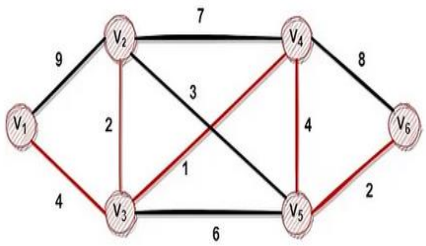
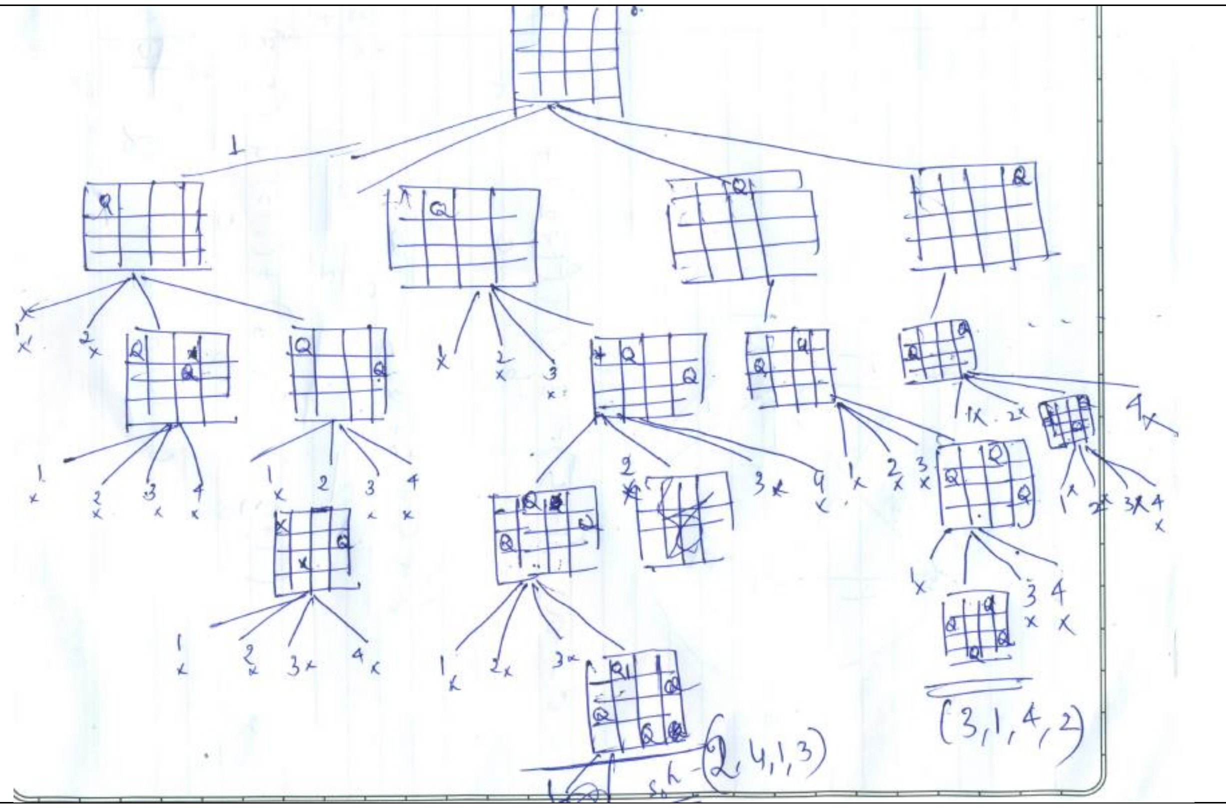
Academic year 2022-2023 (Even Sem)

