QUESTION 2015

Group – A
(Multiple Choice Type Questions)

1. Answer any ten questions.

i) Given two sorted lists of size "m" and "n" respectively. The number of comparisons needed in the worst case by merge sort will be

   ✓a) $m*n$ b) $\text{Max}(m,n)$ c) $\text{Min}(m,n)$ d) $m+n-1$

ii) The running time $T(n)$ where "n" is the input size of a recursive algorithm is given by

$$T(n) = c + T(n-1), \quad \text{if } n > 1$$
$$= d, \quad \text{if } n < 1$$

The order of the algorithm is

   a) n^2 ✓b) n c) n^3 d) n^n

iii) Tight bound for building a max heap algorithm will be

   a) $O(\log n)$ b) $O(n^2)$ ✓c) $O(n \log n)$ d) $O(n)$

iv) Travelling salesman problem is

   a) P   b) NP   c) NP-complete   ✓d) NP-Hard

v) Complexity of BFS algorithm is _____ if graph is represented as adjacency list.

   ✓a) $\theta(n+e)$ b) $\theta(n^2)$ c) $\theta(\log n)$ d) $\theta(n+e\log n)$

vi) Ω-Notation provides an asymptotic

   a) upper bound
   ✓b) lower bound
   c) one that is sandwiched between the two bounds
   d) none of these

vii) The space requirement for the quick sort method depends on the

   a) number of nested recursive calls   b) size of the stack
   ✓c) both (a) and (b)   d) none of these

viii) Kruskal's Algorithm for finding minimum spanning tree is an example of

   a) Dynamic programming   ✓b) Greedy method
   c) Both (a) and (b)   d) None of these

ix) Which of the following is solved by using Branch and Bound method?
   a) Knapsack Problem
   b) Hamiltonian Problem
   c) Travelling Salesman Problem
   ✓d) 15-Puzzle Problem

x) Time complexity for the Floyd's algorithm to find all pairs of shortest path of a graph G with V vertices and E edges using dynamic programming method is:
   a) $O(V^2)$
   ✓b) $O(V^3)$
   c) $O(E^2)$
   d) $O(E^3)$

Group – B
(Short Answer Type Questions)
2. Find the best and worst case time complexity of Quick Sort.
See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 5.

3. State Master theorem and find the time complexity for the recurrence relation.

$$T(n) = 2T(n/4) + \sqrt{n}$$

See Topic: INTRODUCTION, Short Answer Type Question No. 3.

4. Explain the max-flow min-cut theorem with an example.
See Topic: GRAPH & TREE TRAVERSAL ALGORITHMS, Short Answer Type Question No. 5.

5. Differentiate between divide and conquer and dynamic programming.
See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 10.

6. Write an algorithm for n-queen's problem. Find its time complexity.
See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 15.

Group – C
(Long Answer Type Questions)
7. a) Find the minimum number of operations required for the following matrix chain multiplication using dynamic programming.

$$A(10 \times 20) * B(20 \times 50) * C(50 \times 1) * D(1 \times 100)$$

b) What is union-find algorithm? Explain with an example.
c) Write Knuth-Morirs-Pratt algorithm for string matching problem.
a) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 6(a).
b) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 1.
c) See Topic: GRAPH & TREE TRAVERSAL ALGORITHMS, Long Answer Type Question No. 5(a).

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8. a) Define the following notations with example:

Big-oh (O), Little-oh (o), Ω, θ

b) If $\qquad T(n) = \begin{cases} 1, & n = 1 \\ 2T(n/2) + 5n, & n > 1 \end{cases}$

Then show that $T(n) = O(n \log_2 \eta)$. Show all steps of derivation.

a) See Topic: INTRODUCTION, Long Answer Type Question No. 1.

b) See Topic: INTRODUCTION, Long Answer Type Question No. 8.

9. a) Solve the knapsack problem for given condition: $n = 3$, knapsack capacity $(m) = 20$, profits

$(p1,\ p2,\ p3) = (25,\ 24,\ 15)$ and weight $(w1,\ w2,\ w3) = (18,\ 15,\ 10)$.

b) What are the characteristics of Greedy method?

c) What is negative weight-cycle? Write Bellman-Ford algorithm to find single source shortest distance of a directed graph.

a) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 14.

b) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 2.

c) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 25.

