

Homework 2

PART I: "Paper-and-pencil exercises"

1. (Ch. 6) Discuss how well the standard approach to game playing would apply to games such as tennis, pool, and croquet, which take place in a continuous physical state space. Include a discussion of how you would discretize the problem and how well that discretization would be expected to work. Consider whether these games can be modeled correctly as turn-taking games, and describe why or why not. Describe whether randomized strategies would be helpful for any of these games, and why or why not.
2. (Ch. 7) Discuss what is meant by *optimal* behavior in the wumpus world. Show that the definition of the PL-WUMPUS-AGENT in Figure 7.19 is not optimal, and suggest ways to improve it.
3. (Ch. 9) Work problem 9.18 a-c (page 318, "Horses are animals...").
4. (Ch. 9) Work problem 9.19 a-g (pages 318 – 319, "Here are two sentences...").
5. (Ch. 11) Work problem 11.4 a-d (pages 412 – 413, "Monkey-and-bananas...").

PART II: "Exercises using LISP code – 'Logic' section"

To invoke LISP, log onto a Unix account and run "clisp". [A Linux version can also be used, but I haven't tested the code under Linux, so you're on your own.] To get help on available commands in clisp, type (help) or :h. To exit, type (exit) or (quit).

- Become familiar with the basics of LISP by stepping through the on-line LISP tutorial found here: <http://grimpeur.tamu.edu/~colin/lp/>. (*Nothing to turn in here.*)
- The rest of this exercise is derived from <http://aima.cs.berkeley.edu/lisp/doc/user.html>, which you should refer to for more information on the LISP software that is available for our text. (Note, unfortunately, that some of these writeups refer to page numbers that are actually from the 1st edition of the text, so they are incorrect for our text. However, you should be able to find the appropriate pages of our 2nd edition text from the context.)

Load the LISP "Logic" software that comes with our text, and run the built-in test function:

- (load "/home/cs594ai/aima/SunOS/aima.lisp")
[If you're using Linux, the command is: (load "/home/cs594ai/Linux/aima.lisp").]
- (aima-load 'logic)
[This will load the code specifically for Part III of the text. Other packages are also available for the other parts of the book, which we'll use at other times. Refer to the above web page for more info if you're interested.]

Study the overview of the "Logic" code, provided here: <http://aima.cs.berkeley.edu/lisp/doc/overview-LOGIC.html>, along with the source code for testing the logic software, which is here – <http://aima.cs.berkeley.edu/lisp/logic/test-logic.lisp> – and can be executed as follows:

- (test 'logic)

Use this output, the source code for this logic testing, as well as the overview of the code, to help you understand how to use the existing Logic code.

(Nothing to turn in here.)

TURN IN THE FOLLOWING for PART II: (All outputs should be generated by provided LISP code, not by hand):

Using the provided LISP code, generate the following outputs, turning in printouts of the actual LISP statements and output:

6. Using the ‘truth-table’ function, verify the last 6 equivalences in Figure 7.11 (page 210).
7. Using the ‘validity’ function, decide whether the sentences in problem 7.8 (page 237) are valid, unsatisfiable, or both.
8. You are given the following statements:

If the unicorn is mythical, then it is immortal, but if it is not mythical, then it is a mortal mammal. If the unicorn is either immortal or a mammal, then it is horned. The unicorn is magical if it is horned.

- a. Use ‘setf’, ‘tell’, and ‘ask’, to generate axioms representing the above statements.

Using your axioms from part 7a, generate answers to the following:

- b. Is the unicorn mythical?
 - c. Is the unicorn magical?
 - d. Is the unicorn horned?
9. Use first-order logic to write axioms describing the following predicates: *Grandchild*, *GreatGrandparent*, *Brother*, *Sister*, *Daughter*, *Son*, *Aunt*, *Uncle*, *BrotherInLaw*, *SisterInLaw*, and *FirstCousin*. Enter these axioms into the provided LISP reasoning system, as well as the facts depicted in the family tree in Figure 8.5 (page 270). Debug your axioms by asking the LISP reasoning system who are Elizabeth’s grandchildren, Diana’s brothers-in-law, and Zara’s great-grandparents. Turn in the definitions of the axioms, as well as the LISP output to the above questions.