Planning

Aim The aim of this lab is for you to investigate how planning works, and to understand how to formalize the world where the agent is situated in a logical way.

Preparation Go through the slide material of Lecture 8 Planning on the course website. Try out also the STRIPS planner with the Blocks World example.

About the lab This lab consists of three parts, and it can be done by at most two persons.

Lab examination demonstrate the tasks you solved to Pierangelo during any scheduled lab session.

Grading Task A → 3 / Tasks A, B → 4 / Tasks A, B, C → 5

Task A - Shakey the Robot

Shakey the robot (1966-1972 SRI International) was the first general-purpose mobile robot to be able to reason about its own actions. While other robots would have to be instructed on each individual step of completing a larger task, Shakey could analyze the command and break it down into basic chunks by itself.

The robot's programming was primarily done in LISP. The STRIPS planner it used was conceived as the main planning component for the software it utilized. As the first robot that was a logical, goal-based agent, Shakey experienced a limited world. A version of Shakey's world could contain a number of rooms connected by corridors, with doors and light switches available for the robot to interact with. Shakey had a short list of available actions within its planner. These actions involved traveling from one location to another, turning the light switches on and off, opening and closing the doors, climbing up and down from rigid objects, and pushing movable objects around.[1]

The original STRIPS program was designed to control Shakey the robot. Figure 2 shows a version of Shakeys world consisting of four rooms lined up along a corridor, where each room has a door and a light switch. The actions in Shakeys world include moving from place to place, pushing movable objects (such as boxes), climbing onto and down from rigid objects (such as boxes), and turning light switches on and off. The robot itself was never dexterous enough to climb on a box or toggle a switch, but the STRIPS planner was capable of finding and printing out plans that were beyond the robots abilities. Shakeys actions are listed in Figure 1.

[1] http://en.wikipedia.org/wiki/Shakey_the_robot

- **go(x, y)**, which requires that Shakey be at x, and that x and y are locations in the same room. By convention a door between two rooms is in both of them.
- Push a box b from location x to location y within the same room: **push(b, x, y)**. You will need the predicate box(...) and constants for the boxes.
- For Shakey to be able to find a box in a room, the light must be on in that room.
- To switch the light in a room on or off, Shakey must climb onto a box that is positioned below the switch (otherwise he can not reach the switch).
- Climb onto a box **climbUp(b)**; climb down from a box **climbDown(b)**. You will need the predicate on and the constant floor.
- Turn a light switch on **turnOn(s)**; turn it off **turnOff(s)**. To turn a light on or off, Shakey must be on top of a box at the light switchs location.

Figure 1: Shakey's actions

In this task do the following:

- Download the STRIPS planner from the course website.
- Describe Shakeys actions and the world from Figure 2 in STRIPS notation.
- Run the planner with your description of the world to find a plan to get box2 into room2.
- Run the planner to find a plan to bring all the boxes from room1 to room4.
- Note that the STRIPS planner we use is a simple progression planner, and it is not that efficient. This task does not require you to find the optimal plan.

Task B

Not available; I will try to make it as soon as possible.

Task C

As above ...

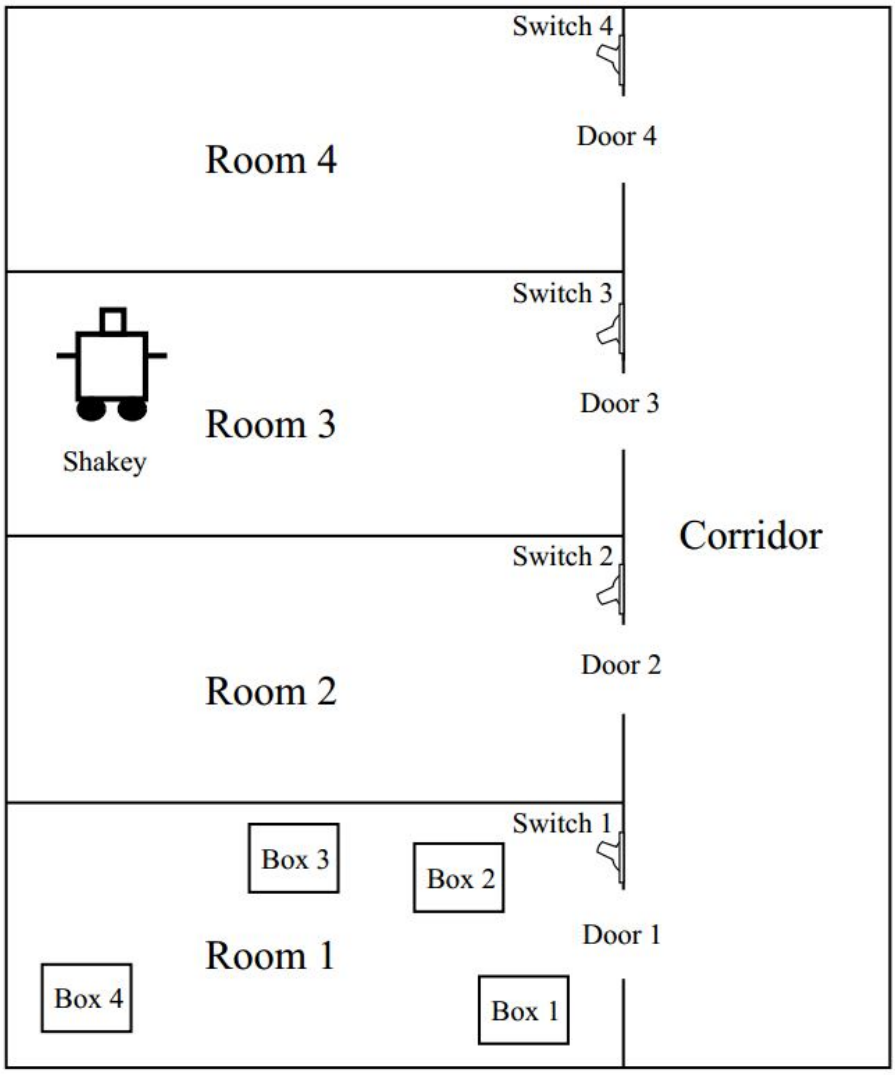

Figure 2: Shakeys world. Shakey can move between landmarks within a room, can pass through the door between rooms, can climb climbable objects and push pushable objects, and can flip light switches.