



# AMERICAN COLLEGE

## CSC410 INTRODUCTION TO ARTIFICIAL INTELLIGENCE ECTS Course Syllabus

<b>Code</b> CSC410	<b>Title</b> Introduction To Artificial Intelligence	
<b>ECTS Credits</b> 6	<b>Department</b> Computer Science	<b>Instructor</b> Dr. Gregoris Liasis
<b>Semester</b> Fall	<b>Cycle</b> First	<b>Language of Instruction</b> English

### Description

Introduction to the theory and practice of artificial intelligence including solving problems by searching, adversarial search and games, knowledge and reasoning, knowledge representation, uncertain knowledge and reasoning, machine learning and neural networks, learning probabilistic models, deep learning, probabilistic programming, natural language understanding, multiagent systems and computer vision.

### Learning outcomes

By the end of the course, students are expected to:

- understand full breadth and depth of the field of artificial intelligence (AI)
- describe the latest technologies of the field
- understand the theoretical foundations of AI and problem solving using intelligent agents;
- gain an understanding of the patterns of intelligence as they operate in a world of uncertainty, complexity and change;
- understand adversarial search and games;
- understand the practical exposure to deep learning models for natural language processing
- be able to relate the theoretical foundations of intelligent problem solving with the data structures and algorithms needed for its implementation;
- be able to relate probabilistic programming for advancing machine learning
- be able to identify practical applications of AI; and
- describe search strategies and solve problems by applying a suitable search method

**Prerequisite(s):** CSC202

### Learning methods and educational activities

Lectures, classes, demonstrations and examples, independent and private study.

**Teaching hours:** 39

### Assessment methods and weight

Assignments:	20%
Mid-term examination:	30%
Final Examination:	50%

### Grading system

90-100	<b>A</b>	85-89	<b>B+</b>	80-84	<b>B</b>	75-79	<b>C+</b>
70-74	<b>C</b>	65-69	<b>D+</b>	60-64	<b>D</b>	0-59	<b>F</b>

## Required book(s)

Title:	Artificial Intelligence: A Modern Approach
Author(s):	S. Russell and P. Norvig
Publisher:	Pearson
Edition:	4th
Year:	2021

## Content

<b>Week 1</b>	<b>Introduction:</b> What Is AI; The Foundations of Artificial Intelligence; The History of Artificial Intelligence; The State of the Art; Risks and Benefits of AI; <b>Intelligent Agents:</b> Agents and Environments; Good Behavior: The Concept of Rationality; The Nature of Environments; The Structure of Agents.
<b>Week 2</b>	<b>Problem Solving: Solving Problems by Searching:</b> Problem-Solving Agents; Example Problems; Search Algorithms; Uninformed Search Strategies; Informed (Heuristic) Search Strategies; Heuristic Functions; <b>Search in Complex Environments:</b> Local Search and Optimization Problems; Local Search in Continuous Spaces; Search with Nondeterministic Actions; Search in Partially Observable Environments; Online Search Agents and Unknown Environments
<b>Week 3</b>	<b>Adversarial Search and Games:</b> Game Theory; Optimal Decisions in Games; Heuristic Alpha-Beta Tree Search; Monte Carlo Tree Search; Stochastic Games; Partially Observable Games; Limitations of Game Search Algorithms;
<b>Week 4</b>	<b>Knowledge and Reasoning: Logical Agents:</b> Knowledge-Based Agents; The Wumpus World; Logic; Propositional Logic: A Very Simple Logic; Propositional Theorem Proving; Effective Propositional Model Checking; Agents Based on Propositional Logic; <b>First-Order Logic:</b> Representation Revisited; Syntax and Semantics of First-Order Logic; Using First-Order Logic; Knowledge Engineering in First-Order Logic;
<b>Week 5</b>	<b>Knowledge Representation:</b> Ontological Engineering; Categories and Objects; Events; Mental Objects and Modal Logic; Reasoning Systems for Categories; Reasoning with Default Information;
<b>Week 6</b>	<b>Uncertain Knowledge and Reasoning: Probabilistic Reasoning:</b> Representing Knowledge in an Uncertain Domain; The Semantics of Bayesian Networks; Exact Inference in Bayesian Networks; Approximate Inference for Bayesian Networks; Causal Networks;
<b>Week 7</b>	<b>Probabilistic Programming:</b> Relational Probability Models; Open-Universe Probability Models; Keeping Track of a Complex World; Programs as Probability Models; <b>Making Simple Decisions:</b> Combining Beliefs and Desires under Uncertainty; The Basis of Utility Theory; Utility Functions; Multiattribute Utility Functions; Decision Networks; The Value of Information; Unknown Preferences;
<b>Week 8</b>	<b>Revision for Mid-term Examination; Mid-term Examination.</b>
<b>Week 9</b>	<b>Learning: Multiagent Decision Making:</b> Properties of Multiagent Environments; Non-Cooperative Game Theory; Cooperative Game Theory; Making Collective Decisions; <b>Learning from Examples:</b> Forms of Learning; Supervised Learning; Learning Decision Trees; Model Selection and Optimization; The Theory of Learning; Linear Regression and Classification; Nonparametric Models; Ensemble Learning; Developing Machine Learning Systems
<b>Week 10</b>	<b>Learning Probabilistic Models:</b> Statistical Learning; Learning with Complete Data; Learning with Hidden Variables: The EM Algorithm; <b>Deep Learning:</b> Simple Feedforward Networks; Mixing and matching models, loss functions and optimizers; Loss functions; Models; Optimization Algorithms; Generalization; Recurrent neural networks; Unsupervised, semi-supervised and transfer learning; Applications.
<b>Week 11</b>	<b>Communicating, Perceiving, and Acting: Natural Language Processing:</b> Language Models; Grammar; Parsing; Augmented Grammars; Complications of Real Natural Language; Natural Language Tasks.

<b>Week 12</b>	<b>Deep Learning for Natural Language Processing:</b> Limitations of Feature-Based NLP Models Word Embeddings; Recurrent Neural Networks; Sequence-to-sequence Models; The Transformer Architecture; Pretraining and Transfer Learning; Introduction; Image Formation; Simple Image Features; Classifying Images; Detecting Objects; The 3D World; Using Computer Vision;
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<b>Week 13</b>	<b>Revision for Final Examination.</b>
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## Student workload

Activity	Hours
Class attendance	36
Independent Study	31
Test Preparation	15
Test	1,5
Mid-term Preparation	20
Mid-term Examination	1,5
Project Preparation	18
Final Exam Preparation	25
Final Examination	2
<b>Total</b>	<b>150</b>