DEPARTMENT OF
## COMPUTER SCIENCE & ENGINEERING

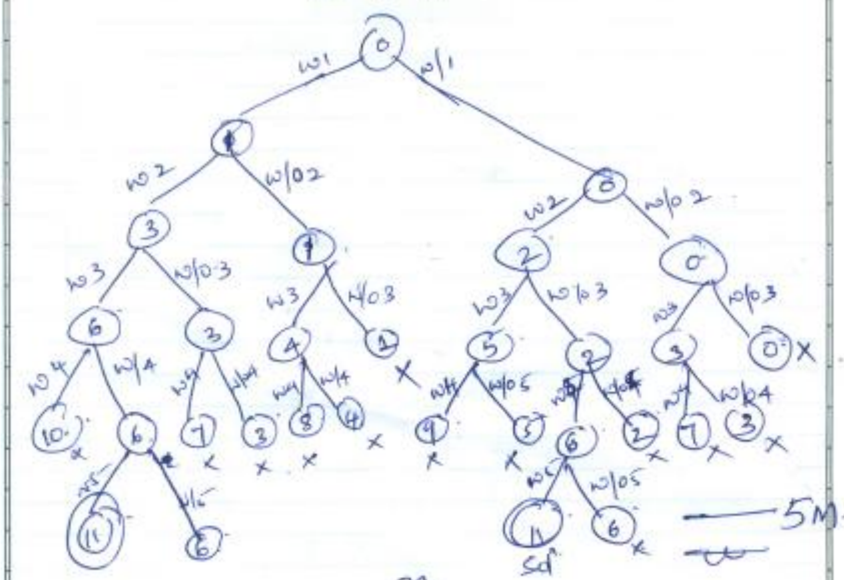
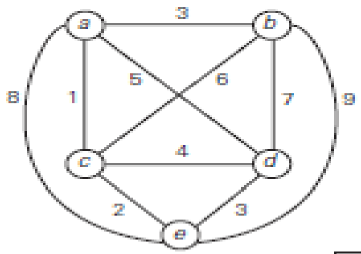
| Date | September 2023 | Maximum Marks | 50 |
|---|---|---|---|
| Course Code | 21CS43 | Duration | 90 Min |
| Sem | IV Semester | Improvement Test | |
| DESIGN AND ANALYSIS OF ALGORITHMS | | | |

| Sl. No. | Questions | M |
|---|---|---|
| 1a. | Write the Algorithm to find minimum spanning tree using prim’s algorithm-4M<br><br>**ALGORITHM** *Prim(G)*<br>//Prim’s algorithm for constructing a minimum spanning tree<br>//Input: A weighted connected graph $G = \langle V, E\rangle$<br>//Output: $E_T$, the set of edges composing a minimum spanning tree of $G$<br>$V_T \leftarrow \{v_0\}$ //the set of tree vertices can be initialized with any vertex<br>$E_T \leftarrow \varnothing$<br>**for** $i \leftarrow 1$ **to** $\lvert V\rvert - 1$ **do**<br>find a minimum-weight edge $e^* = (v^*, u^*)$ among all the edges $(v, u)$<br>such that $v$ is in $V_T$ and $u$ is in $V - V_T$<br>$V_T \leftarrow V_T \cup \{u^*\}$<br>$E_T \leftarrow E_T \cup \{e^*\}$<br>**return** $E_T$ | 4 |
| b | Solve the following instances of the single-source shortest-paths problem with vertex $v_1$ as the source:<br><br>Trace - 4M<br>V1(-,-) V2(V1,9),V3(V1,4),V4(-,∞),V5(-,∞),V6(-,∞)<br>V3(V1,4) V2(V3,6),V4(V3,5),V5(V3,10),V6(-,∞)<br>V4(V3,5) V2(V3,6), V5(V4,9),V6(V4,13)<br>V2(V3,6) V5(V4,9),V6(V4,13)<br>V5(V4,9) V6(V5,11)<br>V6(V5,11)<br>Shortest Path & Cost- 1+1<br>V1-V3-V2=6<br>V1-V3=4<br>V1-V3-V4=5<br>V1-V3-V4-V5=9<br>V1-V3-V4-V5-V6=11 | 6 |
| 2.a | With the help of state space tree solve the 4-queens problem using Backtracking approach<br>State space tree – 5M<br>Solution -1M | 6 |

