CS 188 Final Exam, 1230-330, Thu Dec 12, 1996

Make sure you have all 3 pages of this exam. Tha maximum score possible is 190 points. Good luck.

1. A lie detector test is known to be 80% reliable when the person is guilty and 95% reliable when the person is innocent. If a suspect is chosen from a group of suspects of whom only 1% have ever committed a crime, and the test indicates that he is guilty, what is the probability that he is innocent ?

2. A knight on an infinite chessboard must be transferred from an initial position of $(0,0)$ to a goal position (m,n) using the minimum number of legal knight moves. Find an admissible heuristic function h that you could use to solve the problem using the A^* algorithm.

3. What is the space complexity of A^* in the following two cases (a) $h = h^*$ (b) $h = 0$

4. The NAND function of n binary inputs $x_1, \ldots, x_n$ is defined to be $\sim (x_1 \wedge x_2 \wedge \ldots \wedge x_n)$. Our convention is to represent T and F by the numbers 1 and 0 respectively. Can this function be represented by a single layer perceptron? Either prove that this is impossible or construct such a perceptron. You may assume that n is known in advance.

5. The SAME function of 2 inputs x_1, x_2 is defined to be 1 if the inputs are the same (both 0 or both 1) and 0 otherwise. Can this function be represented by a single layer perceptron? Either prove that this is impossible or construct such a perceptron.

6. Construct an example of a knowledge base and query where backward chaining is much more efficient than forward chaining. Is this always true?

7. Which of the following formulas are valid?

$$((p \Rightarrow q) \Rightarrow p) \Rightarrow p$$

$$F \Rightarrow p$$

$$[\forall x p_1(x) \vee \forall x q_1(x)] \Rightarrow \forall x (p_1(x) \vee q_1(x))$$

$$\forall x(p_1(x) \vee q_1(x)) \Rightarrow [\forall x p_1(x) \vee \forall x q_1(x)]$$

$$[\exists x p_1(x) \wedge \exists x q_1(x)] \Rightarrow \exists x(p_1(x) \wedge q_1(x))$$

$$\exists x(p_1(x) \wedge q_1(x)) \Rightarrow [\exists x p_1(x) \wedge \exists x q_1(x)]$$

$$[\forall x \exists y p_3(x, y)] \Rightarrow [\exists y \forall x p_3(x, y)]$$

$$[\exists y \forall x p_3(x, y)] \Rightarrow [\forall x \exists y p_3(x, y)]$$

8. In computer vision, a major problem is the recovery of depth information that is lost in the process of perspective projection. State 5 different methods for extracting depth information from images. In each case, explain briefly with a diagram.

9. Construct an example each to illustratef the following issues in understanding natural language

   (a) Resolving indexicals

   (b) Resolving anaphora

   (c) Resolving lexical ambiguity

10. The purpose of this exercise is to test your understanding of the partial order planning approach (such as the POP planner we studied in class). Please be brief.

    (a) What is the advantage of specifying partial order among plan steps instead of total order?

    (b) What is the use of recording causal links?

11. Explain the basic idea behind feedback control. Give an example when it is the most appropriate way for a robot to determine what action to perform next. Can you think of some application where both planning and control are necessary?

12. Explore the tree from left to right using the alpha-beta procedure. Assume that the top level is a maximizing level. Cross out all nodes where static evaluation need not occur. Indicate the winning path or paths.

    Of the two copies of the tree, you may use one for rough work and indicate the answer neatly on the other.