CS 309
Autonomous Intelligent Robotics (FRI I)
HW 2: PDDL Due: 02/26/2019

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http://justinhart.net/files/homework/2019_spring_cs309/HW2/hw2.pdf

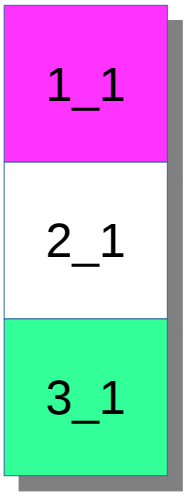
Implement the following in PDDL. These problems build on each other, so earlier problems may serve as a guide to later problems.

Your submission should be a zip file with all of the domain and fact files for this problem. Technically, you can use the same domain file for all 4 problems. The problems are designed to make you think, but ultimately to describe one single domain in which a robot puts laundry into a laundry bin. If you use more than one domain file, make them domain_1.pddl, domain_2.pddl, and so forth, otherwise, domain.pddl. Your fact files should be facts_1.pddl, facts_2.pddl, and so forth.

Problem 1:

The Toyota Human Support Robot (HSR) is the robot that we use in RoboCup@Home. Imagine an HSR in a grid world apartment. The HSR must do a few basic tasks. Your first task is to get the HSR to simply go down a hallway.

The robot starts in cell 1_1 and must arrive in cell 3_1. It can only enter into adjacent cells. Your move action should be named “move_from_to”. So, your final plan should output something akin to:
MOVE_FROM(HSR, 1_1, 2_1)
MOVE_FROM(HSR, 2_1, 3_1)



Write the domain and facts in PDDL that represent this problem and output this plan.

Important facts to model.
1) The robot must be “in” a cell at any given time.
2) The robot can only move into an adjacent cell.
3) Your goal should be in(HSR, 3_1).

Problem 2:

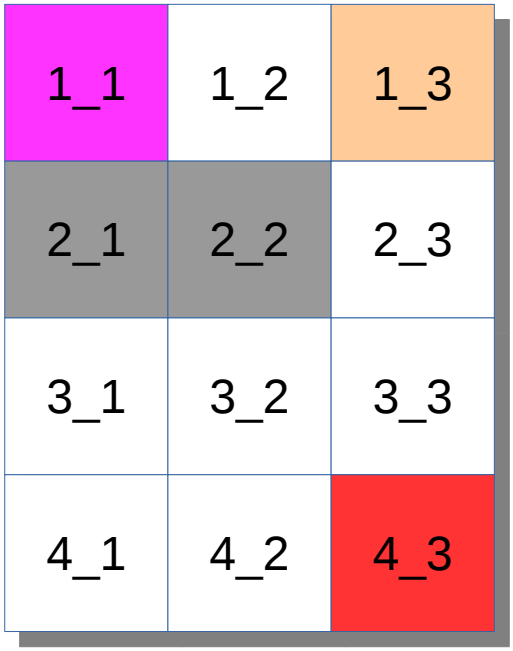
Now, imagine a more complicated grid, similar to the one in the previous problem. There is now a wall in cells 2_1 and 2_1. The robot cannot pass through the wall, but must navigate from 1_1 to 3_1.

Problem 3:

The HSR must pick a shirt up off of the floor and put it into a laundry bin. The HSR cannot be in the same cell as the shirt. For convenience's sake, when picking the type for the HSR and the shirt, do not make one “robot” and one “shirt.” Make them both “thing.” To pick up the shirt, the HSR must be in a cell adjacent to one the shirt is in. Similarly, to put the shirt into the bin, the HSR must be in a cell adjacent to the laundry bin. Similar to the shirt, the HSR cannot be in the same cell as the laundry bin, so just make it a “thing” to. To mark that the HSR is a robot, make a predicate that calls the HSR a “robot.” To mark that the shirt is laundry, make a predicate that makes the shirt “laundry.” To mark that the laundry bin is a laundry bin, make a predicate that marks the laundry bin a “laundry_bin,” and its type “thing” as well.

Important facts for this model:
1) The HSR, laundry bin, and shirt are all of type “thing.”
2) The HSR is known to be a robot because of the ROBOT() predicate, which acts on type “thing.”
3) The laundry bin is known to be a laundry bin because of the LAUNDRY_BIN(predicate).
4) The shirt is laundry because of the LAUNDRY() predicate.
5) The HSR can only pick up objects in adjacent cells.
6) The HSR can only put a piece of laundry into the laundry bin if it is in an adjacent cell to the laundry bin.
7) It does not matter what cell the HSR ends in.
8) Your goal should be IN_LAUNDRY_BIN(SHIRT, BIN).
9) The wall is the same as in Problem 2.
10) The robot starts in 1_1
11) The laundry bin is in 4_3
12) The shirt is in 1_3

Diagram on next page.



Problem 4:

Okay, just one more to make you think. There is now a closed door in cell 2_3. The robot only has one gripper and so only can open the door if its gripper is empty. It can only put the shirt down into an adjacent cell, so it must pick up the shirt before it can enter cell 1_3, and put it down before it can open the door. When the robot puts down the shirt, it can only do so into an adjacent cell with no wall and no door in it. The robot must open the door before it can walk through it. The robot's goal is still to put the shirt into the bin.

Important facts for this model:
1) Everything from problems 1, 2, and 3.
2) There is a door in cell 2_3.
3) The door starts out closed.
4) The robot must open the door to pass through it.
5) The robot only has one arm and can only open the door if its gripper is empty.
6) The robot can only put the piece of laundry down into an adjacent cell.
7) The goal is still IN_LAUNDRY_BIN(SHIRT, BIN)