Assignment 1

CS590: Adv. Artificial Intelligence

Fall 2024

Due date: September 17, 2024, 11:59 pm
Submissions: Submit your written answers as a PDF on Blackboard by the posted deadline.
Total Points: 22 pts

Problem 1 (Ch. 1) [2.5pts]

Define in your own words: (a) intelligence, (b) artificial intelligence, (c) agent, (d) rationality, (e) logical reasoning.

Problem 2 (Ch. 1) [2.5pts]

Many of the computational models of cognitive activities that have been proposed involve quite complex mathematical operations, such as convolving an image with a Gaussian or finding a minimum of the entropy function. Most humans (and certainly all animals) never learn this kind of mathematics at all, almost no one learns it before college, and almost no one can compute the convolution of a function with a Gaussian in their head. What sense does it make to say that the "vision system" is doing this kind of mathematics, whereas the actual person has no idea how to do it?

Problem 3 (Ch. 2) [4pts]

For each of the following activities, give a PEAS description of the task environment and characterize it in terms of the properties listed in Section 2.3.2. (Use Figure 2.6 as an example)

A) Playing soccer.
B) Exploring the subsurface oceans of Titan.
C) Shopping for used AI books on the Internet.
D) Playing a tennis match.
E) Practicing tennis against a wall.
F) Performing a high jump.
G) Knitting a sweater.
H) Bidding on an item at an auction.

Problem 4 (Ch. 2) [5pts]

Define in your own words the following terms: agent, agent function, agent program, rationality, autonomy, reflex agent, model-based agent, goal-based agent, utility-based agent, learning agent.

Problem 5 (Ch. 3) [5pts]

Which of the following are true and which are false? Explain your answers.

A) Depth-first search always expands at least as many nodes as A^* search with an admissible heuristic.
B) $h(n) = 0$ is an admissible heuristic for the 8-puzzle.
C) A^* is of no use in robotics because percepts, states, and actions are continuous.

D) Breadth-first search is complete even if zero step costs are allowed.
E) Assume that a rook can move on a chessboard any number of squares in a straight line, vertically or horizontally, but cannot jump over other pieces. Manhattan distance is an admissible heuristic for the problem of moving the rook from square A to square B in the smallest number of moves.

Problem 6 (Ch. 3) [3pts]

Prove each of the following statements, or give a counterexample:

A) Breadth-first search is a special case of uniform-cost search.
B) Depth-first search is a special case of best-first tree search.
C) Uniform-cost search is a special case of A^* search.