CS486 Assignment 1

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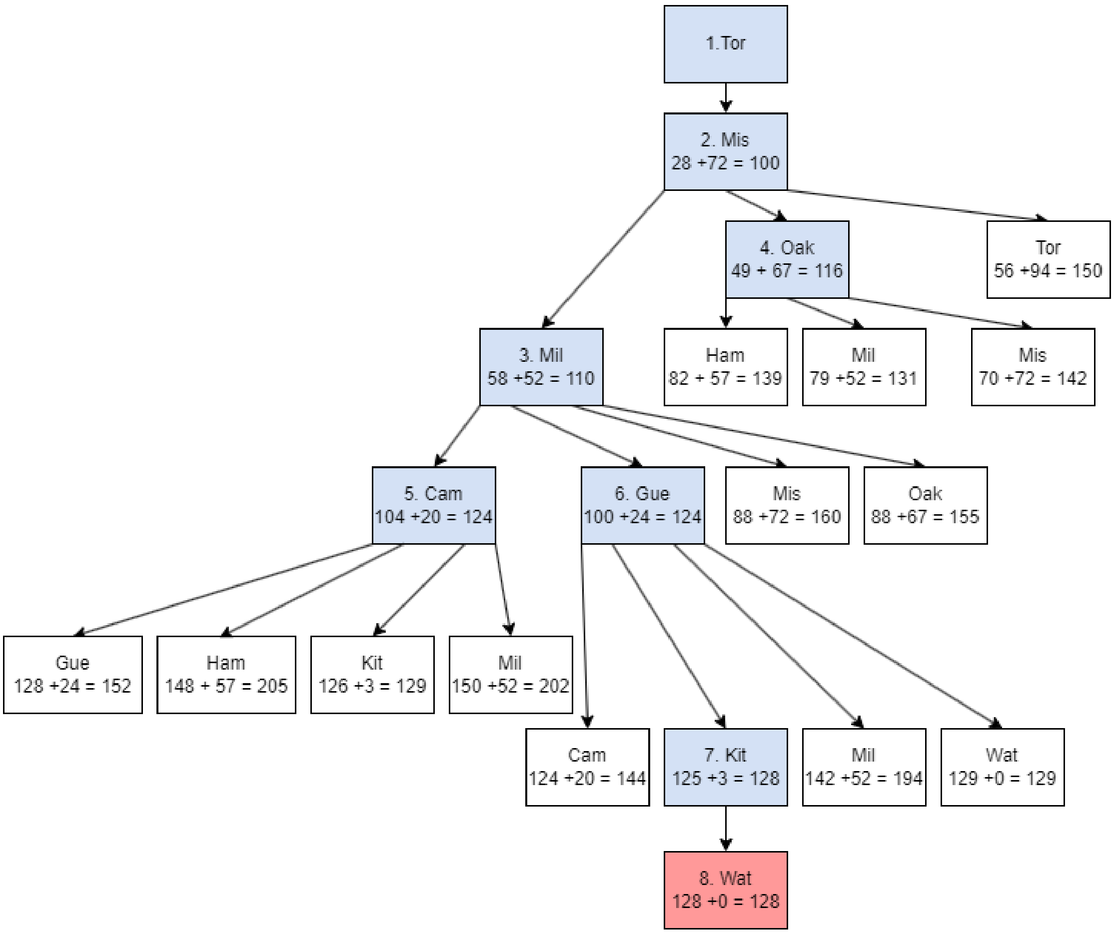
Q1

(a) The Euclidean distance is always the shortest path from the current node to the goal. It is not constant as the distance between different places can hardly be the same. The Euclidean distance is always less than or equal to the actual cost.

(b) By triangle's inequality, the Euclidean distance is always less than the actual cost, it is a straight line connecting two places. It satisfies the Monotone restriction such that $h(m) - h(n) \leq cost(m,n)$ for every arc<m,n>

(c)



Q2

(a) (Submitted to marmoset)

(b) The game terminates in 10 seconds when running game with MinimaxHeuristicPlayer at depth 2. The first depth that the game terminates beyond 10s is when depth = 5.

(c) My heuristic function records the difference in the number of two-in-a-rows that each player has, as well as three-in-a-rows. Other than that, the function also checks the points at the two ends of the continuous rows. The resulted value only increases or decreases when there is '.' at both ends of the rows, to eliminate the pattern that being blocked. The final value is calculated by value of three-in-a-rows multiplied by 2 and two-in-a-rows multiplied by 1/10, since there is more chance to win when achieving a three-in-a-row.
My heuristic function outperforms three_line_heur since it checks more conditions to eliminate invalid patterns. It also counts two-in-a-row to check if there is more possible to form a three-in-a-row.

(d) Depth decreased to 4 due to long runtime.

Agent1	Agent2	Wins	Draws	Losses
MinimaxPlayer, depth 3, three_line_heur	RandomPlayer	20	0	0
MinimaxPlayer, depth 3, my_heuristic	RandomPlayer	20	0	0
MinimaxPlayer, depth 4, three_line_heur	MinimaxPlayer, depth 2, three_line_heur	13	3	4
MinimaxPlayer, depth 4, my_heuristic	MinimaxPlayer, depth 2, my_heuristic	16	1	3
MinimaxPlayer, depth 4, my_heuristic	MinimaxPlayer, depth 4, three_line_heur	16	2	2

Q3

(a) Variables: The variable of the problem is the column position Xi ($i=1,2,\ldots,N$) of a Queen put on i th row. There are N variables since there are N rows.

Domain: The domain of each variable is $\{1, 2, ..., N\}$.

Constrains:

1. For all i and j, $i \neq j$ (no Queens in the same row)
2. For all i and j, $Xi \neq Xj$ (no Queens in the same column)
3. For all i and j, $|Xi - Xj| \neq |i - j|$ (no Queens in the same diagonal)

(b) Variables: The variable of the problem is the column position Xi ($i=1,2,\ldots,N$) of a Octopi put on i th row. There are N variables since there are N rows.

Domain: The domain of each variable is $\{1, 2, ..., N\}$.

Constrains:

1. For all i and j, $i \neq j$ (no Octopi in the same row)
2. For all i and j, $Xi \neq Xj$ (no Octopi in the same column)
3. For all i and j, $block(Xi) \neq block(Xj)$,
   where $block(i)$ = $[(i - 1)//M, (Xi - 1)//M]$ (no Octopi in the same block i)