Academic year 2024-2025 (Even Sem)

DEPARTMENT OF **COMPUTER SCIENCE & ENGINEERING**

Date: June 2025	**Improvement Test- Scheme & Solution**	Maximum Marks: 10 + 50
Course Code: CD343AI	Sem: 4^{th} UG	Duration: 120 Minutes
Design and Analysis of Algorithms (Common to CS/CD/CY/IS/AIML)		

SCHEME AND SOLUTION

S.No	Part A	M	BT	CO
1.1	**1. Problem Domain (1 mark)** Backtracking: Used for constraint satisfaction problems (e.g., N-Queens, Sudoku) where any feasible solution is acceptable. Branch and Bound: Used for optimization problems (e.g., Travelling Salesman, Knapsack) where the optimal solution is required. **2. Pruning Strategy (1 mark)** Backtracking: Prunes paths based on constraint violation (infeasibility). Branch and Bound: Prunes paths using bound values to eliminate non-promising options.	02	1	2
1.2	**Codeword for each character: 1 mark** a-0000 b-0001 c-001 d-010 e-011 f-1 **Encoding for the word 'dead': 1 mark** 0100110000010	02	2	3
1.3	**Promising Node (1 mark):** A promising node in a state space tree is a node that has the potential to lead to a feasible or optimal solution. It satisfies the problem's constraints (in backtracking) or has a bound better than the current best (in branch and bound). **Non-Promising Node (1 mark):** A non-promising node is a node that cannot lead to a feasible or optimal solution. It is pruned or excluded from further exploration to save computation time.	02	1	1
1.4	**Definition: 1 mark** The assignment problem is to assign n tasks to n agents such that: - Each task is assigned to one agent. - Each agent is assigned one task. - The total cost/time is minimized. **Design Techniques (at least 2): 1 mark** 1. Exhaustive Search – tries all possible assignments (inefficient for large n). 2. Backtracking – eliminates infeasible solutions based on constraints. 3. Branch and Bound – uses cost bounds to prune suboptimal solutions. 4. Hungarian Algorithm – a polynomial-time optimal solution method.	02	1	1
1.5	overlapping	01	1	2
1.6	**Best-First Search.** Explanation (optional): Best-First Search selects the next node to explore based on the lowest cost-bound value, ensuring that the most promising (potentially optimal) node is explored first.	01	1	2

<table>
<tr><th></th><th>Part B</th><th></th><th></th><th></th></tr>
<tr><td>1</td><td>Solution: (4 + 2) = 6 marks (showing all the steps + Conclusion)
Algorithm: 4 marks (with complete header – i/p, o/p, functionality details)

Maximum Profit: 44
Items Included: {Item 3, Item 4}

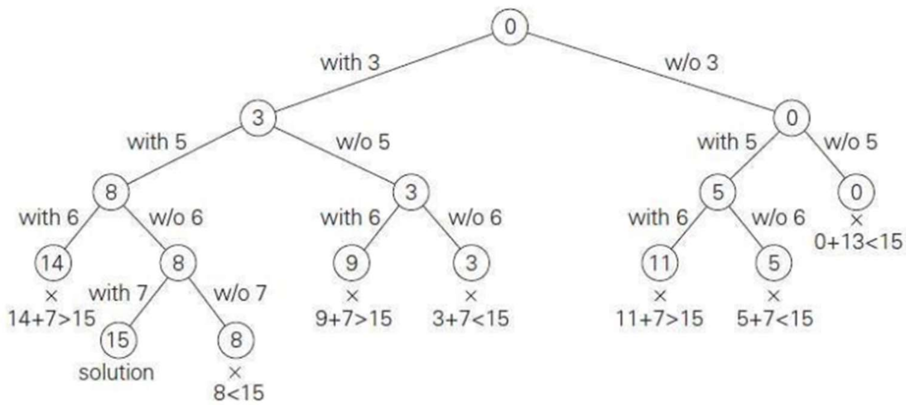
<table><tr><th>i/item</th><th>w=0</th><th>w=1</th><th>w=2</th><th>w=3</th><th>w=4</th><th>w=5</th></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td><td>12</td><td>12</td><td>12</td><td>12</td></tr><tr><td>2</td><td>0</td><td>10</td><td>12</td><td>22</td><td>22</td><td>22</td></tr><tr><td>3</td><td>0</td><td>10</td><td>12</td><td>29</td><td>39</td><td>41</td></tr><tr><td>4</td><td>0</td><td>10</td><td>15</td><td>29</td><td>39</td><td>44</td></tr></table></td><td>10</td><td>3</td><td>5</td></tr>
<tr><td>2</td><td>Solution: (4 + 2) = 6 marks (showing all the steps + Conclusion)
Algorithm: 4 marks (with complete header – i/p, o/p, functionality details)