10. a) Define P-class, NP-class, NP-complete class and NP-hard class of problems. What is the relation between them?

b) What do you mean by deterministic and non-deterministic algorithm? Write a non-deterministic algorithm for searching an element from a given list of real numbers. Also, specify its time complexity.

c) State satisfiability problem. State Cook's theorem in connection with P and NP problem.

a) See Topic: TRACTABLE AND INTRACTABLE PROBLEMS, Long Answer Type Question No. 1(c).

b) See Topic: TRACTABLE AND INTRACTABLE PROBLEMS, Long Answer Type Question No. 4.

c) See Topic: TRACTABLE AND INTRACTABLE PROBLEMS, Short Answer Type Question No. 7.

11. Write short notes on any three of the following:

    a) Recursion tree

    b) External Sorting

    c) Minimum spanning tree

    d) BFS and DFS

    e) Clique Decision problem

a) See Topic: INTRODUCTION, Long Answer Type Question No. 9(c).
b) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 21(a).
c) See Topic: GRAPH & TREE TRAVERSAL ALGORITHMS, Long Answer Type Question No. 8(c).
d) See Topic: GRAPH & TREE TRAVERSAL ALGORITHMS, Long Answer Type Question No. 8(d).
e) See Topic: TRACTABLE AND INTRACTABLE PROBLEMS, Long Answer Type Question No. 5(a).

QUESTION 2016

Group – A
(Multiple Choice Type Questions)

1. Answer any ten questions.

i) Which of the following algorithm design techniques is used in quick sort algorithm?
    a) Dynamic programming   b) Backtracking
    ✓c) Divide and Conquer   d) Greedy method

ii) Which of the following algorithms solves the All-Pair Shortest path Problem?
    a) Dijkstra's   ✓b) Floyd's Warshall's
    c) Prim's   d) Kruskal's

iii) Travelling Salesman problem is
    ✓a) NP Hard   b) NP   c) NP Complete   d) None of these

iv) Complexity of the recurrence relation $T(n) = 8T(n/2) + n^2$ is
    a) O (n)   b) O (n^2)   c) O ($\log_2 n$)   ✓d) O (n^3)

v) The minimum number of colors needed to color a graph having n > 3 vertices and 2 edges is
    a) 2   ✓b) 3   c) 4   d) 1

vi) The fractional Knapsack problem can be solved by using
    ✓a) Greedy method   b) Divide & Conquer Method
    c) Dynamic Programming   d) None of these

vii) Time complexity of Binary Search Algorithm on n items is
    a) O (n)   b) O (n^2)   c) O (n log n)   ✓d) O (log n)

viii) The time factor when determining the efficiency of an algorithm is measured by

    a) counting microseconds   ✓b) counting number of key operations

    c) counting number of statements   d) counting kilobyte of algorithm

ix) The tight bound for building max heap is

    a) O (n)   b) O (log n)   ✓c) O (n log n)   d) none of these

x) BFS of a graph G = (V, E) has running time

    ✓a) $O(|V|+|E|)$ b) $O(|V|)$ c) $O(|E|)$ d) none of these

Group – B
(Short Answer Type Questions)

2. Find the best and worst case complexity of Quick sort.

See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 5.

3. State master's theorem and find the time complexity for the following recurrence:

$$T(n) = 2T\left(n^{\frac{1}{2}}\right) + \log n$$

See Topic: INTRODUCTION, Long Answer Type Question No. 3.

4. Given the weight vector (2, 3, 5, 7, 1, 4, 1) and the profit vector (10, 5, 15, 7, 6, 18, 3) and a Knapsack of capacity 15. Find at least three feasible solutions including optimal one for the knapsack problem of seven objects.

See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 9(b).

5. Solve the following recurrence relation using generating function $a_n = 6a_{n-1} - 11a_{n-2} + 6a_{n-3}$ for $n \geq 3$ with initial condition $a_0 = 1, a_1 = -1$ and $a_2 = 1$.

See Topic: INTRODUCTION, Short Answer Type Question No. 4.

6. Discuss Job Sequencing with Deadlines with an example.

See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 4.

Group – C

(Long Answer Type Questions)

7. a) Consider the evaluation of the product of n matrices:

$$M = M_1 * M_2 * \ldots \ldots * M_n$$

Assuming that the multiplication of a p*q matrix by a q* r matrix require pqr scalar multiplications. Write a dynamic programming algorithm for ordering this multiplication with minimum cost. Explain the algorithm in brief.

b) Critically comment on "Greedy strategy does not work for the 0-1 knapsack problem for all time".

c) What do you mean by non-deterministic algorithms?

a) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 2(b).

b) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 3.

c) See Topic: TRACTABLE AND INTRACTABLE PROBLEMS, Short Answer Type Question No. 4.

