Principles of AI Planning

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Exercise Sheet 3
Due: Friday, November 15th, 2019

Send your solution to `mario.kantz@gmail.com` (PDF only) or submit a hardcopy before the lecture. The exercise sheets may and should be worked on and handed in in groups of two or three students. Please indicate all names on your solution.

Exercise 3.1 (Example for STRIPS regression, 5 points)

Consider the STRIPS planning task with atoms $A = \{a, b, c, d, e\}$, initial state $I = \{a \mapsto 0, b \mapsto 1, c \mapsto 0, d \mapsto 1, e \mapsto 1\}$, goal $\gamma = a \wedge d$, and operators $O = \{o_1, o_2, o_3\}$, where

$$o_1 = \langle b \wedge d, c \wedge e \wedge \neg d \rangle$$
$$o_2 = \langle b, a \wedge \neg c \wedge \neg d \rangle$$
$$o_3 = \langle a, d \rangle.$$

Solve this problem with a *breadth-first search* (BFS) using the STRIPS regression method. Submit the search tree that you obtain and record the solution plan. Do not expand a node further if the formula at that node is unsatisfiable or represents a set of states that is a (strict or nonstrict) subset of the set of states represented by the formula at a previously expanded node. Specify the result of regression for each node of the BFS tree.

Exercise 3.2 (Problem modeling, 2+2+1 points)

This exercise may and should be solved with the fully featured PDDL online editor (`http://editor.planning.domains/`). Send your solution files (with all names mentioned) via email to Mario Kantz (`mario.kantz@gmail.com`).
Rovers operating on other planets must be autonomous, because signals from Earth to planets deep in our solar system take too long.

(a) Model a rover domain with the following specification. There are several waypoints on the planet, some of which are connected. The rover can navigate between two waypoints A and B when A and B are connected. Interesting rocks can be found at any waypoint. The rover can only analyze the rocks of a waypoint when it is at the waypoint. After the rover has analyzed a rock sample, it can transmit the results of this particular analysis to Earth. The transmission of the results of analysed rock samples can only be carried out at certain waypoints where the connection to Earth is good enough. Note that each result is to be transferred via an individual action. All actions have unit costs.

(b) Model the problem of the rover domain shown in Figure 1. The goal is to analyze all rock samples and transfer the results to Earth.

(c) Solve the rover problem from above. More specifically, press `Solve` and select "Domain: *domain.pddl*", "Problem: *problem.pddl*" and "Custom Planner URL: `http://fd-solver.herokuapp.com`". Report the plan found by the integrated planner.
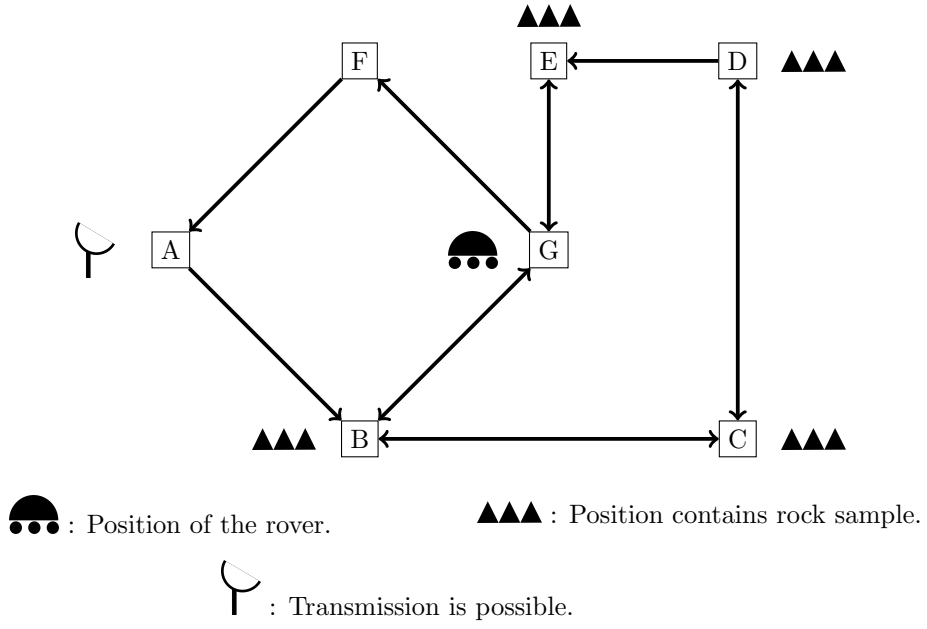
Figure 1: A problem of the rover domain.