Course Description

This course is a study of the use of certain techniques to model intelligence. The techniques consist primarily in the application of logic within the context of an observation-thought-decision-action cycle. A prior course in symbolic logic (PHI 333 or equivalent) is helpful but not required.

At the completion of this course, students will be familiar with the general idea of computation and the idea that thinking is a form of computation, will understand basic aspects of logic programming and its underlying theory, will be familiar with the application of logic programming and some of its variants within the context the agent model of intelligence, will understand basic aspects of the computer language Prolog ("PROgramming in LOGic"), will be familiar with basic aspects of natural language processing, will know some of the experiments in psychology that challenge the use of logic to model human intelligence, and will be familiar with some of the challenges to the logical approach to modeling intelligence generally.

This course satisfies CS (computer/statistics/quantitative applications) in the University Undergraduate General Studies Requirement. This course also satisfies a requirement for the Symbolic Systems Certificate. This certificate is modeled on the program at Stanford, the course of study taken by many influential figures in technology, such as Marissa Mayer (President and CEO of Yahoo!).

Required Books

There are two required books for the course: Robert Kowalski's Computational Logic and Human Thinking: How to be Artificially Intelligent (Cambridge University Press, 2011) and Hector Levesque's Thinking as Computation: A First Course (MIT Press, 2012).

In addition, the authors have made public some of their teaching materials: slides for Thinking as Computation, slides for a shorter and a longer course based on Computational Logic and Human
Thinking, and video lectures (which were recorded at the 22nd International Joint Conference on Artificial Intelligence (IJCAI), Barcelona 2011) for Computational Logic and Human Thinking. These teaching materials are strictly supplementary to the books and my lecture notes.

**Grade for the Course**

The final grade for the course is a function of your grade on 7 assignments. Each assignment (listed below) is worth 14 out of a total of 100 points. There are 2 free points. There is no extra credit. Attendance is not required, but passing the course is unlikely without regular class attendance. Keep your graded assignments. They are your only record of your grades. Incompletes are given only to accommodate serious illnesses and family emergencies, which must be adequately documented.

The final grade for the course uses plus-minus letter grades, A+ to E. This grade is a weighted averaged computed using ASU’s numerical value for the letter grades (A+ = 4.3, A = 4.0, A- = 3.7, B+ = 3.3, B = 3.00, B- = 2.67, C+ = 2.33, C = 2.00, D = 1.00, E = 0).

Here is an example to illustrate how the final grade is computed:

- Assignment #1, A- 14%(3.7) = .518
- Assignment #2, B+ 14%(3.3) = .462
- Assignment #3, B 14%(3.0) = .42
- Assignment #4, A 14%(4.0) = .56
- Assignment #5, B 14%(3.0) = .42
- Assignment #6, B 14%(3.0) = .42
- Assignment #7, B 14%(3.0) = .42
- Free points, A+ 2%(4.3) = .086

In the example, the weighted average sums to 3.306. Relative to ASU’s numerical values for letter grades, 3.306 is closest to B+ (= 3.3). So, in this example, the final grade for the course is B+.

**Lectures and Readings**

Not all the following material is equally important. I highlight the most important points in my lectures and in my lecture notes. This (in addition to the reading in the books) is the material on which you will be graded in your assignments. Use the slides and video as supplementary. It is not necessary to understand every detail of the supplementary material. Some of this material is difficult and appropriate for a more advanced course. The lectures and lecture notes are more understandable than the books, and the books are more understandable than the slides and the video lectures.
UNIT 1:

Thinking is Computation (The Hypothesis in the Course)
- Thinking as Computation 1, 2; slides 1-38.
- Computational Logic and Human Thinking "Introduction," 1; shorter 1-10; video 00:00-12:40; longer 1-33.

Logic and Logic Programming (The Technical Background)
- Thinking as Computation 2; slides 39-55.

Assignment #1

UNIT 2:

Prolog (A Computer Programming Language)

The Psychology of Logic (The Wason Selection Task and The Suppression Task)
- Computational Logic and Human Thinking 2; longer 61-74.

Assignment #2

UNIT 3:

The Fox and the Crow (The Logic Programming/Agent Model)
- Computational Logic and Human Thinking 3, 8; longer 96-108, 157-188.

Assignment #3

UNIT 4:

Negation as Failure (The Suppression Task Revisited)
- Computational Logic and Human Thinking 5, "Appendix A4"; longer 109-130, 247-261.

Assignment #4
UNIT 5:
Prohibitions and Prospective Logic Programming
• Computational Logic and Human Thinking 12.

Abduction and Abductive Logic Programming
• Thinking as Computation 11; slides 314-322.
• Computational Logic and Human Thinking 10, "Appendix A6"; longer 215-228

Assignment #5

UNIT 6:
Understanding Natural Language
• Thinking as Computation 8; slides 188-228.

Assignment #6

UNIT 7:
The Wason Selection Task Revisited
• Computational Logic and Human Thinking 16.

Assignment #7

Contact Information
Thomas A. Blackson
Philosophy Faculty
School of Historical, Philosophical, and Religious Studies
Lattie F. Coor Hall, room 3356
PO Box 874302
Arizona State University
Tempe, AZ. 85287-4302
blackson@asu.edu, tomblackson.com, www.public.asu/~blackson