8. a) State the general Knapsack problem. Write a greedy algorithm for this problem and derive its time complexity.

b) Write an algorithm to find out minimum spanning tree of a graph. Discuss its time complexity.

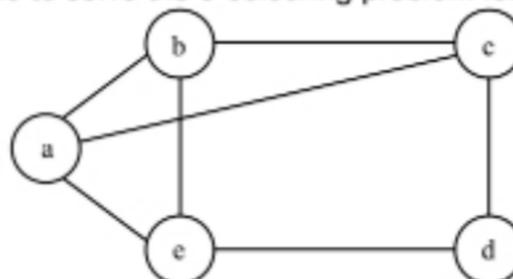**a) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 9(a).**

b) See Topic: GRAPH & TREE TRAVERSAL ALGORITHMS, Long Answer Type Question No. 2.

9. a) Describe the Depth first search algorithm for a given graph and explain its time complexity.
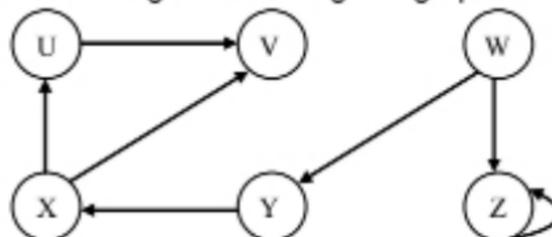
b) Write the algorithm for graph colouring problem.

c) Apply backtracking technique to solve the 3-colouring problem for the following graph.

a) See Topic: GRAPH & TREE TRAVERSAL ALGORITHMS, Long Answer Type Question No. 6.

b) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 3(ii).

c) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 10.

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10. a) Define the classes P and NP.

b) Discuss what you mean by polynomial reductions.

c) Discuss diagrammatically the relations among P class, NP class, NP hard and NP complete.

See Topic: TRACTABLE AND INTRACTABLE PROBLEMS, Long Answer Type Question No. 1(a), (b) & (c).

11. Write the short notes any three of the following:

    a) Vertex Cover problem

    b) Recursion Tree

    c) Heap Creation Technique

    d) Approximation schemes

    e) Asymptotic notation

a) See Topic: APPROXIMATION ALGORITHMS, Long Answer Type Question No. 1(c).

b) See Topic: INTRODUCTION, Long Answer Type Question No. 12(c).

c) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 21(b).

d) See Topic: APPROXIMATION ALGORITHMS, Long Answer Type Question No. 1(b).

e) See Topic: INTRODUCTION, Long Answer Type Question No. 12(a).

QUESTION 2017

Group – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following:

i) Which of the following property/properties is/are necessary for an algorithm?

    a) Definiteness   b) Effectiveness   ✓c) Both (a) and (b)   d) None of these

ii) The total running time of matrix chain multiplication of n matrices is

    a) $o\left(n^4\right)$ ✓b) $o\left(n^3\right)$ c) $o\left(n^2\right)$ d) $o\left(n\right)$

iii) The sub-problems in Divide and Conquer are considered to be

    a) distinct   b) overlapping   c) large size   ✓d) small size

iv) Which of the following algorithm design techniques is used in merge sort?

    a) Dynamic programming   b) Backtracking

    ✓c) Divided and conquer   d) Greedy method

DAA-143

v) Time complexity for recurrence relation $T(n) = 2T(n-1) + c$ is

    a) $O(n^2)$ ✓b) $O(\log n)$ c) $O(n \log n)$ d) $O(2^n)$

vi) Lower bound of time complexity for any comparison based sorting algorithm is

    a) $O(n)$ ✓b) $O(n \log n)$ c) $O(\log n)$ d) $O(n^2)$

vii) Ω notation provides asymptotic

    a) upper bound   ✓b) lower bound

    c) tight bound   d) one that switched between (a) and (b)

viii) Locally best computation is done in

    a) Dynamic programming   ✓b) Greedy method

    c) both (a) and (b)   d) none of these

ix) Which of the following algorithm design techniques is used for solving graph coloring problem?

    a) Divide and conquer   ✓b) Backtracking

    c) Dynamic programming   d) Greedy method

x) By applying Strassen's algorithm we can multiply two $n \times n$ matrices in

    a) $O(n^3)$ time   b) $O(n)$ time   c) $O(n^n)$ time   ✓d) $O(n^{\log 7})$ time

Group – B
(Short Answer Type Questions)

2. Find the best and worst case time complexity of binary search.

See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 14.

