Assignment 5 CECS 451

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1. True or False? You don't need to explain your answers.
   (a) (2 points) h(n) = 0 is an admissible heuristic for the 8-queens problem.
      i. True, because when h(n) is at 0 then that would mean there are no queens in attacking range of each other.
   (b) (2 points) Assume that a rook can move on a chessboard one square at a time in vertically or horizontally, but cannot jump over other pieces. Manhattan distance is an admissible heuristic for the problem of moving the rook from square A to square B in the smallest number of moves.
      i. True
2. (6 points) The heuristic path algorithm is a best-first search in which the evaluation function is $f(n) = (2 - w)g(n) + wh(n)$. What kind of search does this perform for $w = 0$,$w = 1$,and $w = 2$?
   (a) If $w = 0$ then $f(n) = (2 - 0)g(n) + 0h(n) = f(n) = 2g(n)$ the algorithm would be a Breadth-First search or a Depth first Search.
   (b) If $w = 1$ then $f(n) = (2 - 1)g(n) + 1h(n) = f(n) = g(n) + h(n)$ would be a A* search algorithm.
   (c) If $w = 2$ then $f(n) = (2 - 2)g(n) + 2h(n) = f(n) = 2h(n)$ would be a Greedy Algorithm because it expands with minimal h(n).
3. Give the name of the algorithm that results from each of the following cases:
   (a) (2 points) Local beam search with k= 1.
      i. It would be Hill Climb algorithm.
   (b) (2 points) Simulated annealing with T = ∞ at all times.
      i. It would be the Random-restart Hill Climbing algorithm.

4. Imagine that, one of the friends wants to avoid the other. The problem then becomes a two-player pursuit–evasion game. We assume now that the players take turns moving.The game ends only when the players are on the same node; the terminal payoff to the pursuer is minus the total move taken. An example is shown in Figure 1.

   (a) (2 points) What is the terminal payoff at the node (1)?

      i. The terminal payoff at the node (1) would be -4.

   (b) (2 points) What are the positions of the two players at the node (2) and (2)'s children?

      i. The positions of the two players at the node (2) and (2)'s children would be (be) and (bd).

   (c) (3 points) Can we assume the terminal payoff at the node (2) is less than < -4? Answer yes or no, then explain your answers.

      i. Yes, we can assume the terminal payoff at the node (2) is less than -4 because as we go down the tree to whatever minimum there is, the payoff would keep subtracting 1 so it would be soon be less than -4.

   (d) (3 points) Assume the terminal payoff at the node (4) is less than -4. Do we need expand the node (5) and (6)? Answer yes or no, then explain your answers.

      i. If the terminal payoff at the node (4) is less than -4 then no we should not expand the nodes (5) and (6) because we would offset the balance of the tree since the left side of the tree is at a terminal payoff of -4 at node (1).

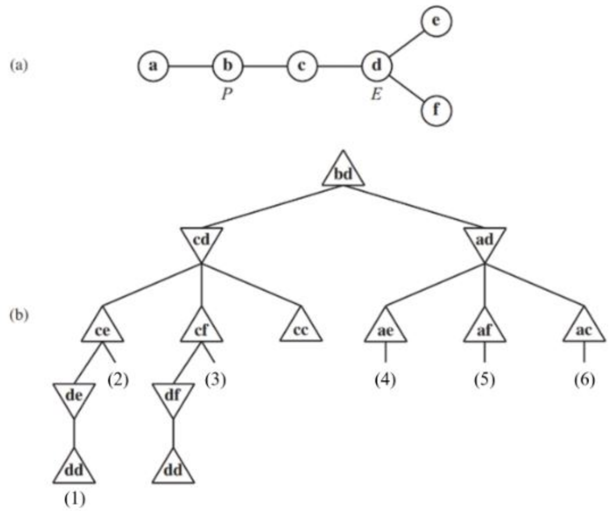
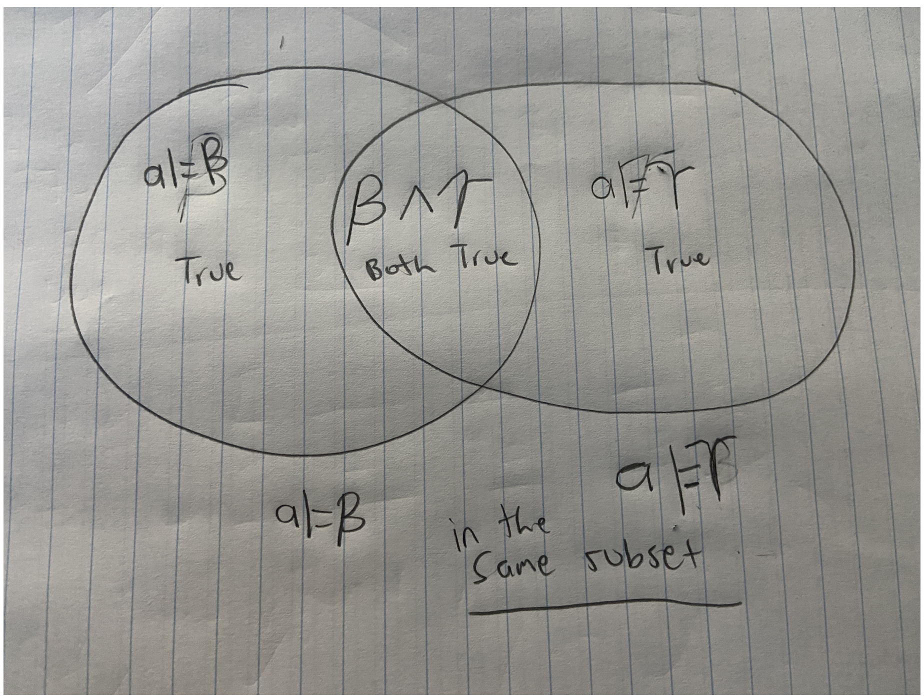


Figure 1: (a) A map where the cost of every edge is 1. Initially the pursuer P is at node b and the evader E is at node d. (b) A partial game tree for this map. Each node is labeled with the P, E positions. P moves first.

5. True or False? You don't need to explain your answers.
   (a) (2 points) $(A \wedge B) \models (A \Leftrightarrow B)$
      i. True
   (b) (2 points) $(C \vee (\neg A \wedge \neg B)) \equiv ((A \Rightarrow C) \wedge (B \Rightarrow C))$
      i. True
   (c) (2 points) $(A \vee B) \wedge (\neg C \vee \neg D \vee E) \equiv (A \vee B)$
      i. True
   (d) (2 points) $(A \vee B) \wedge \neg(A \Rightarrow B)$ is satisfiable.
      i. True

6. (4 points) Prove using Venn diagram, or find a counterexample to the following assertion:

$$\alpha \models (\beta \wedge \gamma) \text{ then } \alpha \models \beta \text{ and } \alpha \models \gamma$$


a|=β
True
β∧γ
Both True
a|=γ
True
a|=β
a|=β
in the
same subset