Homework 3 (Electronic)

Q1 Propositional Logic

25 Points

Which of the following are correct?

Note: If you want to review the definition of some symbols, please read Chapter 7 of the textbook. $\equiv$ is defined at the beginning of Chapter 7.5, $A \equiv B$ means $A \models B$ and $B \models A$.

- [ ] (i) $False \models True$.
- [ ] (ii) $True \models False$.
- [ ] (iii) $(A \land B) \models (A \Leftrightarrow B)$.
- [ ] (iv) $A \Leftrightarrow B \models A \lor B$.
- [ ] (v) $A \Leftrightarrow B \models \neg A \lor B$.
- [ ] (vi) $(A \land B) \Rightarrow C \models (A \Rightarrow C) \lor (B \Rightarrow C)$.
- [ ] (vii) $(C \lor (\neg A \land \neg B)) \equiv ((A \Rightarrow C) \land (B \Rightarrow C))$.
- [ ] (viii) $(A \lor B) \land (\neg C \lor \neg D \lor E) \models (A \lor B)$.
- [ ] (ix) $(A \lor B) \land (\neg C \lor \neg D \lor E) \models (A \lor B) \land (\neg D \lor E)$.
- [ ] (x) $(A \lor B) \land \neg(A \Rightarrow B)$ is satisfiable.
- [ ] (xi) $(A \Leftrightarrow B) \land (\neg A \lor B)$ is satisfiable.

Save Answer

Q2 Oh Yeah? Prove It.

25 Points

Which of the following can be proved? (Work through the proof or come up with a counterexample.)

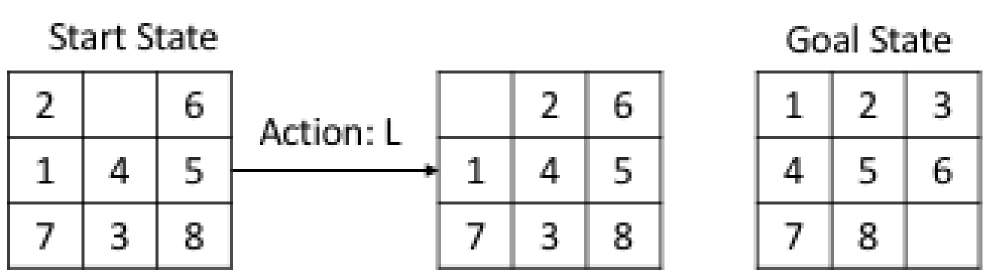
- [ ] i. α is valid if and only if $True \models \alpha$.
- [ ] ii. $\alpha \models \beta$ if and only if the sentence $(\alpha \Rightarrow \beta)$ is valid.
- [ ] iii. $\alpha \equiv \beta$ if and only if the sentence $(\alpha \Leftrightarrow \beta)$ is valid.
- [ ] iv. $\alpha \models \beta$ if and only if the sentence $(\alpha \wedge \neg\beta)$ is unsatisfiable.
- [ ] v. If $\alpha \models \gamma$ or $\beta \models \gamma$ (or both) then $(\alpha \wedge \beta) \models \gamma$.
- [ ] vi. If $\alpha \models (\beta \wedge \gamma)$ then $\alpha \models \beta$ and $\alpha \models \gamma$.
- [ ] vii. If $\alpha \models (\beta \vee \gamma)$ then $\alpha \models \beta$ or $\alpha \models \gamma$ (or both).

Save Answer

Q3 Local Search

25 Points

Let's play the 8-puzzle using the local search algorithm. The size of the board is 3×3, and the start and goal states are shown in the figure. You can only move the blank cell, with one of the following 4 possible actions at each step: U (up), D (down), L (left), and R (right). The heuristic cost function is the number of misplaced cells from the goal state. For example, the cost of the start state is 8, and the cost of the state after taking the action L is 7.



Q3.1

12 Points

Using the hill-climbing algorithm, in what state does the search terminate? List the number of each cell from the top to the bottom rows, left to right, and use 0 to represent the blank cell. For example, if the search terminates at the goal state, then your answer is 1,2,3,4,5,6,7,8,0. When multiple solutions exist, ties are broken alphabetically.

Enter your answer here

Save Answer

Q3.2
13 Points

You will observe that with the hill-climbing algorithm, the search gets stuck. Which of the following ways could enable the search to proceed? Select all that apply.

- [ ] Adding random restarts.
- [ ] Changing the heuristic cost function to be the Manhattan distance from the goal state. Using this cost function, the cost of the start state is 1+3+1+1+1+0+3+1=11.
- [ ] Applying simulated annealing with a sufficiently slow temperature schedule.

Save Answer

Q4 Facts of Search
25 Points

Q4.1
12 Points

Which of the following search algorithms will eventually find the global optimal solution regardless of the start state, given a finite search space and infinite time?

- [ ] Hill climbing with random restarts.
- [ ] Hill climbing with sideway moves.
- [ ] Simulated annealing.
- [ ] Local beam search.

Save Answer

Q4.2

13 Points

Which of the following statements are true? Select all that apply.

- [ ] Hill climbing with random restarts always guarantees to find a globally optimal solution within finite time.
- [ ] When allowing sideway moves for hill climbing algorithm, we may need to modify stopping conditions.
- [ ] For simulated annealing, with the decrease of the temperature, when a move leads to a worse neighbor state than the current state, the search is less likely to take such a neighbor state.
- [ ] If the local search could find the optimal solution with the beam size K, then it also could find the optimal solution with another beam size K'>K.

Save Answer

Save All Answers

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