Dynamic Epistemic Logic

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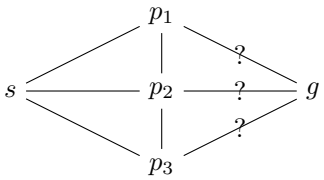
Exercise Sheet 10

Due: January 26th, 2016, 10:00

Exercise 10.1 (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.

(a) 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).

(b) Compute a strong policy and depict it analogously to the policies in the lecture.

Exercise 10.2 (Execution of Maximal Policies; 3 points)

Prove the following proposition from the lecture:

> Let $(\pi_a)_{a \in \mathcal{A}}$ be a policy profile where each π_a is a maximal strong policy for agent a and task Π. Then π_a is defined for all agents $a \in \mathcal{A}$ and global states s occurring in arbitrary executions $(s_0, act_1, \ldots, s, \ldots)$ of $(\pi_a)_{a \in \mathcal{A}}$.

Exercise 10.3 (Conformant and Contingent Planning; 3 points)

Informally relate our standard and implicitly-coordinated epistemic planning notions to conformant[1] and contingent[2] planning, both for the sequential and the conditional cases.

[1] `http://mbp.fbk.eu/conformant.html`
[2] `http://www.jair.org/media/277/live-277-1534-jair.pdf`