | | | | | | | |



**Question Paper Code : 80097**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Fourth Semester

Computer Science and Engineering

CS 8451 — DESIGN AND ANALYSIS OF ALGORITHMS

(Common to Information Technology/Computer and Communication Engineering)

(Regulation 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. How do you measure the efficiency of an algorithm?
2. Prove that the if $f(n) = O(g(n))$ and $g(n) = O(f(n))$, then, $f(n) = \theta\, g(n)$.
3. Write the brute force algorithm to string matching.
4. What is the time and space complexity of Merge sort?
5. State the principle of optimality.
6. What is the constraint for binary search tree insertion?
7. State the principle of duality.
8. Define the capacity constraint in the context of maximum flow problem.
9. Define NP completeness and NP hard.
10. State Hamiltonian Circuit problem.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Solve the following recurrence equation :

(1) $T(n) = T(n/2) + 1$, where $n = 2^k$ for all $k \geq 0$ (4)

(2) $T(n) = T(n/3) + T(2n/3) + cn$, where '$c$' is a constant and '$n$' is the input size. (4)

(ii) Explain the steps involved in problem solving. (5)

Or

(b) (i) Write an algorithm for determining the uniqueness of an array. Determine the time complexity of your algorithm. (10)

(ii) Explain time-space trade off of the algorithm designed. (3)

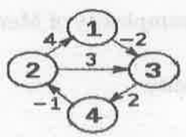
12. (a) What is the convex hull problem? Explain the brute force approach to solve convex-hull with an example. Derive the time complexity. (2 + 7 + 4)

Or

(b) Write the quicksort algorithm and explain it with an example. Derive the worst case and average case time complexity. (5 + 4 + 4)

13. (a) (i) Write the Floyd algorithm to find all pairs shortest path and derive its time complexity. (4 + 3)

(ii) Solve the following using Floyd's algorithm. (6)




Or

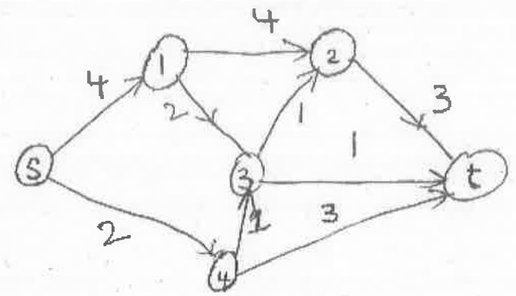
(b) (i) Write the Huffman code algorithm and derive its time complexity. (5 + 2)

(ii) Generate the Huffman code for the following data comprising of alphabet and their frequency. (6)

$a : 1, b : 1, c : 2, d : 3, e : 5, f : 8, g : 13, h : 21$



14. (a) Determine the max-flow in the following network. (13)




Or

(b) Solve the following set of equations using Simplex algorithm : (13)

Maximize : $18x_1 + 12.5x_2$

Subject to : $x_1 + x_2 \leq 20$

$x_1 \leq 12$

$x_2 \leq 16$

$x_1, x_2 \geq 0$.

15. (a) Write an algorithm to solve the Travelling salesman problem and prove that it is a 2 time approximation algorithm. (13)

Or

(b) Write an algorithm for subset sum and explain with an example. (13)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Given a matrix of order $M \times N$, and two coordinates $(p, q)$ and $(r, s)$, which represents the top-left and bottom-right of a sub-matrix of the matrix, $M \times N$, calculate the sum of elements present in the sub-matrix in $O(1)$ time using dynamic programming. Determine the optimal sub-structure and write an algorithm. (10)

(ii) Prove that any algorithm that sorts by comparison, requires $\Omega(n \lg n)$ time. (5)

Or

(b) (i) The longest common subsequence (LCS) is the problem of finding the longest subsequence that is present in the given two sequences in the same order but not necessarily contiguously. Write an algorithm using dynamic programming that determines the LCS of two strings, '$x$' and '$y$' and returns the string '$z$'. (10)

(ii) Prove that any algorithm that searches need to necessarily do $\Omega(\lg n)$ comparisons. (5)

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# Question Paper Code : 90154

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Fourth Semester

Computer Science and Engineering

CS8451 – DESIGN AND ANALYSIS OF ALGORITHMS

(Common to Computer and Communication Engineering / Information Technology)

(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. State the transpose symmetry property of O and Ω.
2. Define recursion.
3. State the convex hull problem.
4. Outline the knapsack problem.
5. What is Brute Force method ?
6. Define a binary search tree.
7. When a linear program is said to be unbounded ?
8. What is a residual network in the context of flow networks ?
9. When is a problem said to be NP hard ?
10. State the Hamiltonian circuit problem.

