

Dynamic Epistemic Logic

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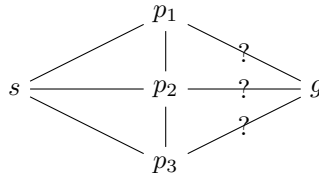
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Exercise Sheet 10

Due: July 17th, 2019, 16:00

Exercise 10.1 (Epistemic Canadian Traveler Problem; 3+3 points)

Consider the following road network where vertices are waypoints and edges are roads. Ground vehicles can drive from one waypoint to a connected one, if the road is not blocked. Air vehicles (i.e., drones) can fly arbitrarily between connected waypoints. An agent can only observe whether or not a road is blocked if its current position is a waypoint adjacent to that road.



Because of the region's unusual climate conditions, it is commonly known that, at any given day, either both paths from p_1 and p_2 to g are blocked (due to floods from the north) or both paths from p_2 and p_3 to g are blocked (due to violent sand storms from the south). Other roads are never blocked. Furthermore, drones can communicate their findings about blocked roads back to ground vehicles, given their line of sight is not obstructed, which happens only on field p_2 and p_3 in the case of a sand storm. Let us assume that there are two agents who both start at s : one truck and a drone. The truck has only sufficient fuel for two movement actions. The cooperative goal is for the truck to reach g . Initially, both agents are unaware of the weather conditions.

- Model the problem as a cooperative epistemic planning task. You may define actions schematically (e.g., a drive action *drive-x-y* for variable locations x, y).
- Compute a strong policy and depict it analogously to the policies in the lecture.

Exercise 10.2 (Optimally Eager Agents; 3+3 points)

Prove the following propositions from the lecture:

- Let Π be a planning task and $(a, T_a)_{a \in A}$ a group of optimally eager agents. If $\pi_a = T_a(\Pi)$ is a maximal strong policy for each $a \in A$, then all executions of $(\pi_a)_{a \in A}$ are deadlock-free.
- Let Π be a uniformly observable and solvable planning task, and $(a, T_a)_{a \in A}$ a group of optimally eager agents. Then all executions by $(a, T_a)_{a \in A}$ of Π are finite.