Graphic Era HILL UNIVERSITY

End Term (Even) Semester Examination May-June 2025

Roll no.....

Name of the Program and semester: BCA IV Semester

Name of the Course: Introduction to Design and Analysis of Algorithms

Course Code: TBC401

Time: 3 hour Maximum Marks: 100

Note:

(i) All the questions are compulsory.
(ii) Answer any two sub questions from a, b and c in each main question.
(iii) Total marks for each question is 20 (twenty).
(iv) Each sub-question carries 10 marks.

Q1. (2X10=20 Marks)

a. Derive the time and space complexity for recursive binary search algorithm. *(CO3)*

b. For T(n)=7T(n/2)+18n2 Solve the recurrence relation and find the time complexity. (CO3)

c. Calculate the time complexity for a given piece of code using asymptotic notation. (CO3)

```
int main() {
    int n = 10;
    for (int i = 0; i < n; i++) {
        for (int j = 0; j < n; j++) {
            printf("%d %d\n", i, j);
        }
    }
    return 0;
}
```

Q2. (2X10=20 Marks)

a. Discuss the drawbacks of Quick Sort and suggest improvements. *(CO3)*

b. Compare divide-and-conquer algorithms with brute-force approaches. *(CO4)*

c. Given the following items with their respective weights and values:

Weight (kg)	Value (₹)	Value/Weight Ratio (₹/kg)
10	60	6
2	10	5
3	12	4

You have a knapsack with a capacity of 13 kg. Using the **Fractional Knapsack Algorithm**, determine the maximum value that can be obtained by filling the knapsack. Show the step-by-step process of selecting items, including any fractional selections. Also calculate the total value and weight of the items selected for the knapsack.

Q3. (2X10=20 Marks)

a. Explain General method of Greedy algorithms. Find the greedy solution for following job sequencing with deadlines problem n = 7, (p1,p2,p3,p4,p5,p6,p7) = (3,5,20,18,1,6,30),

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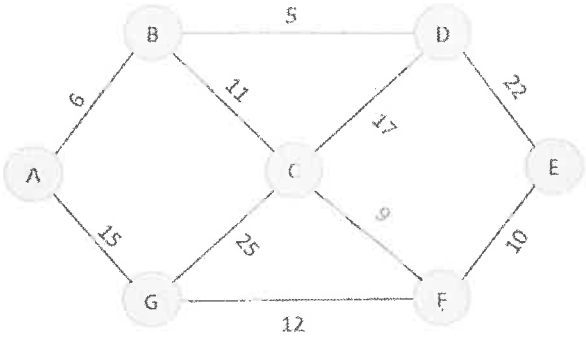
(d1,d2,d3,d4,d5,d6,d7) = (1,3,4,3,2,1,2). *(CO2)*

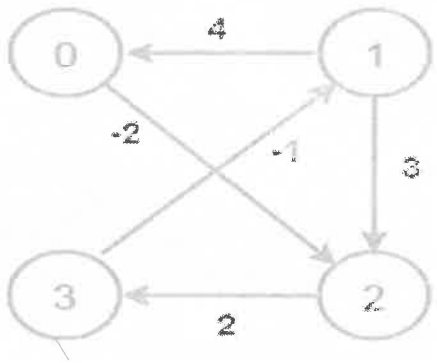
b. Describe the principle of optimality in dynamic programming with an example. *(CO2)*

c. Apply Kruskal's algorithm on a given graph to find the minimum spanning tree. *(CO2)*



Q4. (2X10=20 Marks)

a. Solve the All-Pairs Shortest Path problem using Floyd-Warshall algorithm. *(CO2)*



b. Discuss the difference between Bellman ford algorithm and Dijkstra algorithm and prove with suitable example. *(CO4)*

c. Explain about Optimal Binary Search Tree with Successful and Unsuccessful search probabilities with suitable example.*CO3)*

Q5. (2X10=20 Marks)

a. Identify real-world problems where branch-and-bound techniques are suitable. *(CO1)*

b. How 8-Queen`s problem can be solved using back tracking and explain with an example. *(CO2)*

c. Design an algorithm for solving the Hamiltonian cycle problem using backtracking. *(CO4)*