AI – Midterm

Name:

Score:

(40 points) (90 minutes)

Q1 (6 points): You are given a family of admissible heuristic functions h1, h2, … hn. Which of the following heuristic functions are admissible:

- H1 = c1 . h1 + c2 . h2 + … + cn . hn. // c1, c2, c3 … cn >= 0, c1 + c2 + cn = 1
- H2 = c1 . h1 + c2 . h2 + … + cn . hn. // c1 + c2 + .. cn = 1, Maybe positive or negative.
- H3 = max {h1, h2 …. hn} // Just take the maximum
- H4 = h1 + h2 + h3 + h4 + .. hn // Just take the sum
- H5 = 1/n * sqrt(h1 . h1 + h2 . h2 + … + hn . hn) // square root of squares
- H6 = n / {1 / h1 + 1/h2 + 1/h3 + 1/h4 + …. + 1/hn} // This is also called Harmonic mean

[Just check the ones that are admissible, and cross X the ones that are not. No explanation needed.]

Q2 (4 points):): Why do we need heuristic evaluation functions in adversarial search games (such as tic tac toe)?

Q3 (5 points): Explain the concept of Constraint Propagation. Specifically describe, why do we need it, and how to best use it? If the constraint graph is a tree, then what implications does it have? How do you exploit this fact?

Q4 (5 points): In the context of Markov Decision Processes, what are the advantages of using policy iteration over value iteration?

Q5 (10 points): For the given MDP, find the values for the states S2, S3 and S4. States S1 and S5 are terminal states with values 0 and 1 respectively. Living Reward (R) is 0. Transition function is defined as follows: When going Left or Right, there is a 90% probability that the move goes as planned and 10% probability that no move occurs. Discount rate gamma is 0.9

S1	S2	S3	S4	S5
0	x1	x2	x3	1

Q6 (10 points): In the context of n-puzzle, consider a variation that we can slide multiple tiles in one row or column, if they are touching each other. The cost of this slide operation is the same as that of sliding one tile.

Design an admissible and useful heuristic for this problem.

Q7 (Optional) (2 bonus points): Why might we be interested in some non-admissible heuristic? In other words, how can inadmissible heuristics still help us solve problems like the n-puzzle faster?