Artificial Intelligence — Test Simulation 2

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1 Propositional Logic

Given the following formulas in propositional logic

- φ_1: $(p \rightarrow q)$
- φ_2: $(q \rightarrow (s \wedge t))$
- φ_3: $(r \rightarrow (s \wedge t))$
- φ_4: $(p \vee r)$

show whether the formula $s \wedge t$ is a logical consequence of the theory $\Phi = \{\varphi_1, \varphi_2, \varphi_3, \varphi_4\}$. State your answer as a proof using either variable elimination or DPLL.

2 First Order Logic

Consider the following interpretation for a "sorority world" where an "$\times$" in the cell x, y denotes that x "likes" y

	Abby	Bess	Cody	Dana
Abby	$\times$	-	$\times$	$\times$
Bess	-	$\times$	-	$\times$
Cody	-	-	$\times$	-
Dana	-	$\times$	$\times$	-

and tell which of the following sentences is true in the interpretation:

1. $\forall x.likes(x, x)$
2. $\forall x.\exists y.likes(x, y)$
3. $\exists y.\forall x.likes(x, y)$
4. $\forall x.\forall y.likes(x, y) \rightarrow likes(y, x)$
5. $\forall x.\forall y.(\exists z.likes(x, z) \wedge likes(z, y)) \rightarrow likes(x, y)$.

3 Planning

Use PDDL-STRIPS to formalize a domain where a robot with two grippers can move around a set of rooms and collect objects, considering the following constraints:

- Some objects are heavy and some are light; heavy objects require the robot to use both grippers to carry them, whereas light objects can be carried using only one grippper; therefore the robot can carry only one heavy object or two ligth ones.
- The rooms are numbered from 1 to n and they are connected with a corridor, so the robot can move back and forth to any room.
- A room may contain objects or be empty.
- The robot must be in the room to collect an object in it.
- The object must be dropped in a room to be considered there.

In particular, formalize actions to move from one room to another and collect/drop objects, as well as the predicates to characterize the state. Formalize a problem instance where there are four rooms, the agent is initially in room 1, there are two objects (one light and one heavy) located in room 2 and two objects (one light and one heavy) located in room 3 and the goal is to carry all of them in room 4. Write in the problem file as a comment what would you expect to be the optimal plan (the one featuring the least number of steps).