355 2020 worksheet 5 due Tue Oct 20 23:59 MDT

You can work on this assignment with anyone or anything, but you must acknowledge all people/things who give you any info. You must write all your answers in your own words: do not copy anyone/anything else. We might ask you later to explain your answers: if you cannot, we might deduct some or all marks, and of course report any suspected plagiarism to the appropriate authorities.

1. [1 mark] **If you don't answer this question, we won't be able to mark the rest of your assignment.** Give the names of all persons you consulted on this assignment, and explain who each is (e.g. classmate, friend, family, etc.). Other than the class webnotes, lectures and github repo, list any resource (book, url, video, etc.) you consulted.

2. [4 marks] Consider the A* roadmap example Arad to Bucharest on the course webpage `https://webdocs.cs.ualberta.ca/~hayward/355/jem/tile.html`.

   At each step in the algorithm, for each node X, `cost` stores the length of a _____ found so far from Arad to X, `heuristic` stores an estimate of the remaining distance from X to Bucharest, and `priority` stores _____ . In this example heuristic distances were computed as-the-crow-flies using latitude and longitude, so this heuristic _____ (answer: sometimes or never) overestimates the remaining distance, so the final distances found by A* on this example are _____ (answer: sometimes or always) shortest.

3. [5 marks] Below is the start of an execution of A* on the sliding tile puzzle. MSF is moves so far. EMTG is estimated moves to the goal. Show step 6. (There might be more than one correct answer.) Explain your work.

```
step   current position     positions added to queue
 1.    p0  3 6 7  msf:0     p1  3 6 7  msf:1     p2  3 6 7  msf:1
           2 5 4  emtg:7        2 5 4  emtg:7        - 5 4  emtg:7
           - 1 8                1 - 8                2 1 8
                               in queue  - 1 2 - - - - - - -

 2.    p2  3 6 7  msf:1     p3  - 6 7  msf:2     p4  3 6 7  msf:2
           - 5 4  emtg:7        3 5 4  emtg:7        5 - 4  emtg:8
           2 1 8                2 1 8                2 1 8
                               in queue  - 1 - 3 4 - - - - -

 3.    p1  3 6 7  msf:1     p5  3 6 7  msf:2     p6  3 6 7  msf:2
           2 5 4  emtg:7        2 5 4  emtg:6        2 - 4  emtg:8
           1 - 8                1 8 -                1 5 8
                               in queue  - - - 3 4 5 6 - - -

 4.    p5  3 6 7  msf:2     p7  3 6 7  msf:3
           2 5 4  emtg:6        2 5 -  emtg:6
           1 8 -                1 8 4
                               in queue  - - - 3 4 - 6 7 - -

 5.    p7  3 6 7  msf:3     p8  3 6 7  msf:4     p9  3 6 -  msf:4
           2 5 -  emtg:6        2 - 5  emtg:7        2 5 7  emtg:6
           1 8 4                1 8 4                1 8 4
                               in queue  - - - 3 4 - 6 - 8 9
```

4. [5 marks] (i) Three sliding tile heuristics — inversions, misplaced tiles, manhattan distance — are commonly used to estimate the number of moves to the goal. Which one is used in the above execution? How can you tell?

   (ii) Will the above execution eventually find a shortest solution? Explain briefly.