

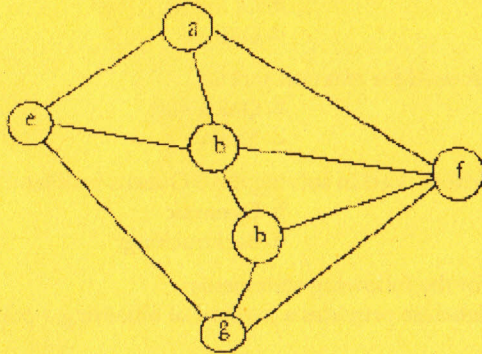
(PART-B : Descriptive)

Time : 2 hrs. 40 min.

Marks : 50

[Answer question no.1 & any four (4) from the rest]

1. Draw the complete undirected graphs on one, two, three, four, and five vertices. Prove that the number of edges in an n-vertex complete graph is $n(n-1)/2$. 10
2. a. Compute the adjacency matrix from the graph given in the figure. 5+5=10



- b. Draw the BFS spanning tree from the given figure.
3. a. What is Recurrence? Give example. 4+6=10
b. Draw a recursive algorithm to solve Tower of Hanoi problem.
4. a. How do you measure the performance of Algorithms? 6+4=10
b. Write an algorithm to compute n^{th} Fibonacci term.
5. a. Define Priority queue. What is a Heap? 5+5=10
b. Explain 8-queen problem in algorithms.
6. a. How a number can search in a sorted list with Divide and Conquer method? 6+4=10
b. Write the Merge sort algorithm.
7. a. How a shortest path between two cities can be detected? Explain. 5+5=10
b. What is Knapsack problem? State the principle of Optimality.
8. a. Prove that Satisfiability is in P if and only if P=NP. 6+4=10
b. What are non-deterministic algorithms? Give example.

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**MASTER OF COMPUTER APPLICATION
THIRD SEMESTER
DESIGN & ANALYSIS OF ALGORITHMS
MCA-302**

(Use separate answer scripts for Objective & Descriptive)

Duration : 3 hrs.

Full Marks : 70

(PART-A : Objective)

Time : 20 min.

Marks : 20

Choose the correct answer from the following:

1×20=20

1. The recurrence relation capturing the optimal time of the Tower of Hanoi problem with n discs is:

a. $T(n) = 2T(n - 2) + 2$	b. $T(n) = 2T(n - 1) + n$
c. $T(n) = 2T(n/2) + 1$	d. $T(n) = 2T(n - 1) + 1$
2. Which of the following sorting algorithms can be used to sort a random linked list with minimum time complexity?

a. Insertion Sort	b. Quick Sort
c. Heap Sort	d. Merge Sort
3. In the worst case, the number of comparisons needed to search a singly linked list of length n for a given element is:

a. $\log_2 n$	b. $n/2$
c. $\log_2 n - 1$	d. n
4. Which one of the following is an application of Stack Data Structure?

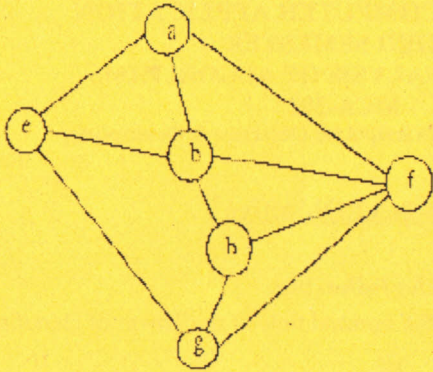
a. Managing function calls	b. The stock span problem
c. Arithmetic expression evaluation	d. All of the above
5. Which one of the following is an application of Queue Data Structure?

a. When a resource is shared among multiple consumers.
b. When data is transferred asynchronously (data not necessarily received at same rate as sent) between two processes.
c. Load Balancing.
d. All of the above.
6. The number of leaf nodes in a rooted tree of n nodes, with each node having 0 or 3 children is:

a. $n/2$	b. $(n - 1)/3$
c. $(n - 1)/2$	d. $(2n + 1)/3$
7. Suppose the numbers 7, 5, 1, 8, 3, 6, 0, 9, 4, 2 are inserted in that order into an initially empty binary search tree. The binary search tree uses the usual ordering on natural numbers. What is the in-order traversal sequence of the resultant tree?