PART – B **(5×13=65 Marks)**

11. a) i) Solve the following recurrence equations using iterative method or tree. **(7)**

ii) Elaborate asymptotic analysis of an algorithm with an example. **(6)**

(OR)

b) Write an algorithm using recursion that determines the GCD of two numbers. Determine the time and space complexity.

12. a) State the travelling salesman problem. Elaborate the steps in solving the travelling salesman problem using brute force approach. **(13)**

(OR)

b) Write the algorithm to find the closest pair of points using divide and conquer and explain it with an example. Derive the worst case and average case time complexity. **(5+4+4)**

13. a) i) Outline the Dynamic programming approach to solve the Optimal Binary search tree problem and analyse its time complexity. **(4+2)**

ii) Construct the Optimal binary search tree for the following 5 keys with probabilities as indicated. **(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 | 0.05 | 0.10 |

(OR)

b) Write a Greedy algorithm to solve the 0/1 knapsack problem. Analyse its time complexity. Show that this algorithm is not optimal with an example. **(5+2+6)**

14. a) What is iterative improvement ? Elaborate the steps in the simplex method with an example. **(13)**

(OR)

b) i) What is a bipartite graph ? Is the subset of a bipartite graph bipartite ? Outline with an example. **(2+1+4)**

ii) Outline the stable Marriage problem with an example. **(6)**

15. a) Elaborate how backtracking technique can be used to solve the n-queens problem. Explain with an example. **(13)**

(OR)

b) Outline the steps to find an approximate solution to NP-hard optimization problems using approximation algorithms with an example. **(13)**

PART – C **(1×15=15 Marks)**

16. a) Sort the following numbers using quick sort.

999, 888, 777, 666, 555, 444, 333, 222, 111, 11, 22, 33, 44, 55, 66, 77, 88, 99.

Illustrate each step in the sorting process. **(15)**

(OR)

b) i) The Longest Increasing Subsequence (LIS) problem is to find the length of the longest subsequence of a given sequence such that all elements of the subsequence are sorted in increasing order. Write an algorithm using dynamic programming that determines the LIS of a string 'x'. For example, the length of LIS for {10, 22, 9, 33, 21, 50, 41, 60, 80} is 6 and LIS is {10, 22, 33, 50, 60, 80}. **(10)**

ii) Determine the Time and Space complexity of the above algorithm. **(5)**

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**Question Paper Code : 57249**

**B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016**

**Third/Fourth Semester**

**Computer Science and Engineering**

24/05/2016 FN

**CS 6402 – DESIGN AND ANALYSIS OF ALGORITHMS**

**(Regulations 2013)**

**Time : Three Hours** **Maximum : 100 Marks**

**Answer ALL questions.**

**PART – A (10 × 2 = 20 Marks)**

1. Give the Euclid's algorithm for computing gcd (m, n).
2. Compare the orders of growth of $n(n-1)/2$ and $n^2$.
3. Give the general strategy of Divide and Conquer Method.
4. What is the closest -pair problem ?
5. Define the Single Source Shortest Paths Problem.
6. State the assignment Problem.
7. What is a state space graph ?
8. State Extreme Point Theorem.
9. Give the purpose of lower bound.
10. What is Euclidean minimum spanning tree problem ?

**PART – B (5 × 16 = 80 Marks)**

11. (a) (i) Give the definition and Graphical Representation of O-Notation. **(8)**

(ii) Give the algorithm to check whether all the elements in a given array of n elements are distinct. Find Worst case complexity of the same. **(8)**

**OR**

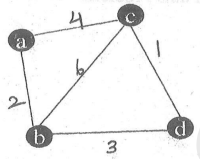
(b) Give the recursive Algorithm for finding the number of binary digits in n's binary representation, where n is a positive decimal integer. Find the recurrence relation and complexity. **(16)**

12. (a) State and Explain the Merge Sort algorithm and Give the recurrence relation and efficiency. **(16)**

**OR**

(b) Explain the method used for performing Multiplication of two large integers. Explain how Divide Conquer Method can be used to solve the same. **(16)**

13. (a) Discuss about the algorithm and Pseudocode to find the Minimum Spanning Tree using Prim's Algorithm . Find the Minimum Spanning tree for the graph shown below.