3. Write the significance of different asymptotic notations (Big-O, Big-omega, Big-theta) with graphical analysis.

See Topic: INTRODUCTION, Long Answer Type Question No. 1.

4. Prove that n! = $0(n^n)$.

See Topic: INTRODUCTION, Short Answer Type Question No. 1.

5. Discuss Strassen's matrix multiplication procedure and show that the time complexity is reduced from the conventional multiplication.

See Topic: MISCELLANEOUS, Short Answer Type Question No. 5.

DAA-144

6. Write a comparison between BFS and DFS algorithms.

See Topic: GRAPH & TREE TRAVERSAL ALGORITHMS, Short Answer Type Question No. 1.

Group – C

(Long Answer Type Questions)

7. a) Compare Dynamic programming and Greedy approach.

b) Discuss Bellman-Ford's algorithm for single source shortest path problem.

c) Prove that the time complexity of Bellman-Ford's algorithm is Θ (VE)

a) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 5(b).

b) & c) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 11(a) & (b).

8. a) Which one is better and why?

   i) Max Min calculation using divide & conquer approach

   ii) Max Min calculation using normal approach.

b) Given the four matrices using $P_{10 \times 20}, Q_{20 \times 50}, R_{50 \times 1}, S_{1 \times 100}$. Find the optional sequence for the computation of multiplication operation. Write the algorithm also.

a) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 16.

b) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 19(a).

9. a) What do you mean by chromatic number of a graph?

b) Write down Floyd's algorithm to find all paired shortest paths of a graph.

c) What do you mean by greedy method?

d) Consider the following table that consists of some items with weight and cost values:

Items	I_1	I_2	I_3	I_4	I_5
Weight	5	10	15	22	25
Cost	30	40	45	77	90

If the knapsack capacity W =60 kg, find optional solution using greedy criteria and write an algorithm for doing so.

a) See Topic: TRACTABLE AND INTRACTABLE PROBLEMS, Short Answer Type Question No. 8.
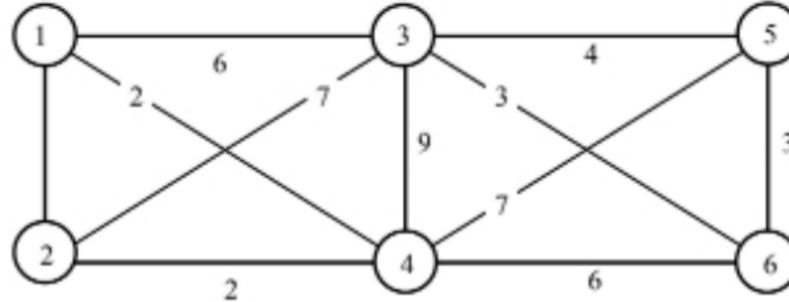
b) See Topic: GRAPH & TREE TRAVERSAL ALGORITHMS, Short Answer Type Question No. 2.

c) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 2.

d) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 19(b).

DAA-145

10. a) Differentiate between Prim's and Kruskal's algorithm. Find the minimum cost spanning tree using Prim's algorithm for the graph given below. Write down the complexity of Prim's and Kruskal's algorithm.

1st Part: See Topic: GRAPH & TREE TRAVERSAL ALGORITHMS, Short Answer Type Question No. 4.

2nd & 3rd Part: See Topic: GRAPH & TREE TRAVERSAL ALGORITHMS, Long Answer Type Question No. 7.

11. Write the short notes any *three* of the following:

a) 8-Queens problems

b) Hamiltonian cycle

c) NP-hard and NP-complete classes

d) BFS *vs*. DFS

e) Ford – Fulkerson algorithm

a) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 21(c).

b) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 21(d).

c) See Topic: TRACTABLE AND INTRACTABLE PROBLEMS, Long Answer Type Question No. 5(b).

d) See Topic: GRAPH & TREE TRAVERSAL ALGORITHMS, Long Answer Type Question No. 8(d).

e) See Topic: GRAPH & TREE TRAVERSAL ALGORITHMS, Long Answer Type Question No. 8(e).

