CSAE 42: Artificial Intelligence

Instructor: Dr. Suraiya Jabin

Marks weightage: 5 (towards Theory Internal Assessment)

Note:

1. Collaborations on assignment works are not permitted.
2. Cheating and any other anti-intellectual behavior, including giving your work to someone else or downloading solution through Internet or copying your answers from your room mate or from back of the book, will be dealt with severity or may result in evaluation zero.
3. Assignments after the due date would not be accepted and will result in evaluation zero out of five.

Given on: Monday, March 30, 2020

Due on: Monday, April 8, 2020 (During lab class)

Topics: Exhaustive Search, Heuristic Search, Game Tree, First-Order Logic

Text Book: AI A Modern Approach, 3rd Edition by Russel and Norvig

Reference Book: AI by Rich and Knight, TMH

1. Whether the admissibility property of a heuristic implies monotonicity? Give explanation for your answers. Suggest a heuristic which is admissible but not monotonic.

2. Solve Missionaries and Cannibals problem using A* algorithm. Try at least two heuristics and compare with baseline case, *i.e.,* the breadth first search.

3. Solve the game by suggesting a good heuristic:

Initial State:

B	B	B		W	W	W

Goal State: States where no B is to the left of any W; Operators:

- A tile may hop over one or two other tiles into the empty position with cost equal to no. of tiles jumped over.
- A tile may move into an adjacent empty location with cost 1.

4. The heuristic algorithm is a best-first search in which the objective function is f(n)=(2-w) g(n) + w h(n). For what values of w is this algorithm guaranteed to be optimal? What kind of search does this perform when w=0? When w=1? When w=2?
5. Consider this starting position of a simple 4-square game:

A			**B**
1	**2**	**3**	**4**

Player A moves first. The 2 players take turns moving, each player must move his token to an open adjacent space in either direction. If the opponent occupies an adjacent space, then a player may jump over opponent to the next open space if any. The game ends when one player reaches the opposite end of the board. If player A reaches space 4 first, then the value of game to A is +1; if player B reaches space 1 first, then the value of game to A is -1. This game can be generalized to n squares for any n>2. Prove that A wins if n is even and loses if n is odd.

6. A and B play the following game: Given the expression: N=9+X+Y-Z, where X, Y, Z are variables representing single digits (range 0 to 9), A would like to maximize N while B would like to minimize it. Towards this end, A chooses a single digit number and B substitutes this for a variable of his choice (X,Y, or Z). B then chooses the next value and A the variable to substitute the value. Finally A proposes a value for the remaining variable. Assuming both play to their optimal strategies, the value of N at the end of the game would be? Give your answer if N=12+X*(Y-Z).
7. Solve game of NIM with 13 tokens on the desk using MiniMax game strategy.
8. Solve Cryptarithmetic Puzzle using constraint satisfaction strategy and clpfd (constraint logic programming and functional dependency) in Prolog:

   base+ball=games