STS 350

Final Exam

Name ______________________________

Wednesday, May 9, 4:00 - 6:00 PM
200 pts.

The primary question of this course is "Is cognition computable?" In building our understanding of the question, we have looked at what is computable, and have studied several computational approaches to cognition.

I. Starters.

1. (10 pts.) Descartes started our discussion with the position that such a thing would not be possible. What was his objection?

2. (10 pts.) Alan Turing gave us a response in his "Turing Test". Briefly describe the Turing test and say why it can be considered a response to Descartes.

3. (10 pts.) Briefly describe Marr's three levels of explanation of an information processing system. What has this to do with our efforts this semester?

4. (10 pts.) Our author states his version of our thesis as a commitment to CRUM. What is CRUM, and how does it state the primary issue of cognitive science?

II. What is computation? Several questions.

1. In our study of computation, we began with the programming language LISP.

a. (5 pts.) Write the following in LISP: "if (x > y) then set **z** to 1; otherwise set **z** to 2".

c. (5 pts.) In LISP, write the code to define a function **avg** which will add its two arguments and return the average. For example, (avg 4 6) should **return** (not print) a 3.

2. (10 pts.)

a. What is an **algorithm**?

b. We discovered that computers actually could do a very small number of things. List the five things that a computer can do.

3. (15 pts.) We looked a bit further at computation at the end of the term and studied finite state automata, push-down automata, and the Turing Machine. Please give a detailed (but brief) explanation of each.

4. (15 pts.) Grammars also belong in the notion of computation. Consider the following grammar for simple expressions:

E -> E + T | E - T | T
T -> T * F | T / F | F
F -> x | y | z | (E)

Using this grammar, construct a derivation or a parse tree (your choice) for the expression (x + y) * z

5. (10 pts.) Finally, the Turing-Church thesis gives us a general idea (although one not universally subscribed to) of what computation means. Please say what the Turing-Church thesis is, both formally and informally.

III. Approaches to cognition.

Our study of programming in LISP (and also in CLIPS) together with our study of formal models of computation (FSA's, PDA's, Turing Machines) give us some understanding of what computation means. Returning to our main thesis, we looked at some ways in which cognition could be modeled computationally.

1. (10 pts.) What is artificial intelligence?

2. (10 pts.) We can (informally) divide work in artificial intelligence to symbolic AI and connectionist AI. Briefly describe each point of view and say how they differ.

3. (10 pts.) What is a physical symbol system?

4. (10 pts.) What is the physical symbol system hypothesis? What does it mean?

5. (10 pts.) Symbolic AI is some times equated with knowledge representation + search. Describe two knowledge representation schemes we have studied this term, illustrating your answer with a diagram or an example.

6. (15 pts.) Describe uninformed depth-first search, and the role a heuristic might play.

7. (10 pts.) CLIPS gave us some examples from symbolic AI. Give an example of a rule in CLIPS which checks to see if fire has been detected and which then asserts a new fact that we should alert the fire department if it has. Please be careful in your use of CLIPS syntax. The fact that a fire has been detected and the new fact that we should alert the fire department can be unstructured facts.

8. (10 pts.) Considering the last question, say what a **rule** (also called a **production**) is in a rule-based system.

9. (Let's see if I can get it right this time)

a. (5 pts.) Consider a perceptron with two inputs X and Y in addition to the bias element. Suppose that the weights on the perceptron are as follows: The bias element has weight +1, the X input has weight –2, and the Y element has weight –2. Sketch a picture of this perceptron (as we have been sketching perceptrons in class).

b. (5 pts.) Considering the perceptron of part (b) above, complete the following table: (i.e., say what 'Out' should be for each X and Y input). Do you recognize it?

X	Y	Out
1	1	
1	0	
0	1	
0	0	

(Continuation of the problem on the preceding page)

c. (5 pts.) Finally, associated with each two-input perceptron is a straight line. Write the equation of the line associated with the perceptron in part (b) and give a quick sketch of the graph of the line.