STS 350

Final Exam

Name _____

Wednesday, May 10
4:00 PM
200 pts.

I. The basic argument:

1. (10 pts.) What is Cognitive Science?

2. (10 pts.) Our textbook takes the point of view that what Thagard calls **CRUM** is an appropriate stance for cognitive science to take. What is **CRUM**, and how does it apply to cognitive science?

3. (10 pts.) Descartes had an opinion on this subject in our first reading of the year. What did he have to say about the central issue of cognitive science?

4. (10 pts.) Alan Turing also had a response to the issue and, while he did not address Descartes' concerns directly, he did take issue with his conclusions Descartes came to. What position did he take on the central issue of cognitive science?

5. (10 pts.) As a logician/mathematician, Turing came up with a tongue-in-cheek "test" to see if his position had any substance. Briefly describe this test.

II. Attempts to demonstrate the primary thesis of cognitive science (AI).

Artificial Intelligence is frequently divided into two camps: Symbolic AI (GOFAI) and Connectionist AI. We begin with GOFAI, and since we frequently write that GOFAI = KR (knowledge representation) + Search, we start with KR.

1. (10 pts.) What is a frame? As a part of your answer, use a frame as we have seen it in CLIPS.

2. (10 pts.) The notion of a "script" arose (I believe) in psychology and was taken up by Roger Shank in an effort to understand simple stories. What is a script generally? In computer science?

3. (10 pts.) Frames (and scripts for that matter) are database solutions to the problem of knowledge representation: Logic and semantic networks are two more solutions. Briefly describe IS-A and semantic networks as knowledge representation schemes.

We now consider the second part of the equation GOFAI = KR + search

4. (15 pts.) Give a description of the wine-pouring problem in terms of states and operators. As a part of your answer, describe briefly the appropriate preconditions and postconditions for your operators[1].

[1] The wine-pouring problem consists of three containers: a full 8-cup container, and empty 5-cup and 3-cup containers. The problem is to pour from container into container until we have two containers each containing exactly 4 cups of wine.

5. (15 pts.) In the context of your answer to problem 5 above, briefly describe depth and breadth first search.

7. (10 pts.) Grammars clearly belong in the symbolic approach to AI. 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)

8. (5 pts.) How does a grammar give a response to Descartes?

9. (15 pts.) Finally, symbolic AI is characterized by the physical symbol system hypothesis. What is a physical symbol system, how does it differ from a basic computer, and what is the physical symbol system hypothesis?

When we think about thinking, we may tend to describe our own thinking in terms of symbols and search, but connectionists point out that this is not an appropriate description of the "grey porridge" that is our physical brain.

9. (5 pts.) Briefly describe the connectionist model for computation.

10. Some questions about perceptrons.

    a. (10 pts.) What is a perceptron? As a part of your answer, give an example of a two-input perceptron for some (your choice) logical function (and, or, nand, nor).

b. (5 pts.) Why is it that a single perceptron can not be built to implement the XOR function?

III. Computational issues

1. (5 pts.) What is an algorithm? When we say that a computer is a machine that runs algorithms, what are we saying?

2) (15 pts.) One of the tenets of cognitive science is that we can view cognition in terms of information processing. David Marr gave us a way to view information processing on several levels. In his discussion, Marr presented Chomsky's theory of grammars as an explanation on the level of computational theory. Considering this, suppose that we have a computer and computer program that can pass the Turing Test. Briefly describe Marr's three levels, and say something about the way in which explanations at each level might differ if we are discussing the performances of the computer/computer program and of the human subject (not the interrogator) in the Turing Test .

3. (10 pts.) Give a brief description of a Turing Machine.

4. (10 pts.) When we write programs for a computer, we use a computer language of some sort. In LISP, write a function (using **defun**) for a function which will take three arguments a, b, c and which will return a * (b + c)