26102021220215

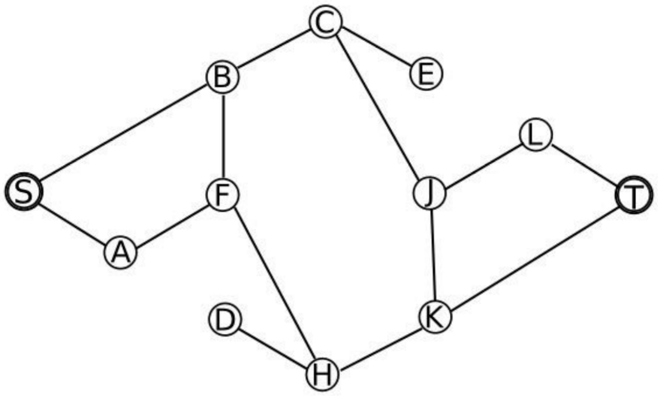
Name: Mohammad Ibrahim Abu-Amara

ID: 20180358

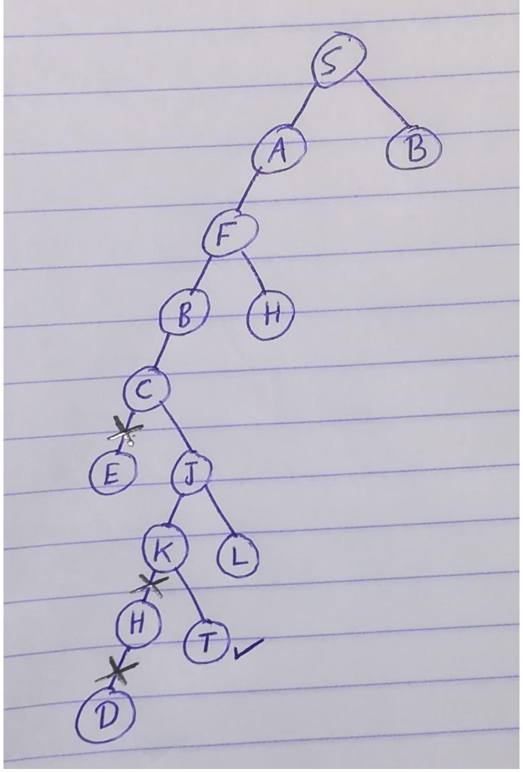
Subject: Artificial Intelligence Search Homework (**AI-Homework1**)

Part 1

Graph



Tree



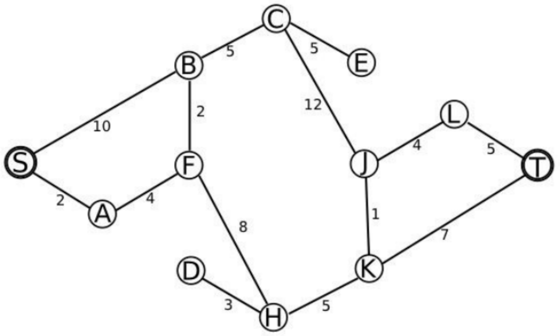
Trace

1. (S) ⇒ **S** removed, (SA, SB) computed and added.
2. (SA, SB) ⇒ **SA** removed, (SAF, SAS) computed, (SAF) added.
3. (SAF, SB) ⇒ **SAF** removed, (SAFB, SAFH, SAFA) computed, (SAFB, SAFH) added.
4. (SAFB, SAFH, SB) ⇒ **SAFB** removed, (SAFBC, SAFBF, SAFBS) computed, (SAFBC) added.
5. (SAFBC, SAFH, SB) ⇒ **SAFBC** removed, (SAFBCE, SAFBCJ, SAFBCB) computed, (SAFBCE, SAFBCJ) added.
6. (SAFBCE, SAFBCJ, SAFH, SB) ⇒ **SAFBCE** removed, (SAFBCEC) computed, nothing added.
7. (SAFBCJ, SAFH, SB) ⇒ **SAFBCJ** removed, (SAFBCJK, SAFBCJL, SAFBCJC) computed, (SAFBCJK, SAFBCJL) added.
8. (SAFBCJK, SAFBCJL, SAFH, SB) ⇒ **SAFBCJK** removed, (SAFBCJKH, SAFBCJKT, SAFBCJKJ) computed, (SAFBCJKH, SAFBCJKT) added.
9. (SAFBCJKH, SAFBCJKT, SAFBCJL, SAFH, SB) ⇒ **SAFBCJKH** removed, (SAFBCJKHD, SAFBCJKHK, SAFBCJKHKF) computed, (SAFBCJKHD) added.
10. (SAFBCJKHD, SAFBCJKT, SAFBCJL, SAFH, SB) ⇒ **SAFBCJKHD** removed, (SAFBCJKHDH) computed, nothing is added.
11. (SAFBCJKHKT, SAFBCJKT, SAFBCJL, SAFH, SB) ⇒ goal is reached; reports success.

