

Homework #1: Chapters 1, 2, 3

The following exercises are due at the beginning of class on February 4. Please type your answers or neatly write them on your own paper. Each exercise will be graded for correctness, so start early and be sure you are confident in your answers. Also, remember that all work should be your own. Note, the last problem is on the back of this sheet.

1. [15 points] Develop a PEAS description for the following task environments:
 - a) A credit card fraud detection agent that monitors an individual's transactions and reports suspicious activity.
 - b) A grocery store scanner that digitally scans a fruit or vegetable and identifies it.
 - c) A robot that can help rescue workers locate the injured in a collapsed building.
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. Be sure that your choices accurately reflect the way you have designed your sensors and actuators. Give a short justification for each property.
3. [10 points] Write a pseudocode agent program for the goal-based agent described by Fig. 2.13 (p. 52). Use the pseudocode for the model-based reflex agent as inspiration (Fig. 2.12, p. 51). Assume that the agent has a function that can enumerate its possible actions and goal satisfaction can be achieved by choosing a single action.
4. [20 points] The missionaries and cannibals problem is usually stated as follows. Three missionaries and three cannibals are on one side of a river, along with a boat that can hold one or two people. Find a way to get everyone to the other side without ever leaving a group of missionaries in one place outnumbered by the cannibals in that place. Assume there is no way to send the boat across without at least one person in it. Give the initial state, goal test, actions, transition model, and path cost function for this problem, making only those distinctions necessary to ensure a valid solution. Draw a diagram of the complete state space.
5. [25 points] Sudoku is a popular logic puzzle. Consider a 4x4 puzzle like the one 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 with each node showing the current grid and labeled with the order in which it was 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. [15 points] Consider a search problem in which every state has exactly 10 successor states, none of which can be reached from any other state. Assume the maximum depth of a search is 9, and the shallowest solution is at depth 7. Note, the depth of the root is considered to be 0.
- If we use breadth-first search, what is maximum number nodes that could be generated, and what is the maximum number of nodes that would need to be stored in memory at any given time?
 - Answer part (a) for depth-first search.
 - What are the comparative advantages and disadvantages of using these two search strategies for this problem?