Node: Distance: Path
P: 0: P
Q: 1: P→Q
R: 2: P→Q→R
S: 5: P→Q→S
T: 7: P→T
U: 3: P→Q→R→U</td><td>10</td><td>3</td><td>2</td></tr>
<tr><td>3</td><td>Solution: (4 + 2) = 6 marks (showing all the steps + Conclusion)
Algorithm: 4 marks (with complete header – i/p, o/p, functionality details)

Edge: Weight
1-4 : 1
1-2 : 2
2-3 : 3
1-5 : 4
2-6 : 7

Total cost = 17</td><td>10</td><td>3</td><td>3</td></tr>
<tr><td>4</td><td>Solution: (4 + 2) = 6 marks (showing all the steps + Conclusion)
Algorithm: 4 marks (with complete header – i/p, o/p, functionality details)</td><td>10</td><td>2</td><td>4</td></tr>
</table>

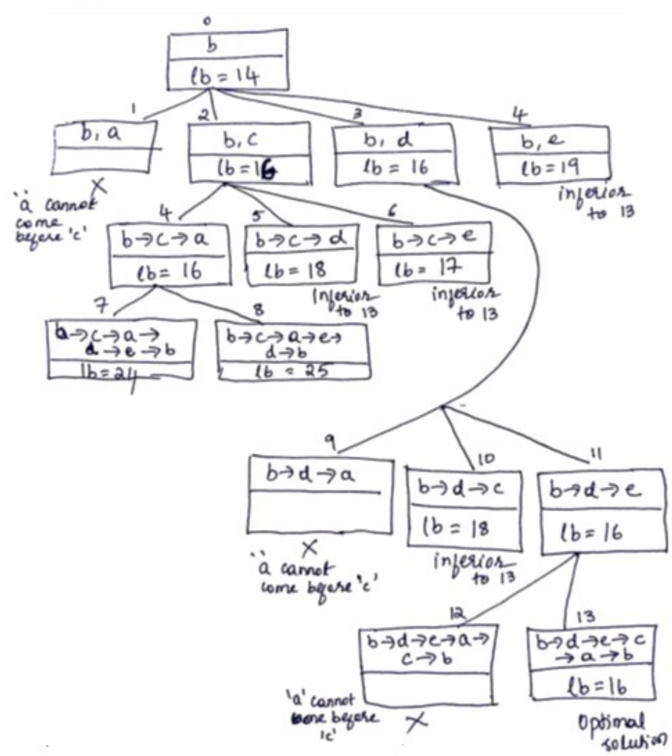
Academic year 2024-2025 (Even Sem)

<table>
<tr><td></td><td>


Answer: subset {3,5,7}
</td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>
Procedure to compute lower bound: 2 marks
State-space tree with number for all the nodes: 7 marks
Conclusion: 1 mark

Lower Bound = 14

$$= [\overset{a}{(1 + 3)} + \overset{b}{(3 + 6)} + \overset{c}{(1 + 2)} + \overset{d}{(3 + 4)} + \overset{e}{(2 + 3)}]/2$$
$$= 14$$



</td><td>10</td><td>4</td><td>5</td></tr>
</table>