CS533
Intelligent Agents and Decision Making
Homework 1, Winter 2011

1. Exercise 10.3
2. Exercise 10.4 (here "PDDL sentence" is the same as "STRIPS definition")
3. Exercise 10.7
4. How many levels will GraphPlan need to expand in order to solve the "Sussman Anomaly" shown in Figure 10.4 of your book? Explain your answer. For the set of actions, consider actions that correspond to the blocks-world STRIPS schemas given in the book.
5. Exercise 10.10a (here "final level of the graph" refers to the level after which no more changes occur)
6. A standard propositional STRIPS planning problem (as described in class) specifies: 1) a goal condition, 2) an initial state, and 3) a set of propositional STRIPS actions with positive preconditions. We will refer to the set of all standard STRIPS problems as *STANDARD*.

   (a) *Let NegPre be the class of problems that are specified as above, except that actions are allowed to have negative preconditions. (Note that NegPre is a strict superset of STANDARD.) Show how to convert any problem $p \in NegPre$ to a problem $p' \in STANDARD$, such that p has a solution iff p' has a solution. In other words, give a reduction from PlanSAT for NegPre to PlanSAT for STANDARD. Prove your answer for full credit.*

   (b) *Let DisjGoal be the class of problems that are standard STRIPS problems only they have disjunctive goals. A disjunctive goal is a disjunction of standard goals, where a standard goal is a set of propositions. For example, the following is a disjunctive goal:*

   $$\{on(a,b), on(b,c)\} \text{ or } \{on(c,b), on(b,a)\}$$

   We say that a problem in DisjGoal is solvable iff there is an action sequence from the initial state to some state that satisfies at least one of the goal disjuncts. So in our example above we must reach a state with either the tower (a,b,c) or (c,b,a).
   Repeat part (a) for DisjGoal.