QUESTION 2018

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for each of the following:

i) Best case time complexity for Binary search in unsuccessful case is

a) $O(n)$ ✓b) $O(\log n)$ c) $O(1)$ d) $O(n \log n)$

ii) Time complexity of Quick sort in worst case is

a) $O(n)$ b) $O(\log n)$ ✓c) $O(n^2)$ d) $O(n \log n)$

iii) The Big O Notation of the expression $f(n) = n\log_2 n + n^2 + e^{\log_2 n}$ is

   ✓a) $O(n^2)$ b) $O(\log_2 n)$ c) $O(\log_2 n)$ d) $O\left(e^{\log_2 n}\right)$

iv) A machine needs a minimum of 100 ms to sort 1000 names by quick sort. The minimum time needed to sort 100 names will be approximately

   a) 50.2 ms   b) 6.7 ms   c) 72.7 ms   ✓d) 11.2 ms

v) Time complexity for recurrence relation $T(n) = 2T(n/2) + n$ is

   a) $O(\log n)$ ✓b) $O(n \log n)$ c) $O(n)$ d) $O(n^2)$

vi) Which of the following approaches is Divide and Conquer Strategy?

   ✓a) Top-down   b) Bottom-up   c) Both (a) and (b)   d) None of these

vii) What is the time complexity to insert an element into a heap?

   a) $O(n \log n)$ ✓b) $O(\log n)$ c) $O(n)$ d) None of these

viii) Which of the following design techniques is used in the Quick Sort Algorithm?

   a) Dynamic programming   b) Black tracking

   c) Greedy method   ✓d) Divide and Conquer

ix) The average number of comparisons performed by merge sort algorithm in merging 2 sorted lists of length 2 is

   a) 8/5   b) 11/7   c) 11/6   ✓d) 8/3

x) Which of the following standard algorithm is not based on Dynamic Programming?

   a) Bellman-Ford Algorithm for single source shortest path

   b) Floyd Warshall Algorithm for all pairs shortest paths

   c) 0-1 Knapsack problem

   ✓d) Prim's Minimum Spanning Tree

Group – B
(Short Answer Type Questions)

2. Discuss Job Sequencing with deadlines providing an example.

See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 4.

3. Write an algorithm for Graph Coloring Problem. What is the time complexity of the algorithm?

See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 19.

DAA-147

4. Derive the worst case time complexity of quick sort.

See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 17.

5. Write an algorithm to insert an element into a heap. What is the complexity of the algorithm? Justify.

See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 18.

6. Write a recursive algorithm for finding maximum and minimum from a list of elements. Also find the complexity of your algorithm.

See Topic: MISCELLANEOUS, Short Answer Type Question No. 6.

Group – C
(Long Answer Type Questions)

7. a) Write an algorithm for matrix chain multiplication.

b) Explain it with a suitable example.

a) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 7.

b) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 17(a).

8. a) Write an algorithm for all pair shortest path also compute its complexity.

b) Solve 8 Queen problem using Backtracking approach.

a) See Topic: GRAPH & TREE TRAVERSAL ALGORITHMS, Short Answer Type Question No. 2.

b) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 8.

9. a) What do you mean by Divide and Conquer Strategy?

b) Write an algorithm for Merge Sort.

c) Analyze the time complexity of Merge Sort algorithm.

a) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 1.

b) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 20(a).

c) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 4.

10. a) What is Heap property?

b) Create a Max-Heap containing the following elements:

10, 20, 30, 40, 50, 60, 70, 80, 90, 100

c) Write an algorithm of Heap Sort.

d) Find the running time of this algorithm.

a), c) & d) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 12.

b) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 20(b).

DAA-148

11. Write the short notes on any *three*:
    i) Union Find Algorithm
    ii) Dijkstra's Algorithm
    iii) Ford-Fulkerson Algorithm
    iv) Bellman-Ford Algorithm
    v) Heuristic Algorithm

i) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 1.

ii) See Topic: GRAPH & TREE TRAVERSAL ALGORITHMS, Long Answer Type Question No. 8(a).

iii) See Topic: GRAPH & TREE TRAVERSAL ALGORITHMS, Long Answer Type Question No. 8(e).

iv) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 21(f).

v) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 21(e).

