Homework 3

1. (Planning, Ch. 11) Work problem 11.7 a-d on page 413 in the text (“Examine definition…”).

2. (Planning, Ch. 11) Construct levels 0, 1, and 2 of the planning graph for the problem in Figure 11.2 on page 380.

3. (Planning, Ch. 11) Consider the problem of putting on one’s shoes and socks, as defined in Section 11.3.
   a. Apply GraphPlan to this problem and show the solution obtained.
   b. Now add actions for putting on a coat and a hat. Show the partial order plan that is a solution, and show that there are 180 different linearizations of the partial-order plan.
   c. What is the minimum number of different planning graph solutions needed to represent all 180 linearizations?

4. (Planning, Ch. 12) Why can’t conditional planning deal with unbounded indeterminacy?

5. (Planning, Ch. 12) Work problem 12.14 on page 460 in the text (“The following quotes…”).

6. (Planning, Ch. 12) Consider the following problem: A patient arrives at the doctor’s office with symptoms that could have been caused either by dehydration or by disease $D$ (but not both). There are two possible actions: $Drink$, which unconditionally cures dehydration, and $Medicate$, which cures disease $D$, but has an undesirable side-effect if taken when the patient is dehydrated.
   a. Write the problem description (i.e., the initial state, action definitions) using conditional planning descriptions like those given in section 12.4.
   b. Give a sensorless plan that solves the problem, enumerating all relevant possible worlds.
   c. Now, add a $Test$ action that has the conditional effect $CultureGrowth$ when $Disease$ is true and in any case has the perceptual effect $Known(CultureGrowth)$. Define this new $Test$ action.
   d. Give a conditional plan that solves the new problem and minimizes the use of the $Medicate$ action.

7. (Perception) You are to design a sensor suite for a new robot for use by fire fighters. The robot is designed to seek out people in a smoke filled building. Keep in mind the following: (1) visibility is often very limited due to smoke, (2) heat can be both an attractive force (e.g., due to people) or repulsive (e.g., due to fire), and (3) obstacles may have a wide variety of sound absorption (e.g., carpeting or furniture). Describe the types of sensors that may be needed, how they should be used, and what their shortcomings may be. (Don’t focus on how the robot moves – just on the sensors it will need to use.)

8. (Robotics, Ch. 25) Work problem 25.5, parts a, b, and d, page 943 (“This exercise explores…”).

9. (Robotics, Ch. 25) Work problem 25.6 a-c, page 944-945 (“Consider the simplified…”).