CS322 Fall 1999
Module 2 (Symbols and Semantics)
Assignment 2

Due: 1:30pm, Monday 20 September 1999.

The aim of this assignment is to learn about semantics and how to axiomatize a domain.

We will discuss this assignment in Monday's class. Please be prepared to play your part in the discussion. You are to hand in this assignment at the end of the lecture.

Question 1

Given the knowledge base

$$a \leftarrow b \wedge g.$$
$$b \leftarrow c \wedge d.$$
$$b \leftarrow e.$$
$$c.$$
$$d \leftarrow f.$$
$$f.$$

where $\{a, b, c, d, e, f, g\}$ is the set of all atoms.

(a) Give a model of the knowledge base.

(b) Give an interpretation that is not a model of the knowledge base.

(c) Give two atoms that are logical consequences of the knowledge base.

(d) Give two atoms that are not logical consequences of the knowledge base.

Question 2

Consider the domain of house plumbing represented in the diagram of Figure 1.

In this example constants $p1$, $p2$ and $p3$ denote cold water pipes. Constants $t1$, $t2$ and $t3$ denote taps and $d1$, $d2$ and $d3$ denote drainage pipes. The constants *shower* denotes a shower, *bath* denotes a bath, *sink* denotes a sink and *floor* denotes the floor. Figure 1 is intended to give the denotation for the symbols.

Suppose we have as predicate symbols:

- *pressurised*, where *pressurised*(P) is true if pipe P has mains pressure in it.
- *on*, where *on*(T) is true if tap T is on.
- *off*, where *off*(T) is true if tap T is off.
- *wet*, where *wet*(B) is true if B is wet.
- *flow*, where *flow*(P) is true if water is flowing through P.
- *plugged*, where *plugged*(S) is true if S is either a sink or a bath and has the plug in.
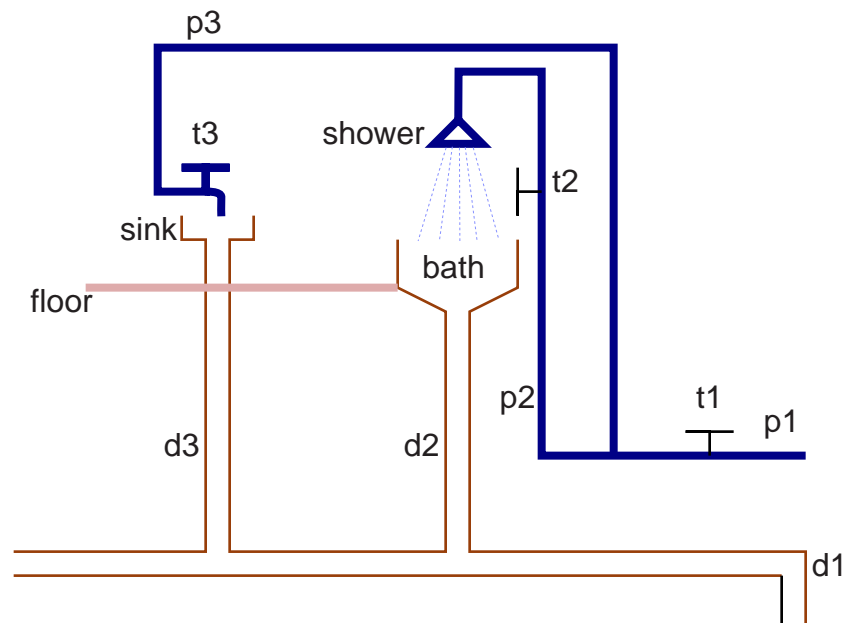
Figure 1: The Plumbing Domain

- *unplugged*, where *unplugged*(*S*) is true if *S* is either a sink or a bath and has the plug in.

The file plumbing.pl (available on the web and in `~cs322/cilog/`) contains a CILog axiomatization for how water can flow down drain *d*1 if taps *t*1 and *t*2 are on and the bath is unplugged.

1. Finish the axiomatization for the sink in the same manner as the axiomatization for the bath. Test it in CILog.

2. Axiomatize how the floor is wet if the sink overflows or the bath overflows. They overflow if the plug is in and water is flowing in. You may invent new predicates as long as you give their intended interpretation. [Assume that the taps and plugs have been in the same positions for one hour; you don't need to axiomatize the dynamics of the turning on taps and inserting and removing plugs.] Test it in CILog.

3. Suppose there is a hot water system is installed to the left of tap *t*1. This has another tap in the pipe leading into it, and supplies hot water to the shower and the sink (there are seperate hot and cold water taps for each). Add this to your axiomatization. Give the denotation for all constants and predicate symbols you invent. Test it in CILog.

You need to hand in a complete listing of your program, including the intended interpretation for all symbols used and a trace of the CILog session to show it runs.

Question 3

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