# Agent-Based Systems
Tutorial 3

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Q1 (Adapted from Russell & Norvig) Shakey the robot was the application for which the STRIPS language was originally developed. The figure below shows a version of Shakey's world consisting of four rooms and a corridor. Each room has a door and light switch. Shakey can move from place to place, push movable objects, climb on (and down from) rigid objects and turn light switches on and off (actually the real Shakey couldn't, but the planner can handle all these actions). Shakey needs to climb on a box to turn a light switch, and we assume that all rooms are connected by doors which belong to both rooms.
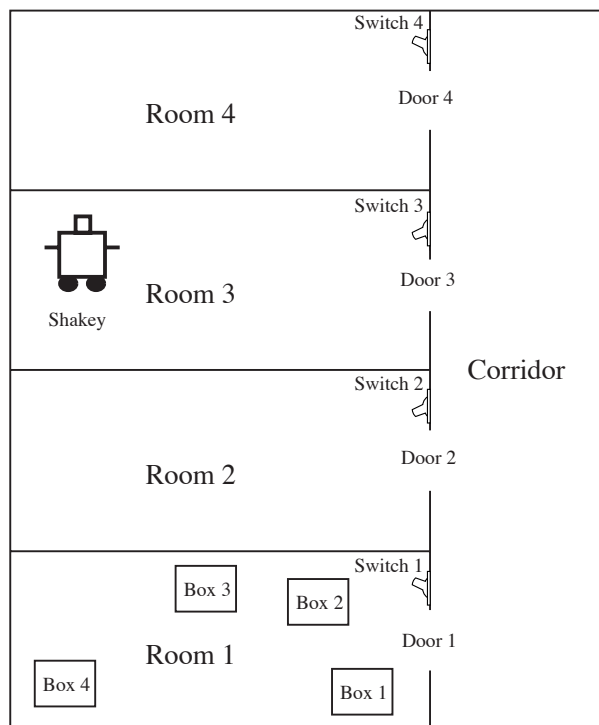
1. Develop a logical language for describing Shakey's world
2. Describe Shakey's actions by appropriate action schemata
3. Formally describe the initial state shown in the figure above
4. Construct a plan for Shakey to get Box_2 into $Room_2$

Q2 The Advanced Thermostat System: Assume a heater control system controls a living room and a bedroom area, and is equipped with

- separate thermostats and heater units for both rooms
- timer clocks that allow the thermostat settings to be overruled at certain times (by binary "on"/"off" settings) and also time to be sensed
- motions sensors to note whether people are present in the room

Your task is to build an intelligent BDI-based agent using the control loop discussed in the lecture:

Practical Reasoning Agent Control Loop
1. $B \leftarrow B_0$; $I \leftarrow I_0$; /* initialisation */
2.   while $true$ do
3.   get next percept ρ through $see(\ldots)$ function
4. $B \leftarrow brf(B, \rho)$; $D \leftarrow options(B, I)$; $I \leftarrow filter(B, D, I)$;
5. $\pi \leftarrow plan(B, I, Ac)$;
6.   while not $(empty(\pi)$ or $succeeded(I, B)$ or $impossible(I, B))$ do
7. $\alpha \leftarrow head(\pi)$;
8. $execute(\alpha)$;
9. $\pi \leftarrow tail(\pi)$;
10.   get next percept ρ though $see(\ldots)$ function
11. $B \leftarrow brf(B, \rho)$;
12.   if $reconsider(I, B)$ then
13. $D \leftarrow options(B, I)$; $I \leftarrow filter(B, D, I)$
14.   if not $sound(\pi, I, B)$ then
15. $\pi \leftarrow plan(B, I, Ac)$
16.   end-while
17. end-while

For complex actions you can assume a plan library that will return a sequence of actions to achieve any achievable goal from any given initial state.

1. Design a language for describing the advanced thermostat world formally in terms of percepts, actions, and beliefs

2. Suggest a suitable agent design by formally defining the brf, $options$, $filter$ and $reconsider$ functions. You can assume all other functions above to be readily available.

3. For a sequence of percepts of your choice of a few steps, sketch the operation of your system by tracing the workings of the BDI control loop using the functions you have designed.