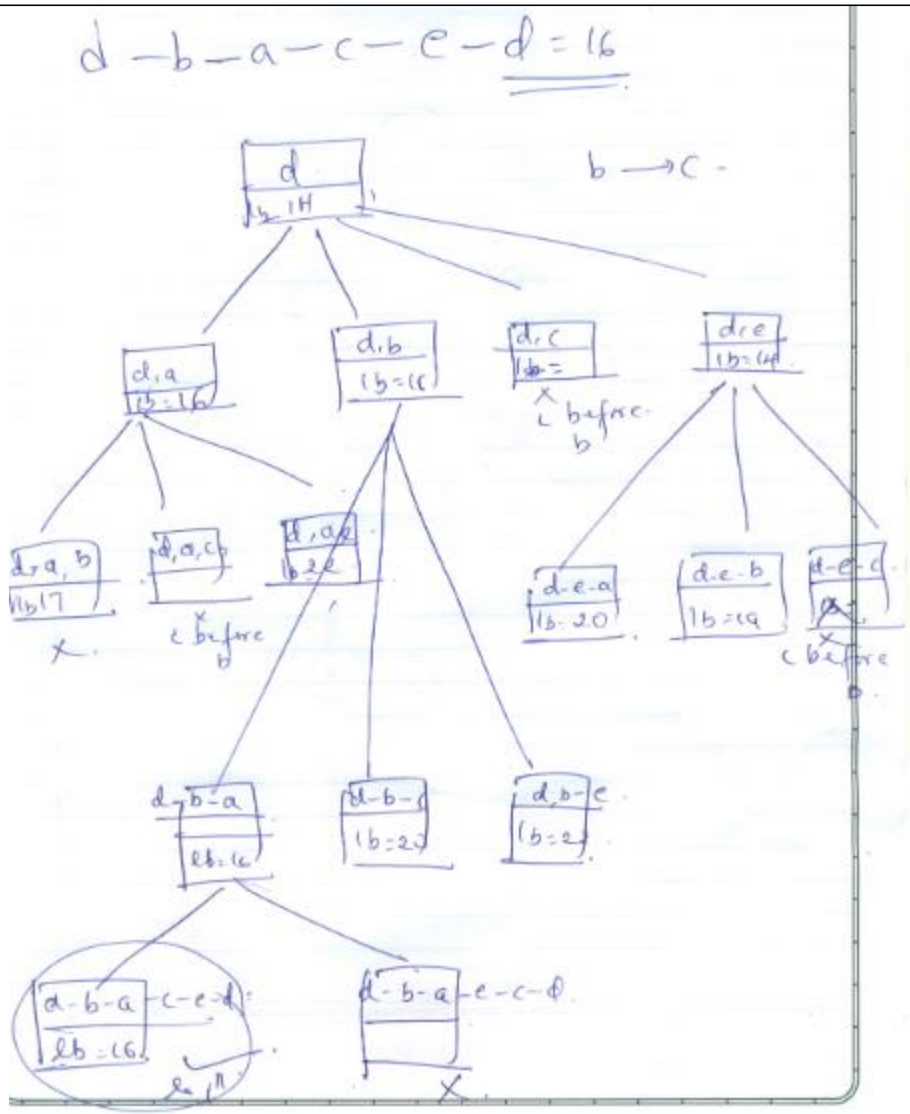
Academic year 2022-2023 (Even Sem)

