Homework #3: Chapters 11-14, 16

The following exercises are due at the beginning of class on April 7.

1. *[15 pts.]* Do exercise 13.6 from the book (p. 489).
2. *[20 pts.]* Do exercise 14.3 (a-d) from the book (p. 534).
3. *[15 pts.]* Consider the following variation of the Wumpus World agent. The agent has a choice of eight actions: move in one of the four directions (north, south, east, or west) or shoot its only arrow in one of those directions. If the agent moves into a square with the Wumpus or a pit in it, the agent dies; it can move into any other square safely. A square cannot contain both a Wumpus and a pit. The arrow will only travel one square, but if the Wumpus is in the square the arrow will kill it. The agent's utility is calculated as follows:

   -1000 for an action that results in death
   -100 for wasting the arrow by shooting at a square that doesn't contain the Wumpus
   100 for moving into a safe square
   200 for killing the Wumpus with an arrow

   For each of the four adjacent squares (North, South, East, and West), the agent has determined the probability that they contain the Wumpus and the probability that they contain a pit. These probabilities are given in the following table:

Square	**P(Wumpus)**	**P(Pit)**
North	0.2	0.1
South	0.0	0.0
East	0.8	0.0
West	0.0	0.5

   What is the expected utility of each action? To maximize the chance for partial credit, be sure to show your work. If the agent follows the principle of maximum expected utility and only considers single actions (as opposed to action sequences), which action will it choose?
4. *[10 pts.]* Consider the STRIPS air cargo problem described in Figure 11.2 of the book (p. 380). What are all of the concrete actions that are applicable in the initial state? Note that a concrete action is one in which all of the variables are instantiated to constants.
5. *[15 pts.]* Do exercise 11.4 (a-b) from the book (p. 412). Assume that your domain predicates are:
   - At(x,l): x is at location l
   - Height(x,h): x has height h
   - Have(x,o): x has object o
   - Pushable(o): object o can be pushed
   - Climbable(o): it is possible to climb on object o

   Give a total-order plan that is a solution to the goal Have(Monkey,Bananas). You do not have to use an algorithm to find this plan.
6. *[15 pts.]* Consider the problem of putting on one's shoes and socks, as defined in Section 11.3 of the book. Define STRIPS actions for putting on a coat and a hat. Show the partial order plan that is a solution to the goal of putting on all of the items, and show that there are 180 different linearizations of this solution. Make sure that your plan follows the principle of least commitment.
7. *[10 pts.]* Do exercise 12.10 from the book (p. 460).