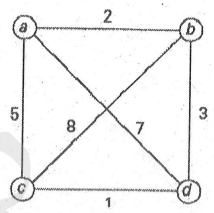



And Discuss about the efficiency of the Algorithm. **(16)**

**OR**



(b) Find all the Solution to the travelling salesman problem (cities and distances shown below) by exhaustive search. Give the optimal solution. **(16)**

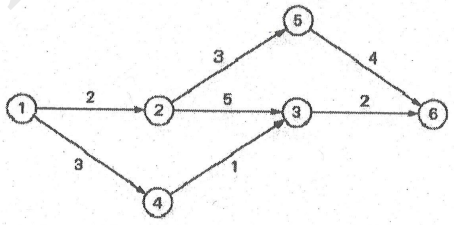



14. (a) (i) Summarize the simplex method. **(8)**

(ii) State and prove Max-Flow Min-Cut Theorem **(8)**

**OR**

(b) Apply the shortest-augmenting-path algorithm to the network shown below. **(16)**




15. (a) Give any five undecidable problems and explain the famous halting Problem. **(16)**

**OR**

(b) State the subset-sum problem and Complete state-space tree of the backtracking algorithm applied to the instance A = {3, 5, 6, 7} and d = 15 of the subset-sum problem. **(16)**

Reg. No. : | | | | | | | | | | | | |

**Question Paper Code : 71679**

06/06/2017 FN

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

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. What is an Algorithm?

2. Write an algorithm to compute the greatest common divisor of two numbers.

3. Devise an algorithm to make for 1655 using the Greedy strategy. The coins available are {1000, 500, 100, 50, 20, 10, 5}.

4. What is closest-pair problem?

5. State the general principle of greedy algorithm.

6. What do you mean by dynamic programming?

7. What do you mean by 'perfect matching' in bipartite graphs?

8. State: Planar coloring graph problem.

9. What is an articulation point in a graph?

10. Define 'P' and 'NP' problems.

PART B — (5 × 13 = 65 marks)

11. (a) Briefly explain the mathematical analysis of recursive and non-recursive algorithm. (13)

Or

(b) Explain briefly Big oh Notation, Omega Notation and Theta Notations. Give examples. (13)

12. (a) What is divide and conquer strategy and explain the binary search with suitable example problem. (13)

Or

(b) Solve the following using Brute-Force algorithm: (13)

Find whether the given string follows the specified pattern and return 0 or 1 accordingly.

Examples :

(i) Pattern: "abba", input: "redblueredblue" should return 1

(ii) Pattern: "aaaa", input: "asdasdasdasd" should return 1

(iii) Pattern: "aabb" input: "xyzabcxzyabc" should return 0.

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 Huffman's tree for 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) Describe in detail the simplex algorithm methods. (13)

Or

(b) Explain KMP string matching algorithm for finding a pattern on a text, and analyze the algorithm. (13)



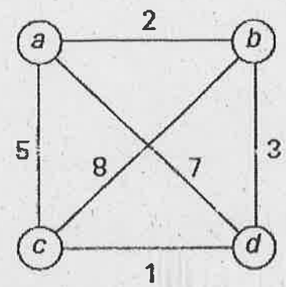
15. (a) Discuss the approximation algorithm for NP- hard problems. (13)

Or

(b) Describe the backtracking solution to solve 8-queens problem. (13)

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)

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Reg. No. : | | | | | | | | | | | | |

16/05/18 FN

**Question Paper Code : 40906**

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018
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. Give the Euclid's algorithm for computing gcd of two numbers.
2. What is a basic operation ?
3. What is an exhaustive search ?
4. State Master's theorem.
5. Define transitive closure of a directed graph.
6. Define the minimum spanning tree problem.
7. How is a transportation network represented ?
8. What is meant by maximum cardinality matching ?
9. How is lower bound found by problem reduction ?
10. What are tractable and non-tractable problems ?

PART – B **(5×13=65 Marks)**

11. a) Define Big O notation, Big Omega and Big Theta Notation. Depict the same graphically and explain.

(OR)

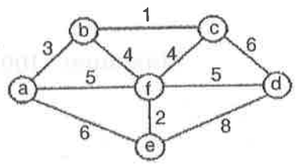
b) Give the General Plan for Analyzing the Time Efficiency of Recursive Algorithms and use recurrence to find number of moves for Towers of Hanoi problem.

