# National University of Computer & Emerging Sciences, Karachi Spring-2020 CS-Department

**CS 401 – Artificial Intelligence**

**Credits Hours:** 3

**Instructor:** Dr Fahad Sherwani/ Saeeda Kanwal / Nida Pervaiz

# Course Description

Artificial Intelligence is a core course in Computer Science curriculum. It mainly focuses on the study of how to realize the intelligent human behaviors on a computer. The ultimate goal of AI is to make a computer that can learn, plan, and solve problems autonomously. In this course, we will study the most fundamental knowledge for understanding AI. We will introduce some basic search algorithms for problem solving; knowledge representation and reasoning; pattern recognition; fuzzy logic; supervised learning and unsupervised learning.

# Course Objectives

1. The main purpose of this course is to provide the most fundamental knowledge to the students so that they can understand what the AI is.
2. To study the tradeoff choices in the design and implementation of different models.
3. To provide a rigorous “hands-on” experience with implementing different models on multiple datasets
4. To analyze time/space tradeoff for different solutions to the same problem.

# Learning Outcomes

1. Student will be able to learn and understand the core concept of AI.
2. Students will be able to understand how different analysis within various domains are done.
3. A concept of machine learning will be given so that they can analyze different real world problems.
4. A variety of supervised and unsupervised learning approaches will enable them to understand why specific models are chosen while considering some examples from real world.

# Programming Assignments

There will be 3 programming assignments for the course. No plagiarism is acceptable in these submissions.

**Course Project**

Project is included within the course where the students need to use any domain of AI and incorporate into some dataset using particular models. Image analysis, supervised and unsupervised learning, classification etc are the areas where they will work on.

# Quizzes

There will be n quizzes and the best n-1 will be counted towards grading.

# Course Outline

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| **Week** | **Topics** |
| 1-2 | **Fundamentals of AI and Design of Rational Agents**  Introduction, Foundations and State of the Art. Agents and Environments, Rationality and Structure |
| 3-4 | **Solving Problems by Searching**  Problem-Solving agents and example problems, Solution finding using Uninformed search techniques (Breadth-first, Uniform-cost, Depth-first**, Depth-limited, Iterative deepening depth-first, Bidirectional**) and Informed (Heuristic) search techniques (Greedy best-first and A\*). Proof of A\*. |
| 5 | **Optimization Problems and Local Search**  Hill-climbing search, simulated annealing**,** local beam search, genetic algorithms |
| 6 | **MID TERM 1** |
| 7 | **Games and Adversarial Search**  Optimal decision in games. Minimax algorithm. Alpha-Beta Pruning. |
| 8 | **Constraint Satisfaction Problems (CSPs)**  Definition. Examples: Map coloring, Job-shop scheduling. Variations of CSPs. Inference. Backtracking and Local search for CSPs. Intelligent backtracking. Exclude: Structure of CSPs |
| 9 | **Knowledge based agents**  Logic. Propositional Logic. Syntax, Semantics, Inference. Proofs. Horn clauses and definite clauses. Forward and Backward chaining. |
| 10 | **MID TERM II** |
| 11-12 | **Uncertainty**  Acting under uncertainty. Summarizing uncertainty. Basic probability notation and semantics. Probability axioms. Inference using Full-Joint distributions. Bayes’ Rule and its use. Examples of using Bayes’ rule. Intro of Bayesian Network with CPT |
| 13-15 | **Learning**  Supervised learning- learning trees, evaluating and choosing best hypothesis |

**Text Book:**

* 1. Artificial Intelligence: A Modern Approach (3rd Edition), Stuart Russell and Peter Norvig

# Marks Distribution

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|  |  |  |  |
| Assignments | 20% |  |  |
| Quizzes | 10% |  |  |
| Mid Exam | 15% |  |  |
| Class Participation | 05% |  |  |
| Project  Final Exam 40% | 10% |  |  |
| **Total** | **100** |  |  |