Homework #1: Chapters 1, 2, 3

The following exercises are due at the beginning of class on January 30. Each exercise will be graded for correctness, so please start early and be sure you are confident in your answers. Also, remember that all work should be your own. Note this homework is continued on the reverse side.

1. *[15 points]* Develop a PEAS description for the following task environments:
   a) A software agent that can play a computerized game of tic-tac-toe versus a human.
   b) An agent that can query the World Wide Web in order to find answers to arbitrary trivia questions typed in by a user.
   c) A scanner that can identify fruit and vegetables at a grocery store.

2. *[15 points]* For each of the agents described above, categorize it with respect to the six dimensions of task environments as described on pages 40-43. Give a short justification for each property.

3. *[10 points]* One of the problems with the table-driven agent is that the tables can get enormous. One way to reduce the table's size is to only do lookup based on the current percept, as opposed to the entire percept history. Under what conditions would this result in a rational agent? When is it better to use the entire percept history?

4. *[20 points]* Consider the problem of coloring a two-dimensional map using only four colors, such that no two adjacent areas have the same color. Give the initial state, goal test, successor function, and cost function for this problem. Choose a formulation that is precise enough to be implemented. In particular, specify the successor function by describing each action formally (i.e., precisely describe what kinds of states each action can be used in and how the state is changed when an action is applied).

5. *[20 points]* Sudoku is a popular logic puzzle. Consider the 4x4 puzzle given below. The object is to place the numbers 1-4 in the blank squares such that every row contains exactly one of each of the digits, and likewise for every column and each of the 2x2 quadrants. Assume that the only legal action is entering a number into the next *available* square (proceeding from left to right in each row, and moving from top to bottom). This number must not already appear in the same row, column or quadrant (which would violate the puzzle's constraints). Use breadth-first search to solve this problem. Show your search tree, and label each node with the order in which it is expanded. Hint: Your tree should have 8 levels (not including the root node), so be sure to leave room to fit it on one sheet of paper.

Initial State

4		1	
1			4
2		3	
3		4	

6. *[20 points]* Given the map in Figure 3.3 of the book (p. 63), use depth-first search to find a path from Vaslui to Sibiu. Assume that when all else is equal, cities are chosen in alphabetical order and that you can ignore operators that will return you to the city you just came from. Show your search tree and label each node with the order in which it is expanded.