12. a) Explain Merge sort algorithm with an example.

(OR)

b) Explain the working of Strassen's Matrix Multiplication with the help of divide and conquer method.

13. a) Give the Pseudo code for Prim's algorithm and apply the same to find the minimum spanning tree of the graph shown below :




(OR)

b) Explain the memory function method for the knapsack problem and give the algorithm.

14. a) Give the summary of the simplex method.

(OR)

b) Prove that the stable marriage algorithm terminates after no more than $n^2$ iterations with a stable marriage output.

15. a) What is Class NP ? Discuss about any five problems for which no polynomial - time algorithm has been found.

(OR)

b) Elaborate on the nearest-neighbor algorithm and multifragment-heuristic algorithm for TSP problem.

PART – C **(1×15=15 Marks)**

16. a) Consider the problem of finding the smallest and largest elements in an array of n numbers.

i) Design a presorting-based algorithm for solving this problem and determine its efficiency class. **(7)**



ii) Compare the efficiency of the three algorithms :

(A) the brute-force algorithm. (B) this presorting-based algorithm, and (C) the divide-and conquer algorithm. **(8)**

(OR)

b) Apply Warshall's algorithm to find the transitive closure of the digraph defined by the following adjacency matrix

$$\begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

i) Prove that the time efficiency of Warshall's algorithm is cubic. **(7)**

ii) Explain why the time efficiency of Warshall's algorithm is inferior to that of the traversal-based algorithm for sparse graphs represented by their adjacency lists. **(8)**

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08/05/19 AN

Reg. No. : | | | | | | | | | | | | |

**Question Paper Code : 52863**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY, 2019.

Third/Fourth Semester

Computer Science and Engineering

CS 6402 — DESIGN AND ANALYSIS OF ALGORITHMS

(Common to Information Technology)

(Regulation 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Design an algorithm to compute the area and Circumference of a circle.
2. Define recurrence relation.
3. Give the general strategy of Divide and Conquer Method.
4. What is the closest - pair problem?
5. State the general principle of greedy algorithm
6. What do you mean by dynamic programming?
7. What do you mean by 'perfect matching' in bipartite graphs?
8. Define flow 'cut'.
9. Draw the decision tree for comparison of three values.
10. Depict the proof which says that a problem 'A' is no harder or no easier than problem 'B'.

PART B — (5 × 13 = 65 marks)

11. (a) Briefly explain the mathematical analysis of recursive and non-recursive algorithm.

Or

(b) Explain briefly Big oh Notation, Omega Notation and Theta Notations. Give examples.

12. (a) (i) Write the algorithm to perform Binary Search and compute run time complexity.

(ii) Compute the multiplication of given two matrices using Strassen's matrix multiplication method.

$$A = \begin{bmatrix} 1 & 0 & 2 & 1 \\ 4 & 1 & 1 & 0 \\ 0 & 1 & 3 & 0 \\ 5 & 0 & 2 & 1 \end{bmatrix} \quad B = \begin{bmatrix} 0 & 1 & 0 & 1 \\ 2 & 1 & 0 & 4 \\ 2 & 0 & 1 & 1 \\ 1 & 3 & 5 & 0 \end{bmatrix}$$

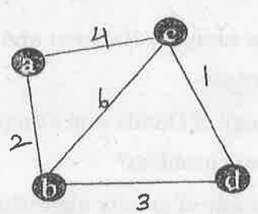
Or

(b) (i) Write down the algorithm to construct a convex hull based on divide and conquer strategy.

(ii) Find the optimal solution to the fractional knapsack problem with given data :

| Item | Weight | Benefit |
|---|---|---|
| A | 2 | 60 |
| B | 3 | 75 |
| C | 4 | 90 |

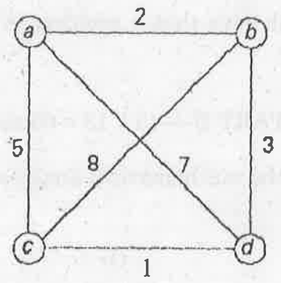
13. (a) Discuss about the algorithm and Pseudocode to find the Minimum Spanning Tree using Prim's Algorithm. Find the Minimum Spanning tree for the graph shown below :




And Discuss about the efficiency of the Algorithm.

Or

(b) Find all the Solution to the travelling salesman problem (cities and distances shown below) by exhaustive search. Give the optimal solution.






