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2023/TDC(CBCS)/EVEN/SEM/
CACCC–401T/065

**TDC (CBCS) Even Semester Exam., 2023**

# COMPUTER APPLICATIONS

**( 4th Semester )**

Course No. : CACCC–401T

**( Design and Analysis of Algorithms )**

*Full Marks* : 70
*Pass Marks* : 28

*Time* : 3 hours

*The figures in the margin indicate full marks for the questions*

## SECTION—A

Answer any *ten* of the following questions : 2×10=20

**1.** What are worst case, best case and average case efficiencies?

**2.** What are the complexities of *(a)* heapify( ) method, *(b)* building a heap, *(c)* heap sort and *(d)* delete from heap?

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3. State the best, average and worst case complexities of binary search for successful and unsuccessful search.

4. What is dynamic programming?

5. Explain the basic principle of divide and conquer method.

6. What are the applications of minimum cost spanning tree?

7. Differentiate between backtracking and branch and bound techniques.

8. In how many passes does the merge sort technique sort the following sequence?

   3, 27, 4, 11, 45, 39, 2, 16, 56

9. What is 8-queen problem?

10. Distinguish between Prim's and Kruskal's spanning tree algorithms.

11. What is NP-hard problem?

12. Mention the advantages and disadvantages of binary search.





13. How can BFS (breadth-first search) be used to detect a cycle in an undirected graph?

14. What is hashing? What is the time complexity of a hash function?

15. Distinguish between merge sort and quick sort.

## SECTION—B

Answer any *five* of the following questions : 10×5=50

16. *(a)* What is an algorithm? Why is the need of studying algorithms? Give the diagram representation of notion of algorithm. 5

    *(b)* Prove that if $f(n) = O(g(n))$ and $g(n) = O(f(n))$, then $f(n) = \theta(g(n))$. 5

17. *(a)* Define $O$-notation, $\Omega$-notation and $\theta$-notation. 6

    *(b)* What is a heap? How does the heap sort algorithm work? 4

18. *(a)* Apply quick sort algorithm to sort the input array = [10, 9, 8, 7, 6, 5, 4, 3, 2, 1]. Analyze the best, average and worst case complexities of quick sort algorithm. 5

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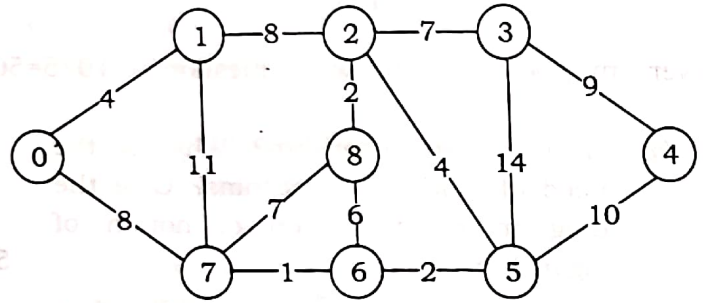
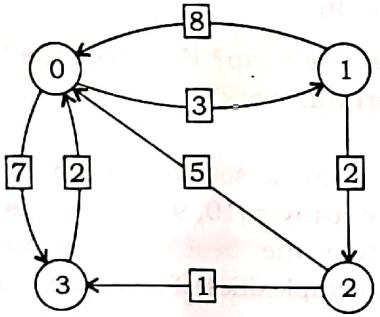
(b) How to find maximum and minimum values using divide and conquer technique? Explain with example. What is the time complexity of finding maximum and minimum? 5

**19.** What is a minimum spanning tree? Compute an MST for the graph of figure using Prim's algorithm : 10




**20.** (a) Find the shortest path using Floyd-Warshall algorithm : 5








(b) What is optimal binary search tree? Explain with the help of an example. What is the time complexity of constructing an OBST? 5

**21.** Solve the travelling salesman problem with the associated cost adjacency matrix using dynamic programming : 10

| | A | B | C | D | E |
|---|---|---|---|---|---|
| A | — | 24 | 11 | 10 | 9 |
| B | 8 | — | 2 | 5 | 11 |
| C | 26 | 12 | — | 8 | 7 |
| D | 11 | 23 | 24 | — | 6 |
| E | 5 | 4 | 8 | 11 | — |

**22.** (a) Write an algorithm of BFS (breadth-first search). Also give an example. What is the time complexity of BFS algorithm? 5

(b) Write an algorithm of DFS (depth-first search). Also give an example. What is the time complexity of DFS algorithm? 5

**23.** (a) Write a short note on AND/OR graph. 5

(b) What is game tree? Explain game tree with an example. 5

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**24.** *(a)* Explain how backtracking is used for solving *N*-queen problem. Show the state space tree. 5

*(b)* Explain subset-sum problem and discuss the possible solution strategies using backtracking. 5

**25.** *(a)* What are the differences between NP-hard and NP-complete problems? 6

*(b)* Explain NP-hard problem with example. 4

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