Artificial Intelligence — Test Simulation 1

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1 Propositional Logic

Given the following formulas in propositional logic

1. $\neg(p \to q)$
2. $\neg(\neg(p \wedge q) \to \neg r)$
3. $((q \wedge r) \to (p \vee \neg q))$

show whether the formula $p \vee r$ is a logical consequence of them. Prove your answer using either variable elimination or DPLL.

2 Logic

Consider the following predicates

- $P(x, y)$ to state that individual x is y's parent;

- $A(x, y)$ to state that individual x is an ancestor of individual y, i.e., either x is a parent of y or x is an ancestor of y's parent;

Consider the following sentences:

1. $\forall x.\neg A(x, x)$
2. $\forall x.\forall y.(P(x, y) \to A(x, y))$
3. $\forall x.\forall y.(\exists z.P(z, y) \wedge A(x, z) \to A(x, y))$

Answer the following questions, providing proofs reasoning on interpretations:

- Are the sentences consistent?

- Given the domain $D = \{mary, susan, juliet\}$ and the interpretation function g such that $g(P) = \{(mary, susan), (susan, juliet)\}$ and $g(A) = \emptyset$, tell whether the interpretation satisfies all the sentences or not;

- Tell whether the sentence $\exists x.P(x, x)$ is a logical consequence of the sentences above or not.

3 Planning

Using PDDL-STRIPS formalize a domain where an agent travels between cities, considering the following constraints:

- the agent can use his car to move from home to the airport, within the same city;

- the agent needs to board a plane in order to move to a different city.

In particular, formalize actions to get on and off the car, drive the car, and board/unboard the plane, as well as the predicates to characterize the state. State a problem instance where there are two cities A and B and the agent is initially at home in city A and needs to move to city B.