

CS322 Fall 1999  
Module 9 (Representing Actions)  
Assignment 9

Due: 1:30pm, Friday 12 November 1999.

**Question 1**

Consider the domain of assignment 2, as shown in Figure 1.

Suppose, at each time step, one of the following actions can be carried out: turn on a specific tap, turn off a specific tap, put a plug in the sink, put a plug in the bath, take the plug out of the sink, take the plug out of the bath, or wait.

Suppose initially all taps are off, and the bath and sink are unplugged, and  $p1$  is pressurized.  $p1$  remains pressurized for all actions.

- (a) Axiomatize, using the situation calculus, how *on*, *plugged* and *unplugged* are affected by the actions.
- (b) Axiomatize the domain so that you can determine whether there is flow in the drains for various situations. You need to consider both the bath and the sink, but you don't need to consider how the floor gets wet.
- (c) Give axioms that let you derive *noflow* for the shower, into the bath and in the drains. *noflow* is true when *flow* is not true. You may **not** use negation as failure. You can define other predicates if you like.
- (d) Suppose the plugged bath with water flowing in goes from empty to half full in one time step (i.e., in the time it takes to execute one action), and from half-full to full in one time step, and will overflow wetting the floor in the next time step. The unplugged bath empties on one time step. The plugged sink fills up in one time step and, in the next time step it overflows with water flowing in. The unplugged sink empties on one time step. Intuitively, think of the action as doing the command, then waiting a bit (enough time for the sink to fill or the bath to half fill).

The floor, once wet, remains wet.

Axiomatize how the floor can be wet in different situations. You can define whatever predicates you may need.

You should try your axiomatization in CILog. The only built-in predicate you may use is inequality ( $\neq$ ).

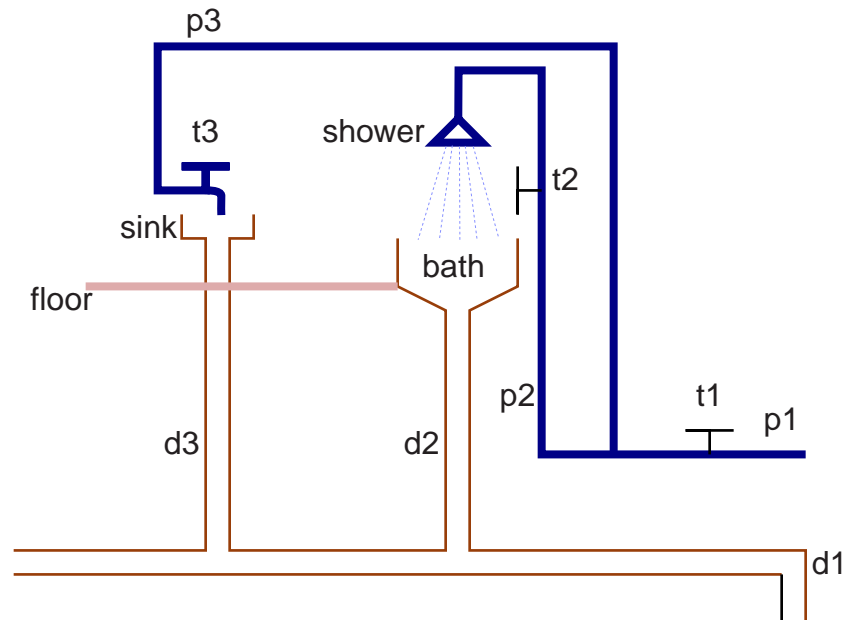


Figure 1: The Plumbing Domain

**Question 2**

1. Suppose you considered using the STRIPS representation for this domain. Which predicates would be static, which would be primitive and which would be derived?
2. Give the STRIPS representation for the action  $turnon(t3)$ .
3. Give the STRIPS representation for the action  $wait$ .
4. Is STRIPS or the situation calculus more natural for representing this domain? Explain why.

**Question 3**

For each question in this assignment, say how long you spent on it. Was this reasonable? What did you learn?