CSCI 300 Artificial Intelligence course objectives and outcomes

Course objectives
0a. Show knowledge of facts and concepts
0b. Summarize the semester’s learning
0c. Carry out documented research on AI
0d. Participate in class activities throughout the semester
0e. Solve problems as part of a team
0f. Present results in the classroom
0g. Reflect on reading of text material
1. Explain what cognition is, with reference to biological, computational, and agent models
2. Explain how heuristics offer ways to pursue goals in exponentially large search spaces
3. Describe the representation and use of knowledge in inference-based problem solving by knowledge-based agents
4. Apply probability theory to describe and model agents operating in uncertain environments
5. Describe ways to supervise agents to learn and improve their behavior
6. Explain adaptive learning from the environment
7. Explain the relation between distributed artificial intelligence and self-organized systems
8. Relate theories of mind and the future of AI to ethical issues raised by artificial cognitive systems
9. (Summary) Distinguish stages in the development of artificial-intelligence research and applications

Background concepts
0.1a. Explain basic precalculus concepts*
0.1b. Write the truth table for a propositional-logic formula or logic circuit*
0.2. Design a looping algorithm*
0.3a. Find a shortest path in a graph*
0.3b. Explain the relation between the logarithm function and the heights of trees*
0.4. Explain basic notions of combinatorics*

Topic 1 outcomes
1.1 Describe some concepts or problems in cognitive science
1.2 Describe the computational-representational understanding of mind*
1.3a. Distinguish classes of agent environments
1.3b. Describe a reflex agent within the rational-agent model of AI*
1.4. Contrast connectionist and automata-based models of computation

Topic 2 outcomes
2.1. Explain what constraint and optimization problems are
2.2a. Explain goal-based state-space search*
2.2b. Perform a goal-driven analysis of a problem with a game tree*
2.3. Apply the definition of intractability to a computational problem
2.4. Explain how heuristics are used to provide adequate solutions to hard search problems*

Topic 3 outcomes
3.1. Explain knowledge-based agents*
3.2. Describe methods of representing and using knowledge*
3.3a. Explain a basic concept of logical inference*
3.3b. Use inference in propositional or predicate logic
3.4. Describe how expert systems work

Topic 4 outcomes
4.1. Describe ways to operate under uncertain knowledge*
4.2. Apply probability theory
4.3. Derive belief from evidence using a belief network
4.4a. Describe and construct a Markov model
4.4b. Describe applications of Bayesian reasoning and Markov modeling
4.5. Describe and apply decision theory and bounded rationality*

Topic 5 outcomes
5.1. Explain what learning is*
5.2a. Describe methods of symbol-based supervised learning
5.2b. Apply the decision tree learning method to sample data
5.3a. Describe the connectionist approach to AI*
5.3b. Construct and train a perceptron
5.4. Describe evolutionary computation
5.5. Explain concepts of natural-language processing

Topic 6 outcomes
6.1. Identify problems that require interactive adaptation*
6.2a. Describe methods of reinforcement learning
6.2b. Describe policy search methods in a sample environment
6.3. Explain features of robotic systems*

Topic 7 outcomes
7.1. Describe distributed AI*
7.2a. Relate intelligence to self-organization and emergent behavior*
7.2b. Apply multi-agent concepts in a computer-based solution design or simulation
7.3. Describe features of stigmergy

Topic 8 outcomes
8.1. Explain two theories of mind*
8.2. Evaluate the weak and strong AI theses
8.3. Explain bounded optimality or other proposed architectures
8.4. Discuss ethical issues raised by future prospects for AI*

*core objective