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**STUDY COMPONENT**

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**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

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## **ORGANISATIONAL COMPONENT**

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### **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: flexible – as per students needs (students shall contact Prof. Ulieru via email to make appointment – [Ulieru@unb.ca](mailto:Ulieru@unb.ca)) Tel. 4587277**

### **3. STUDY MATERIALS**

#### **Textbook**

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

All the lecturing materials (.ppt files and research articles) will be distributed to the students via email

### **4. LEARNING ACTIVITIES**

#### **4.1 Contact time and learning hours**

Number of lecture / discussion classes per week: Two lectures per week (as per official timetable)  
Practical work: Class exercises and assignments as well as two projects on major AI topics.

## **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**

There will be in class group exercises (at each class) – 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.

Two projects – related to the student graduate work - will be created by students with lecturer guidance:

- The first project will be on knowledge and reasoning – with emphasis on knowledge representation (due November 11);
- The final project will explore the planning and acting in the real world topics with emphasis on cooperation / coordination and respectively competition mechanisms (due, with presentation at last class).

## **5. RULES OF ASSESSMENT**

### **Calculation of the final mark**

- In class exercises (participation, willingness to go the extra mile to creatively explore the issue at hand) - 20%
- Assignments – 30%
- Each Project – 25%

## **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*!