ICS 271
Fall 2016
Instructor : Kalev Kask
Homework Assignment 7
Due Tuesday, November 22

1. (10) Define PDDL(STRIPS) operator schemata for the problem of putting on shoes and socks and a hat and a shirt.

2. (10) Explain how backward search using regressions based on PDDL(STRIPS) rules would solve the Sussman anomaly.

3. (20) The monkey-and-bananas problem is faced by a monkey in a laboratory with some bananas hanging out of reach from the ceiling. A box is available that will enable the monkey to reach the bananas if he climbs on it. Initially, the monkey is at A, the bananas at B, and the box at C. The monkey and box have height Low, but if the monkey climbs onto the box he will have height $High$, the same as the bananas. The actions available to the monkey include Go from one place to another, $Push$ an object from one place to another, $ClimbUp$ onto or $ClimbDown$ from an object, and $Grasp$ or $Ungrasp$ an object. Grasping results in holding the object if the monkey and object are in the same place at the same height.

   (a) (5) Write down the initial state description.

   (b) (5) Write the six action schemas.

   (c) (5) Suppose the monkey wants to fool the scientists, who are off to tea, by grabbing the bananas, but leaving the box in its original place. Write this as a general goal (i.e., not assuming that the box is necessarily at C) in the language of situation calculus. Can this goal be solved by a STRIPS-style system?

   (d) (5) Your axiom for pushing is probably incorrect, because if the object is too heavy, its position will remain the same when the $Push$ operator is applied. Is this an example of the ramification problem or the qualification problem? Fix your problem description to account for heavy objects.

4. (15) Construct levels 0, 1, and 2 of the planning graph for the problem in Figure 10.3 in RN.

5. (20) Assume a blocks words planning problem with 3 blocks A, B, C. Given initial state $On(A, Table) \wedge On(B, Table) \wedge On(C, Table)$ and a goal state $On(A, B) \wedge On(B, C)$, translate this problem into a SATplanning problem. Note that we know that this problem has a shortest length plan of 2. Find a model for your SATplan formulation and extract a plan from the model.