14. (a) (i) State and prove Max-Flow Min-Cut Theorem

(ii) Summarize the steps of the simplex method.

Or

(b) (i) Explain briefly about Stable marriage algorithm.

(ii) Determine the time-efficiency class of the stable marriage algorithm.

15. (a) (i) Suggest an approximation algorithm for traveling salesperson problem. Assume that the cost function satisfies the triangle inequality.

(ii) Explain how job assignment problem could be solved, given $n$ tasks and $n$ agents where each agent has a cost to complete each task, using Branch and Bound technique.

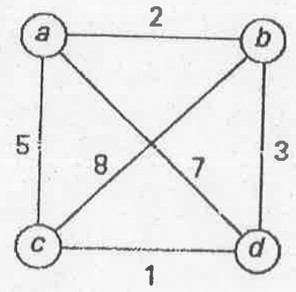
Or

(b) (i) The knight is placed on the first block of an empty board and, moving according to the rules of chess, must visit each square exactly once. Solve the above problem using backtracking procedure.

(ii) Implement an algorithm for Knapsack problem using NP-Hard approach.

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)

IV 21/11/16 F.N

Reg. No. :

**Question Paper Code : 80293**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

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. Design an algorithm to compute the area and Circumference of a circle.
2. Define recurrence relation.
3. Write an algorithm for brute force closest —pair problem.
4. What is worst case complexity of binary search?
5. What is meant by principle of optimality?
6. How to calculate the efficiency of Dijkstra's Algorithm?
7. Define the iterative improvement technique.
8. What is maximum cardinality matching?
9. Write the formula for decision tree for searching a sorted array.
10. State the reason for terminating search path at the current node in branch and bound algorithm.

PART B — (5 × 16 = 80 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. (8)

(ii) State the general plan for analyzing the time efficiency of nonrecursive algorithms and explain with an example (8)

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 $n = 3^k$). (16)

12. (a) There are 4 people who need to be assigned to execute 4 jobs (one person per job) and the problem is to find an assignment with the minimum total cost. The assignment costs is given below, solve the assignment problem by exhaustive search. (16)

| | Job 1 | Job 2 | Job 3 | Job 4 |
|---|---|---|---|---|
| Person 1 | 9 | 2 | 7 | 8 |
| Person 2 | 6 | 4 | 3 | 7 |
| Person 3 | 5 | 8 | 1 | 8 |
| Person 4 | 7 | 6 | 9 | 4 |

Or

(b) Give the algorithm for Quicksort. With an example show that Quicksort is not a stable sorting algorithm. (16)

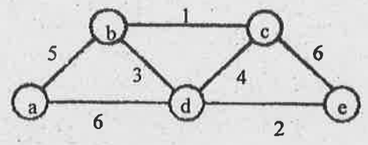
13. (a) Solve the all-pairs shortest-path problem for the digraph with the following weight matrix: (16)

$$\begin{vmatrix} 0 & 2 & \infty & 1 & 8 \\ 6 & 0 & 3 & 2 & \infty \\ \infty & \infty & 0 & 4 & \infty \\ \infty & \infty & 2 & 0 & 3 \\ 3 & \infty & \infty & \infty & 0 \end{vmatrix}$$

Or



(b) Apply Kruskal's algorithm to find a minimum spanning tree of the following graph. (16)




14. (a) (i) State and prove Max-Flow Min-Cut Theorem

(ii) Summarize the steps of the simplex method. (16)

Or

(b) (i) Explain briefly about Stable marriage algorithm. (10)

(ii) Determine the time-efficiency class of the stable marriage algorithm. (6)

15. (a) (i) Draw a decision tree and find the number of key comparisons in the worst and avarage cases for the three-element bubble sort. (8)

(ii) Write backtracking algorithm for 4-Queen's problem and discuss the possible solution. (8)

Or

(b) Solve the following instance of Knapsack problem by branch and bound algorithm. (16)

| Item | weight | profit | |
|---|---|---|---|
| 1 | 5 | $40 | |
| 2 | 7 | $35 | |
| 3 | 2 | $18 | W=l5 |
| 4 | 4 | $4 | |
| 5 | 5 | $10 | |
| 6 | 1 | $2 | |

22/12/17

Reg. No. : | | | | | | | | | | | | |

# Question Paper Code : 50388

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017
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. How to measure an algorithm's running time ?
2. What do you mean by "Worst case-efficiency" of an algorithm ?
3. Give the general plan of divide and conquer algorithms.
4. Write the advantages of insertion sort.
5. What does Floyd's algorithm do ?
6. Define principle of Optimality.
7. What are Bipartite Graphs ?
8. State extreme point theorem.
9. Explain promising and nonpromising node.
10. Differentiate feasible solution and optimal solution.

