# Advanced Artificial Intelligence
# CS 901770

**Instructor:** Dr. Faisal S. Al-Saqqar
**Office Hours: Monday and Wednesday** 14:00-15:00, or by appointment.
**Class Times: Sunday, Tuesday** 14:00 - 17:00.
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## Introduction:

The primary goal of Artificial Intelligence is to build computer systems to solve problems that are hard for typical computer systems to solve, but easy for people. Because of this, emphasis will be placed on the simulation of human intelligence. General problem solving techniques will be studied for the greater part of the course. These will then be extrapolated to show their relevance to specific sub-areas of the discipline.

## Objectives:

At the end of this course, students should have:

- Further developed efficient strategies for learning.
- Gained an appreciation of Artificial Intelligence (AI) as a sub-area of computer science.
- Understood the importance of knowledge to the problem-solving process and the difficulties associated with the acquisition of this knowledge.
- Appreciated the need to have various knowledge representation methods to suit particular types of problems.
- Been able to identify the knowledge representation method for a particular problem definition.
- A relatively in depth knowledge of two other sub-fields of AI (including Neural Networks and Genetic Algorithms).
- An appreciation of the need for AI in real world situation.

## Texts:
### Required References:

1. Stuart Russell and Peter Norvig, ***Artificial Intelligence: A Modern Approach***, 3rd edition, 2009., Prentice-Hall.
2. George F. Luger & William A. Stubblefield. ***Artificial Intelligence, Structures and Strategies for Complex problem Solving*** Fifth edition, Addison Wesley, 2005.
3. Christel Baier and Joost-Pieter Katoen, ***Principles of Model Checking***, The MIT Press, Cambridge, Massachusette, London – England, 2007.

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# Grading

There will be one midterm and one final. The midterm will be in class, and the final will be on the officially scheduled date. No makeups will be given.

- Midterm Exam. 30%
- Research Paper and Project: 30%
- Final exam: 40%

In order to pass the course, students are required to pass **all** exams and the coursework.

The due date for an assignment will be the last date that it will be accepted on. It will NOT be accepted late works (which should be obtained several days before the assignment's due date). All coursework (except the test) can be done in groups of 2.

**Provisional Course Outline:** (not necessarily in the order in which they will be covered).

| Tentative Topics | Readings |
| --- | --- |
| Introduction, Overview | R&N - Chpt 1, 2 |
| Expert Systems Organization, tools, limits, examples Genetic Algorithms Game Playing | R&N – Chpt 6 |
| Knowledge Representation Logical Agents | R&N - Chpt 7 (through 7.5) |
| Knowledge Representation First-Order Logic | R&N - Chpt 8 (through 8.3) |
| Inference in First Order Logic | R&N - Chpt 9 (through p. 278; 9.5) |
| Classical Planning | R&N - Chpt 10 (through p. 324; 10.3) |
| Planning and Acting in the Real World | R&N - Chpt 11 (through 11.4) |
| Learning | R&N - Chpt 18 (through 18.4) |
| Quantifying Uncertainty | R&N - Chpt 13 |
| Probabilistic Reasoning | R&N - Chpt 14 (through p. 506) |
| Hierarchical Planning | R&N - Chpt 12.2 |
| Version Space Learning | R&N - Chpt 19 (through 19.1) |
| Neural Networks | R&N - Chpt 20.5 |
| Decision Making | R&N - Chpt 16 |

## Research paper and project

You will write one research paper or project during the semester. This paper or project will give you an opportunity to explore a topic in some detail and to go through the process of preparing a research document. Writing is an indispensable skill for any computing professional. I hope that you will use this paper or project as an opportunity to improve your professional writing skills.

The presentation project will be organized as follows.

- Your group chooses a topic from a list of possible topics given by me, or your group comes with some new topics with my approval. Then you start to do some research on the topic: surfing the web, going to the library and so on. Then your group writes a presentation report about the topics. The report will be a 10 to 15 pages research paper. The paper should be in postscript, PDF, or html format. Typically, your report might be organized as follows:

  1. **Abstract**     *--- summarize what your research project did*
  2. **Introduction**    *--- background information, literature search, scope and limitations of project*
  3. **Body**      *--- methods used*
  4. **Analysis and conclusions**
  5. **Recommendations**    *--- future work, unsolved problems*
  6. **References**    *--- journals, WWW references*
- Your group presents your result in the class. Your group will have about 25 minutes to present your report. Each group should have at least one student presenting the report.

## Course Policies

I try to accommodate student needs whenever possible, but I can only do so if I know about them.

My regularly-scheduled office hours are times when I am committed to provide assistance to you. No matter how busy I may appear when you arrive; the office hours are for you. You are welcome -- and *encouraged* -- to make use of that time. I am also available by appointment at other times if you cannot make an office hour.

I encourage you to work together on homework assignments, to help you understand the problems and to encounter different points of view. However, **any work you submit must be your own**. Discuss ideas, but write your own answers. You should acknowledge any collaboration in the work you submit. Undocumented or unacceptable collaboration will be considered forms of academic dishonesty.