ARIZONA STATE UNIVERSITY

GENERAL STUDIES COURSE PROPOSAL COVER FORM

Course information:

*Copy and paste **current** course information from Class Search/Course Catalog.*

Academic Unit: Historical, Philosophical and Religious Studies Department: Philosophy

Subject: PHI Number: 319 Title: Philosophy, Computing and Artificial Intelligence Units: 3

Is this a cross-listed course? No
If yes, please identify course(s)

Is this a shared course? Yes If so, list all academic units offering this course: SLS, NCIAS
Course description:

Requested designation: Mathematical Studies–CS

*Note- a **separate** proposal is required for each designation requested*

Eligibility:

Permanent numbered courses must have completed the university's review and approval process.
For the rules governing approval of omnibus courses, contact Phyllis.Lucie@asu.edu or Lauren.Leo@asu.edu.

Submission deadlines dates are as follow:

For Fall 2015 Effective Date: October 9, 2014 For Spring 2016 Effective Date: March 19, 2015

Area(s) proposed course will serve:

A single course may be proposed for more than one core or awareness area. A course may satisfy a core area requirement and more than one awareness area requirements concurrently, but may not satisfy requirements in two core areas simultaneously, even if approved for those areas. With departmental consent, an approved General Studies course may be counted toward both the General Studies requirement and the major program of study.

Checklists for general studies designations:

Complete and attach the appropriate checklist

- Literacy and Critical Inquiry core courses (L)
- Mathematics core courses (MA)
- Computer/statistics/quantitative applications core courses (CS)
- Humanities, Arts and Design core courses (HU)
- Social-Behavioral Sciences core courses (SB)
- Natural Sciences core courses (SQ/SG)
- Cultural Diversity in the United States courses (C)
- Global Awareness courses (G)
- Historical Awareness courses (H)

A complete proposal should include:

- ☒ Signed General Studies Program Course Proposal Cover Form
- ☒ Criteria Checklist for the area
- ☒ Course Catalog description
- ☒ Course Syllabus
- ☒ Copy of Table of Contents from the textbook and list of required readings/books

Respectfully request that proposals are submitted electronically with all files compiled into one PDF. If necessary, a hard copy of the proposal will be accepted.

Contact information:

Name: Cindy Baade Phone: 5-7183

Mail code: 4302 E-mail: cynthia.baade@asu.edu

Department Chair/Director approval: *(Required)*

Chair/Director name (Typed): Matthew J. Garcia Date: 2/3/15

Chair/Director (Signature): Matt Garcia

Arizona State University Criteria Checklist for

MATHEMATICAL STUDIES [CS]

Rationale and Objectives

The **Mathematical Studies** requirement is intended to ensure that students have skill in basic mathematics, can use mathematical analysis in their chosen fields, and can understand how computers can make mathematical analysis more powerful and efficient. The **Mathematical Studies** requirement is completed by satisfying both the **Mathematics [MA]** requirement and the **Computer/Statistics/Quantitative Applications [CS]** requirement explained below.

The **Mathematics [MA]** requirement, which ensures the acquisition of essential skill in basic mathematics, requires the student to complete a course in College Mathematics, College Algebra, or Pre-calculus; or demonstrate a higher level of skill by completing a mathematics course for which a course in the above three categories is a prerequisite.

The **Computer/Statistics/Quantitative Applications [CS]** requirement, which ensures skill in real world problem solving and analysis, requires the student to complete a course that uses some combination of computers, statistics, and/or mathematics.* Computer usage is encouraged but not required in statistics and quantitative applications courses. At a minimum, such courses should include multiple demonstrations of how computers can be used to perform the analyses more efficiently.

*CS does *not* stand for computer science in this context; the "S" stands for statistics. Courses in computer science must meet the criteria stated for CS courses.

Revised April 2014

Proposer: Please complete the following section and attach appropriate documentation.

ASU--[CS] CRITERIA

A COMPUTER/STATISTICS/QUANTITATIVE APPLICATIONS [CS] COURSE MUST SATISFY ONE OF THE FOLLOWING CRITERIA: 1, 2, OR 3

YES	NO		Identify Documentation Submitted
		1. Computer applications*: courses must satisfy both a and b:	
☒	☐	**a.** Course involves the use of computer programming languages or software programs for quantitative analysis, algorithmic design, modeling, simulation, animation, or statistics.	syllabus, table of contents of required books
		b. Course requires students to analyze and implement procedures that are applicable to at least one of the following problem domains **(check those applicable)**:	
☐	☐	i. Spreadsheet analysis, systems analysis and design, and decision support systems.	
☐	☐	ii. Graphic/artistic design using computers.	
☐	☐	iii. Music design using computer software.	
☐	☐	iv. Modeling, making extensive use of computer simulation.	
☐	☐	v. Statistics studies stressing the use of computer software.	
☒	☐	vi. Algorithmic design and computational thinking.	syllabus, table of contents of required books