| | | |
|---|---|---|
| |   | |
| b. | Differentiate Between the following:<br>i) Optimal solution and Feasible solution :<br>optimal solution is a feasible solution with the best value of the objective function<br>a feasible solution is a point and Feasible solution in the problem's search space that satisfies all the problem's constraints<br>ii) Promising node and Non-promising node<br>Promising node corresponds to a partially constructed solution that may still lead to a complete solution otherwise, it is called non-promising 2+2 | 4 |
| 3 a. | General principle of backtracking design technique: The principal idea is to construct solutions one component at a time and evaluate such partially constructed candidates as follows. If a partially constructed solution can be developed further without violating the problem's constraints, it is done by taking the first remaining legitimate option for the next component. If there is no legitimate option for the next component, no alternatives for *any* remaining component need to be considered. In this case, the algorithm backtracks to replace the last component of the partially constructed solution with its next option.-3M | 3 |
| b | Apply backtracking to solve the following instance of the subset sum problem: $A = \{2,3,4,5\}$ and $d = 11$. Give the conditions used to terminate the node as non-promising.<br>State space tree-5M<br>Condition -2M | 7 |

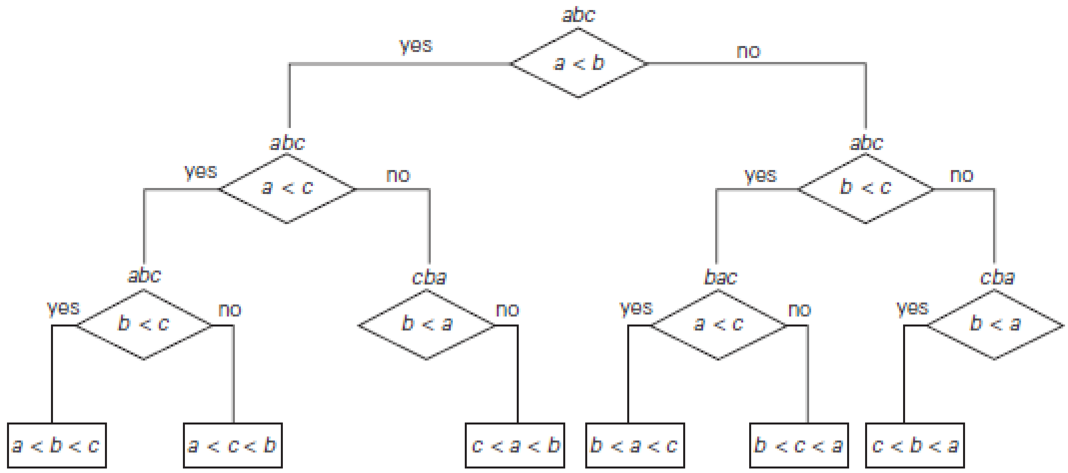
Academic year 2022-2023 (Even Sem)

| | | |
|---|---|---|
| | $A = \{1, 3, 2, 4, 5\} = \{1, 2, 3, 4, 5\}$<br>$d = \{11\}$<br><br>— 5M<br>$s' + \sum_{j=i+1}^{n} s_j < d$ 1M<br>or<br>$s' + s_{i+1} > d$<br>Ans: {1, 2, 3, 5} — 1M<br>{2, 4, 5} | |
| 4 | With the help of a state space tree. Solve the Travelling Salesman Problem for the following graph using branch and bound concept. Find the number of promising and non-promising nodes. Use vertex 'd' as starting node.<br><br>No of promising node -5 No ofnon- promising node -10 -----------2M<br>Solution node-1 ------<br>Solution- d->b->a->c->e->d cost 16 1M<br>State space tree -7M | 10 |

Academic year 2022-2023 (Even Sem)

| | | |
|---|---|---|
| |  | |
| 5 a. | Explain the following with an example. i) P Problem ii) NP Problem iii) NP-Complete Problem<br>1+2+2+M(Definition +Example) | 5 |
| b. | Give the Decision tree for the three-element selection sort 1+2+2=5M | 5 |

Academic year 2022-2023 (Even Sem)

| | | |
|---|---|---|
| |  | |

Academic year 2022-2023 (Even Sem)

Academic year 2022-2023 (Even Sem)