STUDY COMPONENT

I. OBJECTIVES

This course presents an introduction to certain core concepts of Artificial Intelligence (AI). AI has grown tremendously during the past five decades; the goal of the current course is to explore some of the fundamental concepts that underlie this edifice, rather than to give broad coverage of all the ideas encompassed therein.

In particular, the course will focus on "classical AI", which uses concepts of knowledge representation and logic to solve problems of an essentially deterministic nature. Thus, students will learn how to develop intelligent agents that operate in a fairly static, predictable environment.

A brief introduction to reasoning under uncertainty will also be provided, but more advanced topics such as learning, as well as an understanding of probabilistic systems and applications (such as speech and language processing or robotics) fall outside the scope of this course.

II. TOPICS, LEARNING OUTCOMES AND CRITERIA OF ASSESSMENT

1: Introduction

Learning outcomes

At the end of this study theme, the student will have knowledge and understanding of:
1.1.The definition of AI
1.2.The history of AI
1.3.The current state of the art.

Criteria of assessment

Upon successful completion of this theme, the student should be able to:

- Describe the differences between definitions of AI based on human-like behaviour and rationality;
- Give an overview of how fields such as philosophy, neuroscience and mathematics have influenced the development of AI;
- Summarize the historical development of AI;
- Distinguish between tasks that are currently feasible with AI, and those that are still science fiction.

2: Intelligent agents

Learning outcomes

At the end of this study theme, the student will have knowledge and understanding of:
2.1. Rational agents
2.1. The relationship between agents and the environment in which they operate

2.3 The structure of agents

Criteria of assessment

Upon successful completion of this theme, the student should be able to:
- Define performance measures for agent behaviour;
- List the properties of an agent's environment that influence its performance;
- Give a modular breakdown of a typical agent architecture, and assign performance measures to the relevant modules.

3: Propositional logic

Learning outcomes

At the end of this study theme, the student will have knowledge and understanding of:
3.1 The use of knowledge by agents
3.2 Propositional logic and its use in knowledge representation
3.3 Reasoning (inference) with propositional logic

Criteria of assessment

Upon successful completion of this theme, the student should be able to:
- Explain the syntax and semantics of knowledge bases represented in propositional logic;
- Design a system that represents an appropriate target domain using propositional logic;
- Implement the basic inference algorithms for propositional logic: resolution, forward chaining and backward chaining

4. Uncertain Knowledge and Reasoning

Learning outcomes

At the end of this study theme, the student will have knowledge and understanding of:
4.1 Probabilistic modelling of uncertainty
4.2 Probabilistic inference
4.3 Bayes' rule

Criteria of assessment

Upon successful completion of this theme, the student should be able to:
- List and motivate the axioms of probability;
- Compute statistical inferences based on joint probability distributions as well as independence assumptions;
- Use Bayes' rule to combine evidence and prior knowledge

5. Planning and Acting in the Real World

Learning outcomes

At the end of this study theme the student will have knowledge and understanding of:
5.1 Planning graphs and planning with propositional logic
5.2 Scheduling with resource constraints
5.3 Planning and acting in nondeterministic domains

Criteria of assessment

Upon successful completion of this theme, the student should be able to:

- Define a problem in terms of the actions for achievement of a final goal;
- Fulfil a plan by scheduling multiple tasks under time and other constraints;
- Define agents as being *part of the way through* executing a plan

ORGANISATIONAL COMPONENT

1. GENERAL PREMISE AND EDUCATIONAL APPROACH

The study of Intelligent Systems provides numerous opportunities for expanding our human intelligence: we can learn about software engineering, mathematics, logic, control systems, and the like, but also about neurobiology, linguistics, philosophy and psychology. This course is intended to give students a strong basis in the core topics of Artificial Intelligence, and to encourage the exploration of related topics that they find interesting.

To accomplish these goals, the course will rely on self-directed learning by all students. Students will have the opportunity for self-study, collaborate with one another, participate in discussion groups, and perform practical work on projects envisioned by them that shall be aligned with their research interests.

2. LECTURER: Prof. Mihaela Ulieru

Consulting hours in room H 212: Monday 2:30-3:30PM and Friday 2:30 to 4:30PM

3. STUDY MATERIALS

Textbook
S. Russell and P. Norvig, *Artificial Intelligence: A Modern Approach* (second edition), Prentice Hall, 2003

All the lecturing and lab materials as well as the assignments will be available on the course website: http://www.cs.unb.ca/~ulieru/Teaching/Teaching_index.htm

4. LEARNING ACTIVITIES

4.1 Contact time and learning hours

Number of lecture / discussion classes per week: Three lectures per week (as per official timetable)
Practical work: One Lab every two weeks. In addition to the class exercises and assignments students will be introduced to an agent-oriented programming language (Brahms) through progressive Lab assignments. A final project will require students to demonstrate they understood the major concepts related to agent design and development. Some implementation in Brahms of one or more agent modules of their choice will back the proof of their acquired skills.

4.2 Lectures / discussions

At the start of each lecture session the lecturer will provide an overview of the relevant study material and provide students with the opportunity to ask questions. Thereafter, the subject will be exposed in

an interactive manner, practical exercises related to the study theme will be assigned to groups and findings will be shared among groups followed by concluding remarks from the lecturer.

4.3 Assignments and projects

Lectures will be interactive as much as possible, the lecturer will ask questions stimulating student participation with the main purpose to facilitate learning. Each topic will be backed by assignments to give students the opportunity to creatively deepen their knowledge of the subject.

One project will be created by students with lecturer guidance. Students can choose to work alone or in a team of max four on a project. Schedule:

- Project definition due at the end of February (date will be specified in consultation with the students);
- The final project (due before April 15 – with a presentation at class and Demo at the last Lab) will explore the planning and acting in the real world topics with emphasis on the BDI architectural concepts introduced at the Lab using Brahms.

5. RULES OF ASSESSMENT

Calculation of the final mark

- Class participation: 5%
- Class Assignments: 20%
- Lab Assignments: 30% [Lab will run every two weeks starting January 14. Please note that participation at every Lab is absolutely mandatory! If you have to miss a Lab please inform the lecturer before. Lab rescheduling will be acceptable only in case of extenuating circumstances.]
- Project – 45% [Project definition: 15%; Project presentation at class: 10%; Project Demo at the Lab: 20%]

6. GENERAL

Grievance procedures

If you have any problems with this subject, please inform the lecturer so that they can be acted on as soon as possible. If you do not feel like talking to the lecturer, you may ask the class representative (this will be assigned at first class) to see the lecturer on your behalf or to raise the problem at the next class representative meeting.

The formal grievance regulations for reviewing grades of grad students are on page 20 (Section 24) of the Graduate Calendar Regulations.

Plagiarism warning

The regulations on plagiarism are those in the undergrad calendar, at
http://eservices.unb.ca/calendar/undergraduate/display.cgi?tables=regulations&id=10
They also appear on page 29 (and Section 29) of the Graduate Calendar Regulations. Please follow these regulations ***strictly***!