*The **computer applications** requirement **cannot** be satisfied by a course, the content of which is restricted primarily to word processing or report preparation skills, the study of the social impact of computers, or methodologies to select software packages for specific applications. Courses that emphasize the use of a computer software package are acceptable only if students are required to understand, at an appropriate level, the theoretical principles embodied in the operation of the software and are required to construct, test, and implement procedures that use the software to accomplish tasks in the applicable problem domains. Courses that involve the learning of a computer programming language are acceptable only if they also include a substantial introduction to applications to one of the listed problem domains.

YES	NO		Identify Documentation Submitted
		2. Statistical applications: courses must satisfy **a**, **b**, and **c**.	
☐	☒	**a.** Course has a minimum mathematical prerequisite of College Mathematics, College Algebra, or Pre-calculus, or a course already approved as satisfying the MA requirement.	
		b. The course must be focused principally on developing knowledge in statistical inference and include coverage of all of the following:	
☐	☐	i. Design of a statistical study.	
☐	☐	ii. Summarization and interpretation of data.	
☐	☐	iii. Methods of sampling.	
☐	☐	iv. Standard probability models.	
☐	☐	v. Statistical estimation	
☐	☐	vi. Hypothesis testing.	
☐	☐	vii. Regression or correlation analysis.	
☐	☐	**c.** The course must include multiple demonstrations of how computers can be used to perform statistical analysis more efficiently, if use of computers to carry out the analysis is not required.	

YES	NO		Identify Documentation Submitted
		3. Quantitative applications: courses must satisfy **a, b, and c:**.	
☐	☒	**a.** Course has a minimum mathematical prerequisite of College Mathematics, College Algebra, or Pre-calculus, or a course already approved as satisfying the MA requirement.	
		b. The course must be focused principally on the use of mathematical models in quantitative analysis and decision making. Examples of such models are:	
☐	☐	i. Linear programming.	
☐	☐	ii. Goal programming.	
☐	☐	iii. Integer programming.	
☐	☐	iv. Inventory models.	
☐	☐	v. Decision theory.	
☐	☐	vi. Simulation and Monte Carlo methods.	
☐	☐	vii. Other (explanation must be attached).	
☐	☐	**c.** The course must include multiple demonstrations of how computers can be used to perform the above applications more efficiently, if use of computers is not required by students.	

Course Prefix	Number	Title	General Studies Designation
PHI	319	Philosophy, Computing, and Artificial Intelligence	CS

Explain in detail which student activities correspond to the specific designation criteria. Please use the following organizer to explain how the criteria are being met.

Criteria (from checksheet)	How course meets spirit (contextualize specific examples in next column)	Please provide detailed evidence of how course meets criteria (i.e., where in syllabus)
1a	This course involves the use of Prolog and logic programming to model certain aspects of intelligence within the context of an observation-thought-decision-action cycle	Units 1-7
1bvi	This course requires students to analyze and implement procedures applicable to algorithmic design and computational thinking. Students analyze and implement procedures for observation, forward reasoning, abduction, maintenance goal triggering, backward reasoning, acheivement goal reduction, plan selection, and prohibition. Students analyze the differences between classical negation and negation-as-failure as well as the differences between conclusive and defeasible reasoning more generally. Students also analyze and implement procedures for lexicon building, recognizing grammatical sentences, model building, and determining the truth value of sentences relative to models.	Units 1-7

PHI 319 **Philosophy, Computing and Artificial Intelligence** 3 CS

Philosophical problems surrounding artificial intelligence (AI). Thinking as computation and AI; the ethics, epistemology and metaphysics of computing.

Allow multiple enrollments: No **Primary course component:** Lecture
Repeatable for credit: No **Grading method:** Standard Grading

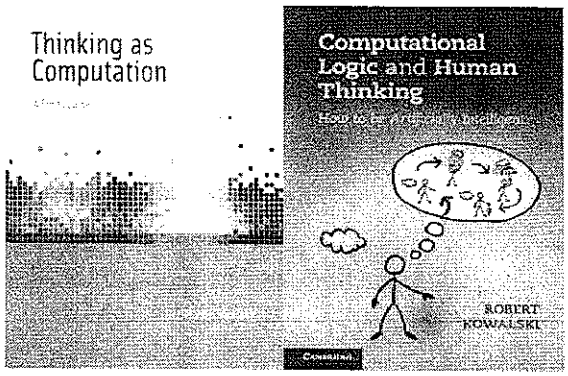
Offered by:

New College of Interdisciplinary Arts and Sciences -- School of Humanities, Arts, and Cultural Studies
Pre-requisites: ENG 102, 105 or 108 with C or better; Minimum 25 hours
College of Letters and Sciences -- College of Letters and Sciences
Pre-requisites: ENG 102, 105 or 108 with C or better; Minimum 25 hours
College of Liberal Arts and Sciences -- Historical, Philosophical & Religious Studies, Sch
Pre-requisites: ENG 102, 105 or 108 with C or better; Minimum 25 hours

Philosophy, Computing, and Artificial Intelligence

PHI 319 (Spring 2015, Session C, 15 Weeks; T,Th 12:00-1:15 Tempe ECG-G227)

Thomas A. Blackson
School of Historical, Philosophical, and Religious Studies
Arizona State University



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.

CS1a
CS1bvi

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: cs 1a 1bvi

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.

• *Computational Logic and Human Thinking* "Appendix A1," "Appendix A2," "Appendix A3," "Appendix A5"; shorter 11-15; video 11:04-18:59; longer 33-60, 75-95, 189-214.

Assignment #1

UNIT 2: cs 1a 1bvi

Prolog (A Computer Programming Language)

• *Thinking as Computation* 3, 4, "Appendix A," "Appendix B," "Appendix C," "Appendix D"; slides 56-97.

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: cs 1a 1bvi

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: cs 1a 1bvi

Negation as Failure (The Suppression Task Revisited)

• *Computational Logic and Human Thinking* 5, "Appendix A4"; longer 109-130, 247-261.

Assignment #4

UNIT 5: CS 1a 1bvi

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: CS 1a 1bvi

Understanding Natural Language

• *Thinking as Computation* 8; slides 188-228.

Assignment #6

UNIT 7: CS 1a 1b vi

The Wason Selection Task Revisited

• *Computational Logic and Human Thinking* 16.

Assignment #7

Contact Information

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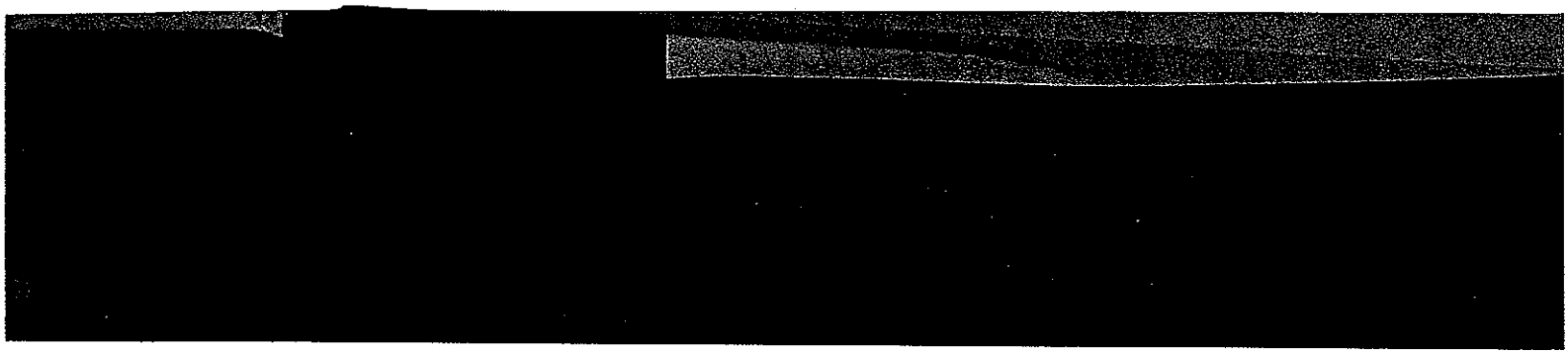
Thinking as Computation

A First Course

Hector J. Levesque

The MIT Press
Cambridge, Massachusetts
London, England



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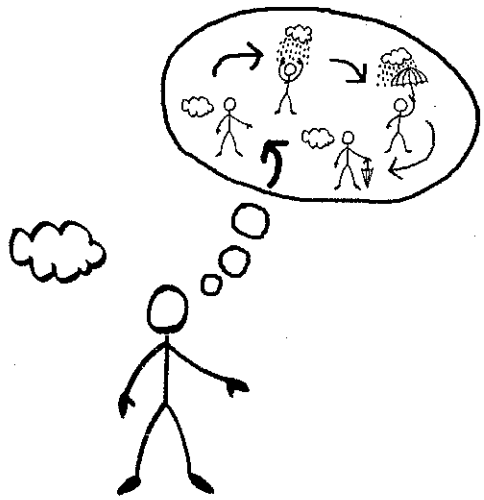
Computational Logic and Human Thinking

How to be Artificially Intelligent

ROBERT KOWALSKI
Imperial College London



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