a. 7 5 1 0 3 2 4 6 8 9	b. 0 2 4 3 1 6 5 9 8 7
c. 0 1 2 3 4 5 6 7 8 9	d. 9 8 6 4 2 3 0 1 5 7

8. Consider the following graph



Among the following sequences

- I) a b e g h f II) a b f e h g III) a b f h g e IV) a f g h b e

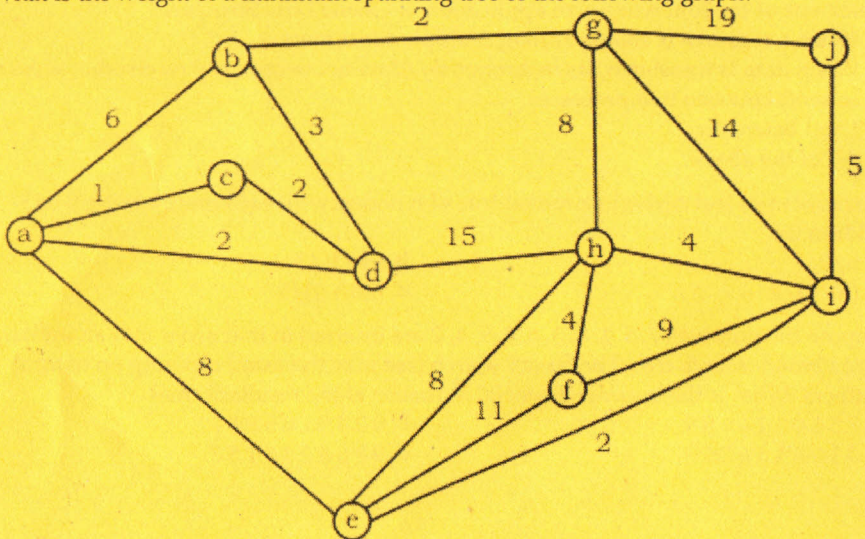
Which are depth first traversals of the above graph?

- a. I, II and IV only
 - b. I and IV only
 - c. II, III and IV only
 - d. I, III and IV only
9. In a heap with n elements with the smallest element at the root, the 7th smallest element can be found in time:
- a. $\Theta(n \log n)$
 - b. $\Theta(n)$
 - c. $\Theta(\log n)$
 - d. $\Theta(1)$

10. How many perfect matchings are there in a complete graph of 6 vertices?

- a. 15
- b. 24
- c. 30
- d. 60

11. What is the weight of a minimum spanning tree of the following graph?



- a. 29
- b. 31
- c. 38
- d. 41

12. Consider the label sequences obtained by the following pairs of traversals on a labeled binary tree. Which of these pairs identify a tree uniquely?

- (i) preorder and postorder
- (ii) inorder and postorder
- (iii) preorder and inorder
- (iv) level order and postorder
- a. (i) only
- b. (ii), (iii)
- c. (iii) only
- d. (iv) only

13. Which of the following is true?

- a. P is subset of NP
- b. NP is subset of P
- c. P and NP are equal
- d. NP is subset of NP hard

14. The total running time of knapsack problem for a simple approach:

- a. $O(n)$
- b. $O(\log n)$
- c. $O(2n \log n)$
- d. $O(2n)$

15. The Sorting method which is used for external sort is:

- a. Bubble sort
- b. Quick sort
- c. Merge sort
- d. Radix

16. What is the type of the algorithm used in solving the 8 Queens problem?

- a. Greedy
- b. Dynamic
- c. Branch and Bound
- d. Backtracking

17. Choose the correct answer for the following statements:

- I. The theory of NP-completeness provides a method of obtaining a polynomial time for NP algorithms.
- II. All NP-complete problems are NP-Hard.
- a. I is FALSE and II is TRUE
- b. I is TRUE and II is FALSE
- c. Both are TRUE
- d. Both are FALSE

18. The Knapsack problem where the objective function is to minimize the profit is.....

- a. Greedy
- b. Dynamic 0/1
- c. Back tracking
- d. Branch & Bound 0/1

19. Sorting is not possible by using which of the following methods?

- a. Insertion
- b. Selection
- c. Deletion
- d. Exchange

20. The maximum number of nodes in a binary tree of depth k is.....

- a. $2k$
- b. k^2
- c. $k(k-1)/2$
- d. $2k-1$

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