PART – B (5×13=65 Marks)

11. a) Discuss the steps in Mathematical analysis for recursive algorithms. Do the same for finding the factorial of a number.

(OR)

b) What are the Rules of Manipulate Big-Oh Expressions and about the typical growth rates of algorithms ?

12. a) Explain the Bruteforce method to find the two closest points in a set of n points in k-dimensional space.

(OR)

b) Explain the working of Merge Sort Algorithm with an example.

13. a) Explain the working of Prim's Algorithm.

(OR)

b) Explain the Dijkstra's shortest path algorithm and its efficiency.

14. a) List the steps in Simplex Method and give the efficiency of the same.

(OR)

b) What is stable marriage problem ? Give the algorithm and analyze it.

15. a) Find the Optimal solution using Branch and Bound for the following assignment problem.

| | Job1 | Job 2 | Job 3 | Job 4 |
|---|---|---|---|---|
| A | 9 | 2 | 7 | 8 |
| B | 6 | 4 | 3 | 7 |
| C | 5 | 8 | 1 | 8 |
| D | 7 | 6 | 9 | 4 |

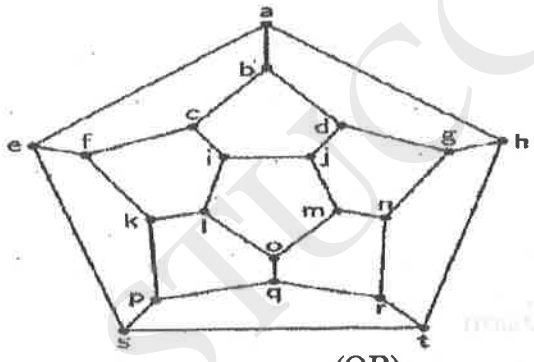
(OR)

b) Give the methods for Establishing Lower Bounds.

PART – C **(1×15=15 Marks)**

(Application/Design/Analysis/Evaluation/Creativity questions) (Case Study/ Comprehensive questions)

16. a) Find a Hamiltonian circuit or disprove its existence in the graph given below.




(OR)

b) Explain the steps in Building a Huffman Tree. Find the codes for the alphabets given below according to the frequency.

| | |
|---|---|
| – (Space) | 4 |
| A | 2 |
| E | 5 |
| H | 1 |
| I | 2 |
| L | 2 |
| M | 2 |
| P | 2 |
| R | 1 |
| S | 2 |
| X | 1 |

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Reg. No. : | | | | | | | | | | | | |

**Question Paper Code : 20364**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

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. Define algorithm. List the desirable properties of an algorithm.

2. Define best, worst, average case time complexity.

3. What are the differences between dynamic programming and divide and conquer approaches?

4. Give an example for Hamiltonian circuit.

5. Define multistage graphs. Give an example.

6. How dynamic programming is used to solve Knapsack problem?

7. Describe iterative improvement technique.

8. What is solution space? Give an example.

9. Define P and NP problems.

10. Give an example for sum-of-subset problem.

PART B — (5 × 13 = 65 marks)

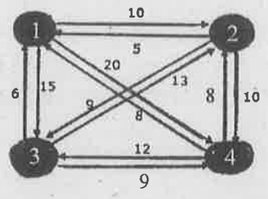
11. (a) (i) Prove that if $g(n)$ is $\Omega(f(n))$ then $f(n)$ is $O(g(n))$. (5)

(ii) Discuss various methods used for mathematical analysis of recursive algorithms. (8)

Or

(b) Write the asymptotic notations used for best case, average case and worst case analysis of algorithms. Write an algorithm for finding maximum element in an array. Give best, worst and average case complexities. (13)

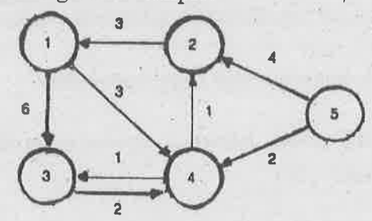
12. (a) Solve travelling salesman problem using brute force approach for the given example. How the solution can be obtained using branch and bound method? (10 + 3)