Final Path is **SAFBCJKHKT**

Part 2

Graph



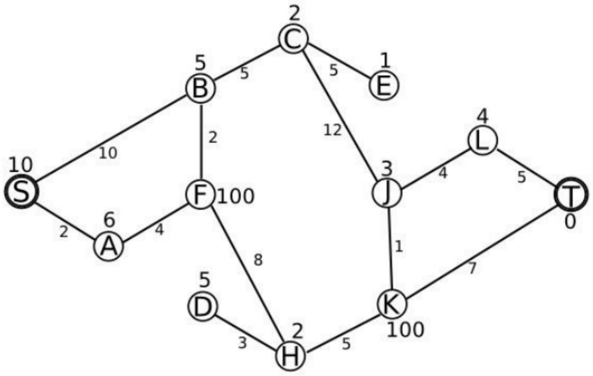
Tree

Trace

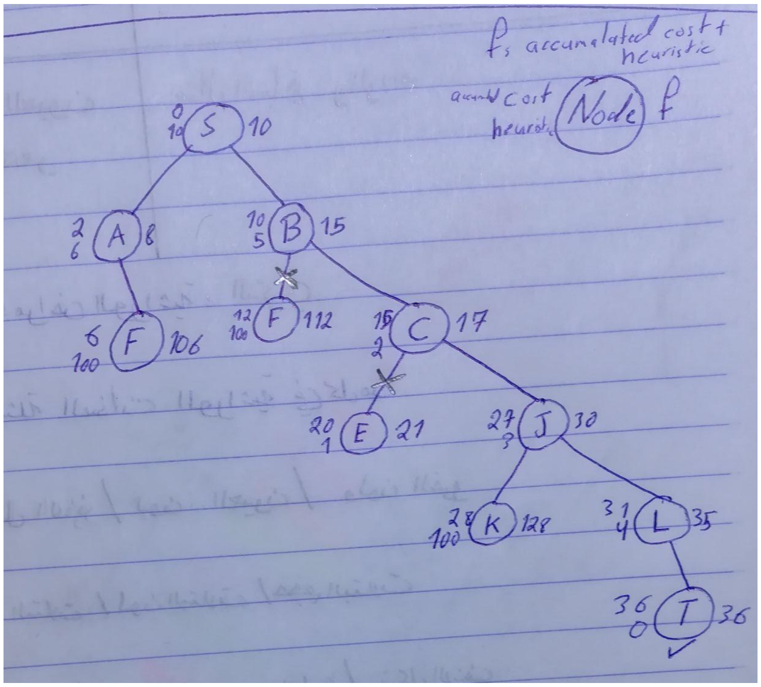
1. (S) ⇒ **0S** removed, (2SA, 10SB) computed, (2SA, 10SB) added.
2. (2SA, 10SB) ⇒ **2SA** removed, (4SAS, 6SAF) computed, (6SAF) added.
3. (6SAF, 10SB) ⇒ **6SAF** removed, (10SAFA, 8SAFB, 14SAFH) computed, (8SAFB, 14SAFH) added
4. (8SAFB, 10SB, 14SAFH) ⇒ **8SAFB** removed, () computed, (15SBC, 12SBF) added.
5.

Part 3

Graph



Tree



Trace

1. (S) ⇒ **10S** removed, (8SA, 15SB) computed, (8SA, 15SB) added.
2. (8SA, 15SB) ⇒ **8SA** removed, (106SAF, 14SAS) computed, (106SAF) added.
3. (15SB, 106SAF) ⇒ **15SB** removed, (30SBS, 112SBF, 17SBC) computed, (17SBC) added.

4. (17SBC, 106SAF) ⇒ **17SBC** removed, (25SBCB, 21SBCE, 30SBCJ) computed, (21SBCE, 30SBCJ) added.
5. (21SBCE, 30SBCJ, 106SAF) ⇒ **21SBCE** removed, (27SBCEC) computed, nothing is added.
6. (30SBCJ, 106SAF) ⇒ **30SBCJ** removed, (41SBCJC, 128SBCJK, 35SBCJL) computed, (128SBCJK, 35SBCJL) added.
7. (35SBCJL, 106SAF, 128SBCJK) ⇒ **35SBCJL** removed, (38SBCJLJ, 36SBCJLT) computed, (36SBCJLT) added.
8. (36SBCJLT, 106SAF, 127SBCJK) ⇒ goal is reached; reports success.

Path is SBCJLT with f = 36

the path that was found is **not** the same as the path that was found in Part 2, that is because the A* of the following:

- The function f for the A* is based on the cost and the heuristic, not just the cost.
- With the branch and bound we don't stop until the **first path does not reach the goal**, while the A* remove paths that are redundant as well as always going with the optimal solution, hence, stopping with reaching the goal.
- The A* algorithm expand nodes in non-decreasing order of the function f, hence, the first goal node selected for expansion must be the optimal node (since f is the true cost for goal nodes which have $heuristics = 0$ and all later nodes will be at least as expensive.
- Given a value of f, such that the value is the optimal solution call it C, the A* expand all nodes with $f(n) < C$, and A* might then expand some of the nodes where $f(n) = C$ before selecting the goal node.

Hence, reaching to the goal would be more optimal and with fewer steps.