

- 1) Define in your own words the following terms: intelligence, artificial intelligence, rationality.
- 2) *Surely, computers cannot be intelligent. They can do only what their programmers tell them.* Do you think this statement is true? Explain your point of view.
- 3) Give a PEAS description for the task environment of an internet book-shopping agent. State any assumptions that you are making about the problem. Then characterize the environment using the properties given in Section 2.3 in your textbook. What is an appropriate design for this agent? (see Section 2.4 in the text)
- 4) Consider the n -queens problem described on pages 66-67 in your text. Three different state spaces are suggested: (a) a complete state formulation where every state corresponds to a particular configuration of n queens on the board, (b) an incremental formulation where every state represents a board with i queens and $0 \leq i \leq n$, and an action places a queen on an empty square. (c) an efficient incremental formulation where every state represents a board with i queens placed on columns 1 to i , $0 \leq i \leq n$, and an action places a queen on column $i + 1$ so that it is not attacked by any of the other queens.
 - (i) For each of the three state spaces, argue whether it is possible to design: a breadth first search, an iterative deepening search, and a bidirectional search algorithm. Be brief and cover all nine combinations.
 - (ii) Show that the number of states for the efficient incremental formulation is at least $O((n!)^{\frac{1}{3}})$. Estimate the largest value for n for which exhaustive exploration (enumerating all states) is feasible, i.e. you think it would complete within an hour or so on your computer. (see the hint from problem 3.5 from page 89 in the text).
 - (iii) For each of the three state spaces, answer the following questions. Is the state space finite or infinite? Can a search tree in the state space be finite or infinite? If it is possible to have both finite and infinite search trees in a particular state space, what conditions you need to impose on the search algorithm in order to guarantee finiteness of the search tree?
- 5) In bi-directional search, two searches occur in parallel, one from the initial state, the other from the goal state. Which of the following search algorithms can be used for the parallel searches and why: breadth first search, depth first search, depth limited search, iterative deepening depth first search.
- 6) Consider the vacuum cleaner world described in your text on page 33 with one modification. The performance measure assigns +1 for each clean room in every time unit and -1 for every move of the agent.

- (i) Can a simple reflex agent be rational? Explain.
- (ii) What about a model based reflex agent, using states? If the answer is yes, design such an agent, explain your design and argue why the agent is rational.
- (iii) How do your previous answers change (if they indeed change) if the agent can perceive the status of both rooms instead of only the status of the room the agent is in.