TMCS Fall 2016, HW 4

Please bring your solutions to class on Thursday October 13. You are invited to work in teams of two but not larger. If you work in a team, submit only a single sheet with both names marked on it.

The two problems below both are grounded in a simple everyday action: boiling an egg for breakfast. Imagine the following little action sequence:

You enter the kitchen – go to the fridge – take out an egg – put it on the kitchen table – go to the cupboard – open it – take out a pot – carry the pot to the sink and pour water in the pot – put the pot on the stove, switch on, wait until it boils – take egg from table and place it in the boiling water – set a timer on your smartphone – when it beeps, carry pot to sink – take out hot egg with spoon – rinse it with cold water – carry it to the breakfast table and place it on a plate.

Problem 1 (60 pts) Derive a lower bound on the number of elementary facts that you need to know to execute this kitchen action successfully. If you start thinking about this, you will find that most facts that you need to know are not like explicit Wikipedia knowledge facts, but implicit (so-called *procedural*) facts of which you usally are not consciously aware. For instance, you know how it feels to hold an egg between thumb and index finger; you know that the surface of an egg is a little rough and shows these almost microscopic pores and warts; ... Hint: just pick one of the action items in the scene description and analyze the implied pieces of knowledge in detail, then boldly generalized to the entire list.

Problem 2 (40 pts) List 5 facts that change their truth value as that kitchen scene unfolds.

Particularly imaginative and complete treatments get up to 5 bonus points.

Please typeset your solution.

Background note. "Boiling a breakfast egg" has been widely used in the AI literature as a demo example for the difficulty of coding everyday procedural knowledge. It is a commonplace conception in AI that it is vastly more difficult (in fact, not solved to the day) to program a robot to successfully boil a breakfast egg, than it is to program a world champion chess playing program.