Or

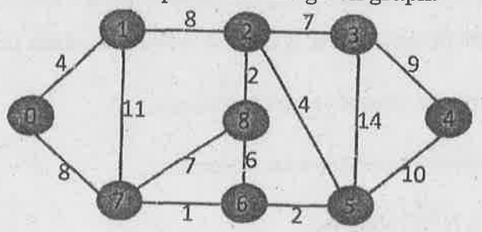
(b) Write the algorithm for quick sort. Provide a complete analysis of quick sort for the given set of numbers 12, 33, 23, 43, 44, 55, 64, 77 and 76. (13)

13. (a) Explain Floyds – Warshall algorithm using dynamic programming. Trace the algorithm for the given example. (13)




Or

(b) Explain how greedy approach is used in Dijkstra's algorithm for finding the single–source shortest paths for the given graph. (13)






14. (a) Illustrate the steps of the simplex methods with an example. (13)

Or

(b) Write the stable marriage algorithm and trace it with an instance. Analyze its running time complexity. (13)

15. (a) Consider the travelling salesperson instance defined by the following cost matrix. (13)

| | | | | |
|---|---|---|---|---|
| ∞ | 20 | 30 | 10 | 11 |
| 15 | ∞ | 16 | 4 | 2 |
| 3 | 5 | ∞ | 2 | 4 |
| 19 | 6 | 18 | ∞ | 3 |
| 16 | 4 | 7 | 16 | ∞ |

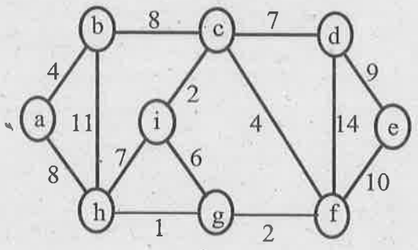
Draw the state space tree and show the reduced matrices corresponding to each of the node.

Or

(b) Discuss the approximation algorithm for NP-hard problems. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Apply the greedy technique to find the minimum spaning tree using Prim's algorithm for the given graph. (15)




Or

(b) Explain the 4-Queen's problem using backtracking. Write the algorithms. Give the estimated cost for all possible solutions of 4-Queen's problem. Specify the implicit and explicit constraints. (15)

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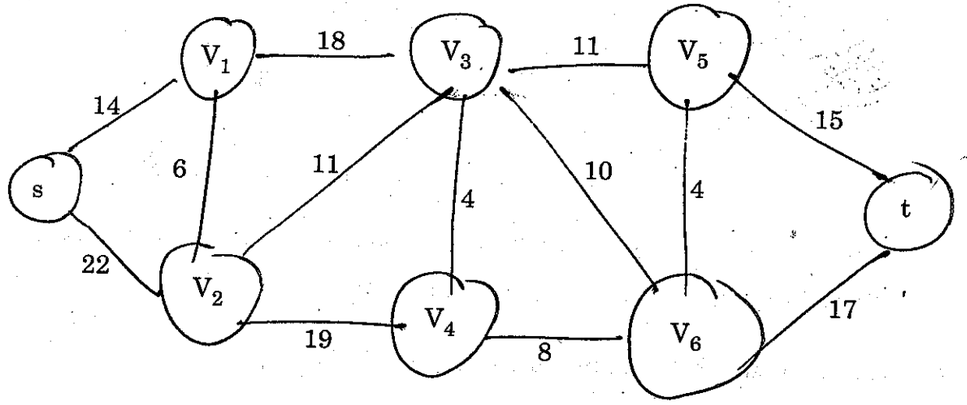
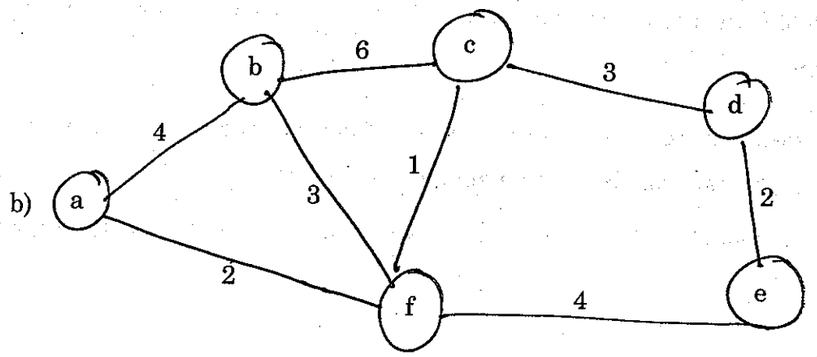
PART – C **(1×15=15 Marks)**