QUESTION 2019

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for each of the following:

i) Best case time complexity for Binary search in unsuccessful case is

    a) $O(n)$ ✓b) $O(\log n)$ c) $O(1)$ d) $O(n \log n)$

ii) Time complexity of quick sort in worst case is

    a) $O(n)$ b) $O(\log n)$ c) $O(n2)$ ✓d) $O(n \log n)$

iii) The Big O notation of the expression $f(n)= n \log_2 n+ n^2+ e \log_2 n$ is

    ✓a) $O(n^2)$ b) $O(\log 2n)$ c) $O(n \log 2n)$ d) $O(e \log 2n)$

iv) A machine needs a minimum of 100 ms to sort 1000 names by quick sort. The minimum time needed to sort 100 names will be approximately

    a) 50.2 ms   ✓b) 6.7 ms   c) 72.7 ms   d) 11.2 ms

v) Time complexity for recurrence relation $T(n) = 2T\left(\dfrac{n}{2}\right) + n$ is

    a) $O(\log n)$ ✓b) $O(n \log n)$ c) $O(n)$ d) $O(n2)$

DAA-149

vi) Which of the following approaches is Divide & Conquer strategy?

✓a) Top-down   b) Bottom-up   c) Both (a) & (b)   d) None of these

vii) A machine needs 200 ms to sort 200 names, using bubble sort. In 800 ms, it can approximately sort

✓a) 400 names   b) 800 names   c) 750 names   d) 1800 names

viii) What is the time complexity to insert an element into a heap?

a) O (n log n)   ✓b) O (log n)   c) O (n)   d) None of these

ix) Which of the following design techniques is used in the Quick sort algorithm?

a) Dynamic programming   b) Backtracking

c) Greedy method   ✓d) Divide and conquer

x) The average number of comparisons performed by merge sort algorithm in merging 2 sorted lists of length 2 is

a) $\dfrac{8}{5}$ b) $\dfrac{11}{7}$ c) $\dfrac{11}{6}$ ✓d) $\dfrac{8}{3}$

xi) Which of the following standard algorithms is not Dynamic programming based?

a) Bellman-Ford Algorithm for single source shortest path

b) Floyd-Warshall Algorithm for all paired shortest path

c) 0-1 Knapsack problem

✓d) Prim's Minimum Spanning tree

xii) Which of the following is not a backtracking algorithm?

a) N queen problem   b) Tower of Hanoi

c) M coloring problem   ✓d) None of these

Group – B
(Short Answer Type Questions)

2. Find the best and worst case time complexity of Quick sort.

See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 5.

3. Prove that if $f(n) = a_m n^m + a_{m-1} n^{m-1} + \ldots + a_1 n + a_0$ then $f(n) = O\left(n^m\right)$

See Topic: INTRODUCTION, Short Answer Type Question No. 5.

4. Find optimal solution using greedy method for a knapsack having capacity 100 for the following list of items having values and weights as given below in the table:

Item	value	Weight
I_1	10	15
I_2	20	25
I_3	30	35
I_4	40	45
I_5	50	55

See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 5(a).

5. Write an algorithm to find a minimal cost spanning tree of undirected graph. Estimate the time complexity of the algorithm.
See Topic: GRAPH & TREE TRAVERSAL ALGORITHMS, Long Answer Type Question No. 2.

6. Write the differences between greedy method and dynamic programming.
See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 5(b).

Group – C
(Long Answer Type Questions)

7. a) Write an algorithm for matrix chain multiplication.
b) Explain it with a suitable example.
a) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 7.
b) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 17(a).

8. a) Write an algorithm for all paired shortest paths also compute its complexity.
b) Solve 8 queen problem using Backtracking approach.
a) See Topic: GRAPH & TREE TRAVERSAL ALGORITHMS, Short Answer Type Question No. 2.
b) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 8.

9. a) What do you mean by Divide and Conquer strategy?
b) Write an algorithm for Merge sort.
c) Analyze the time complexity of Merge sort algorithm.
a) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 1.
b) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 20(a).
c) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 4.

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10. a) What is Heap property?

b) Create a Max-Heap containing the following elements: 10, 20, 30, 40, 50, 60, 70, 80, 90, 100

c) Write an algorithm of Heap sort.

d) Find the running time of this algorithm.

a), c) & d) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 12.

b) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Long Answer Type Question No. 20(b).

11. Write short notes on any three of the following:

    a) Dijkstra's Algorithm

    b) Union-Find Algorithm

    c) DFS and BFS

    d) Asymptotic Notations

a) See Topic: GRAPH & TREE TRAVERSAL ALGORITHMS, Long Answer Type Question No. 8(a).

b) See Topic: FUNDAMENTAL ALGORITHMIC STRATEGIES, Short Answer Type Question No. 1.

c) See Topic: GRAPH & TREE TRAVERSAL ALGORITHMS, Long Answer Type Question No. 8(d).

d) See Topic: INTRODUCTION, Long Answer Type Question No. 12(a).