CSE 4653
Cognitive Science

REQUIRED/ELECTIVE:
Computer Science: Elective
Software Engineering: Elective
Computer Engineering: Elective

CATALOG DATA:
CSE 4653/6653. Cognitive Science. (3) (Prerequisite: CSE 4633/6633 or PSY 4713 or PHI 4143/6143 or AN 4623/6623 or EN 4403/6403). Three hours lecture. The nature of human cognition from an interdisciplinary perspective, primarily utilizing a computational model, including insights from philosophy, psychology, linguistics, artificial intelligence, anthropology, and neuroscience. (Same as PSY 4653/6653).

PREREQUISITE BY TOPIC:
This course is cross-listed with Psychology. To enroll in the course for CSE credit, a student must satisfy the following prerequisites:
1. Intermediate-level programming skills
2. Artificial Intelligence, including introductory-level knowledge of natural language processing approaches, machine learning, and artificial neural networks

TEXTBOOKS AND OTHER REQUIRED MATERIAL:

COORDINATOR:
Julian E. Boggess, Ph.D.

COURSE OBJECTIVES:
Cognitive Science is an interdisciplinary subject which attempts to understand human cognition through the construction of formal models of human information processing. These models represent the brain as if it had many of the characteristics of an electronic computer; in some cases they actually take the form of computer programs which simulate cognitive processes. The goal of this course is to give students a broad overview of the field of Cognitive Science, and to provide them with experience working through some of the implications of looking at cognition as if it were a computational process.

TOPICS COVERED: (Number of class hrs)
1. Introduction: How does science work? What is Cognitive Science? The foundations of cognitive science. The computer as a model. 6
2. Neuroscience in Cognitive Science: Structure and function of the nervous system. Perception and control. Learning and memory. Language. 6
5. Philosophy in Cognitive Science: The philosophy of science. Ontology. Epistemology. Consciousness and free will. 4
solving. Cognitive development.

   Natural language processing. Connectionism.

8. Conclusion: Toward a cognitive science

CONTRIBUTION TO PROFESSIONAL COMPONENT:
   General Education

ASSESSMENTS:
1. Undergraduate students are required to write three 10-page papers on different topics discussed during the semester. Correctness of spelling and grammar are factors included in grading the papers.
2. Students may substitute a laboratory project for one of the required papers. If they choose to do a project, CSE students generally write a program illustrating some concept examined in the course, or simulating some type of cognitive process. Another approach is to try to discuss some area in some field of study in which the concepts studied in class might be applied to improve current practices (such as human-factors engineering). The deliverables for a project include both a written report and an oral presentation to the class.

RELATIONSHIP TO PROGRAM OUTCOMES:
Note: All performance criteria address the ABET outcomes c, d, g, j, CPE outcomes cpe2, cpe3, cpe7, and SE outcomes se2, se7, and se8.
1. Students will know how to analyze cognition in terms of the information processing metaphor.
2. Students will understand the construction of formal models (either symbolic or connectionist) to explain low-level and high-level cognitive processes.
3. Students will show how the cognitive paradigm affects research in the fields of anthropology, sociology, linguistics, psychology, philosophy, and computer science.

PREPARED BY:
Julian Eugene Boggess, III; Associate Professor
Department of Computer Science and Engineering
15 April 2005

ESTIMATE CSAB CATEGORY CONTENT:

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<td>Software Design</td>
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Computer Organization and Architecture
Concepts of Programming Languages

ORAL AND WRITTEN COMMUNICATIONS:
Every student is required to submit at least 3 written reports (not including exams, tests, quizzes, or commented programs) of typically 10 pages and to make 0 oral presentations of typically 0 minutes duration. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.

SOCIAL AND ETHICAL ISSUES:
Students participate in a discussion of the Turing test and Searle’s Chinese Room thought experiment, which leads to a consideration of whether differences exist between artificial and human intelligence, and to what extent ethical issues apply to such artificial entities. We spend about two class periods on these topics. Students are invited, but not required, to include a discussion of these topics in their papers.

THEORETICAL CONTENT:

1. Introduction: How does Science work? What is Cognitive Science? (6 hours)
2. Neuroscience in Cognitive Science (6 hours)
3. Anthropology in Cognitive Science (5 hours)
4. Linguistics in Cognitive Science (6 hours)
5. Philosophy in Cognitive Science (4 hours)
6. Cognitive psychology in Cognitive Science (8 hours)
7. Computer Science: Artificial Intelligence (8 hours)
8. Conclusion: Toward a cognitive science (3 hours)

PROBLEM ANALYSIS:

None.

SOLUTION DESIGN:

None.