16. a) Use Dijkstra's algorithm to find the shortest path for the following graph with s as source and t as destination. **(15)**




(OR)

b) 


Apply Prim's and Kruskal's algorithm for the above graph and find the minimum spanning tree. **(15)**

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Reg. No. :

**Question Paper Code : 91398**

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

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. The (log n)th smallest number of n unsorted numbers can be determined in O(n) average-case time (True/False).
2. Write the recursive Fibonacci algorithm and its recurrence relation.
3. Design a brute-force algorithm for computing the value of a polynomial $p(x) = a_n x^n + a_{n-1}x^{n-1} + \Lambda + a_1 x \Lambda a_0$ at a given point $x_0$ and determine its worst-case efficiency class.
4. Derive the complexity of Binary Search algorithm.
5. Define the Single Source Shortest Paths Problem.
6. State the assignment problem.
7. What do you mean by 'perfect matching' in bipartite graphs ?
8. State Planar coloring graph problem.
9. Write the formula for decision tree for searching a sorted array.
10. State the reason for terminating search path at the current node in branch and bound algorithm.

PART – B (5×13=65 Marks)

11. a) If you have to solve the searching problem for a list of n numbers, how can you take advantage of the fact that the list is known to be sorted ? Give separate answers for

i) Lists represented as arrays. (4)

ii) Lists represented as linked lists. (4)

Compare the time complexities involved in the analysis of both the algorithms. (5)

(OR)

b) i) Derive the worst case analysis of Merge Sort using suitable illustrations. (6)

ii) Derive a loose bound on the following equation : (7)

$f(x) = 35x^8 - 22x^7 + 14x^5 - 2x^4 - 4x^2 + x - 15$.

12. a) State and explain the Merge Sort algorithm and give the recurrence relation and efficiency. (13)

(OR)

b) Explain the method used for performing multiplication of two large integers. Explain how Divide Conquer method can be used to solve the same. (13)

13. a) i) The binary string below is the title of a song encoded using Huffman codes.

00110001011111011001110111011000001001110100101 01.

Give the letter frequencies listed in the table below, build the Huffman codes and use them to decode the title. In cases where there are multiple "greedy" choices, the codes are assembled by combining the first letters (or groups of letters) from left to right, in the order given in the table. Also, the codes are assigned by labeling the left and right branches of the prefix/code tree with '0' and '1', respectively. (7)

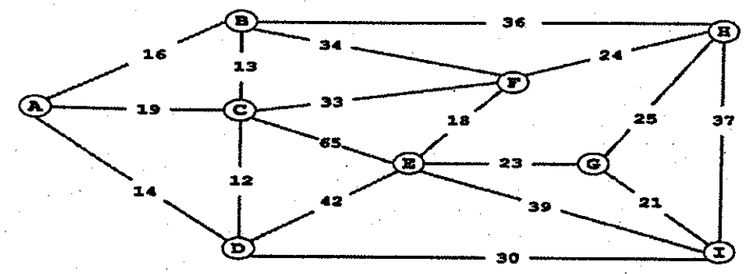
| Letter | a | h | v | w | ' ' | e | t | l | o |
|---|---|---|---|---|---|---|---|---|---|
| Frequency | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |

ii) Write the procedure to compute Huffman code. (6)

(OR)



b) Consider the following weighted graph. (13)




Give the list of edges in the MST in the order that Prim's algorithm inserts them. Start Prim's algorithm from vertex A.

14. a) Describe in detail the simplex algorithm methods.

(OR)

b) Explain KMP string matching algorithm for finding a pattern on a text and analyze the algorithm.

15. a) i) Draw a decision tree and find the number of key comparisons in the worst and average cases for the three-element bubble sort. (7)

ii) Write backtracking algorithm for 4-Queen's problem and discuss the possible solution. (6)

(OR)

b) Solve the following instance of Knapsack problem by branch and bound algorithm. (13)

| Item | Weight | Profit | |
|---|---|---|---|
| 1 | 5 | $40 | |
| 2 | 7 | $35 | |
| 3 | 2 | $18 | **W = 15** |
| 4 | 4 | $4 | |
| 5 | 5 | $10 | |
| 6 | 1 | $2 | |