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CSCI 311 AI

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**Honor Code:** We have neither given nor received unauthorized aid on this assignment.

All group members were present and contributing during all work on this project.

**HW 1: Written Assignment**

1. **Problem 3.3**
   1. **Write a detailed formulation for this problem**

* **State Space:** the states are all the city pairs that the friends can be in – they can be the same city. The problem uses (i, j) to represent these cities.
* **Initial State:** The initial state is the pair of cities (i, j) where the friends are currently located.
* **Goal State:** Some state (i, j) where i == j.
* **Transition Model:** the transition model / cost of the function will be the cost of moving from the start state to a goal state which means the distance between the one friends start and goal location plus the cost of the other friends start and goal location
  1. (iii) D(i, j) / 2 would be the only admissible function because it never overestimates the cost. (ii) and (i) may overestimate the cost because if the friends move directly towards each other, then their distance can be at minimum half the distance between the initial two cities (if there was a direct meeting point in between), so both (ii) and (i) would overestimate this cost.
  2. It is possible to have a completely connected map and for no solution to exist. One option for this is just a map of two cities connected to each other – each time a friend jumps to one, the other friends jumps to the other and it just keeps flip flopping.
  3. Yes this is possible with a few maps. One such map could have a loop where one friend has to make it around the loop and back to the first city before they can meet their friend. If they decide not to use the loop then they would have to go forward and then backtrack to cities they have already visited.

1. **Problem 3.14 – True and False**
   1. **False.** Here is an example…. The goal is in red. The depth first would search the first node and then immediately search the goal node. But A\* would search the first node, then because of the heuristic cost search the right nodes first. So, in this case DFS would expand less nodes.

**A pair of glasses

Description automatically generated with medium confidence**

* 1. **True**
  2. \*\*SKIP\*\*
  3. **True**
  4. **False.** This is false because Manhattan distance would sum up each tile that it takes to get from one square to another using only horizontal and vertical moves. However, a rook can move as many spaces that is wants in one move. So, in this example below, the real cost would be 1 but the Manhattan distance would be 4 – and this is not admissible because it overestimates the cost.

Qr code

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1. **Problem 3.15 – Drawing out states**
2. **BFS:** 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10 – 11
3. **DFS:** 1 – 2 – 4 – 8 – 9 – 5 – 10 – 11
4. **IDS:** 1

1 – 2 – 3

1 – 2 – 4 – 5 – 3 – 6 – 7

1 – 2 – 4 – 8 – 9 – 5 – 10 – 11

1. A\* from Zerind to Bucharest

|  |  |  |
| --- | --- | --- |
| Frontier | Explored | Current State |
| Zerind (0 + 374 = 374) | Zerind, | Zerind |
| Oradea (71 + 380 = 451),  Arad (75 + 366 = 441) | Zerind, Arad | Arad |
| Oradea (71 + 380 = 451),  Sibiu ((75 + 140) + 253 = 468),  Timisoara ((75 + 118) + 329 = 522) | Zerind, Arad, Oradea | Oradea |
| Sibiu ((75 + 140) + 253 = 468),  Timisoara ((75 + 118) + 329 = 522) | Zerind, Arad, Oradea, Sibiu | Sibiu |
| Timisoara ((75 + 118) + 329 = 522),  Fagaras ((75 + 140 + 99) + 176 = 490),  Rimnicu Vilcea ((75 + 140 + 80) + 193 = 488) | Zerind, Arad, Oradea, Sibiu, Rimnicu Vilcea | Rimnicu Vilcea |
| Timisoara ((75 + 118) + 329 = 522),  Fagaras ((75 + 140 + 99) + 176 = 490),  Pitesti (((75 + 140 + 80 + 97) + 100 = 492),  Craiova (((75 + 140 + 80 + 146) + 160 = 601) | Zerind, Arad, Oradea, Sibiu, Rimnicu Vilcea, Fagaras | Fagaras |
| Timisoara ((75 + 118) + 329 = 522),  Pitesti ((75 + 140 + 80 + 97) + 100 = 492),  Craiova ((75 + 140 + 80 + 146) + 160 = 601),  Bucharest ((75 + 140 + 99 + 211) + 0 = 525) | Zerind, Arad, Oradea, Sibiu, Rimnicu Vilcea, Fagaras, Pitesti | Pitesti |
| Timisoara ((75 + 118) + 329 = 522),  Craiova (((75 + 140 + 80 + 146) + 160 = 601),  ~~Bucharest ((75 + 140 + 99 + 211) + 0 = 525),~~  Bucharest ((75 + 140 + 80 + 97 + 101) + 0 = 493) | Zerind, Arad, Oradea, Sibiu, Rimnicu Vilcea, Fagaras, Pitesti, Bucharest | Bucharest  GOAL! |

**OPTIMAL PATH:** Zerind 🡪 Arad 🡪 Sibiu 🡪 Rimnicu Vilcea 🡪 Pitesti 🡪Bucharest (493)

Diagram, radar chart

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