Assignent 4: Ramification, Qualification and Concurrency in domestic robotics

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Who hasn't dreamed about having a number of robots that do all that boring domestic work like cleaning, doing the dishes, doing the bed and putting in order? In this assignment, you should represent some of the knowledge two particular robots could need in order to perform their tasks a particular morning. These two robots, called Bill and Bull, work in the household of Mr. Asimov, and this morning they have to do the following:

1. They should prepare breakfast for Mr. Asimov: coffee, toasted bread and jam.
2. They should serve Mr. Asimov breakfast at the coffe table in the living room.
3. They should bring the newspaper from the hallway to the living room and put it on the coffee table when it arrives in the morning.
4. The big carpet under the coffee table is dusty. The robots need to cooperate to move the coffee table away from the carpet, shake the carpet and put back the coffee table.

A number of things should be taken into consideration, for instance:

- Resource constraints. For instance, each robot has only one pair of arms.
- Ramifications. If a robot is carrying an object, or if an object is on top of another object or contained in another object that is moved, then the object also moves.
- Some things take some time. For instance, if a robot puts a slice of bread into the toaster, then it takes a fixed amount of time for the bread to get ready. Hint: a way to represent the fact than an effect comes after some time (delayed effect) can be represented as follows. Here, $toasted(x)$ is the delayed effect that occurs after 10 time-points, and $toasting(x)$ represents the fact the the process of toastin x is going on.

  $$dep[s, s+8]toasting(x) \Rightarrow R([s+9]toasted(x) \wedge \neg toasting(x)) \qquad (1)$$

  Notice that the robot can do other things while the bread is toasting.

- Qualifications. For instance, you can't put a slice of bread into the toaster if there is already one slice of bread.

Encode a scenario that describes what happens this particular morning in Mr Asimov's house, using the VITAL software. You have plenty of freedom to choose what you want to model and how you want to model it.