INSTITUTO POLITÉCNICO NACIONAL

SECRETARÍA ACADÉMICA

DIRECCIÓN DE EDUCACIÓN SUPERIOR

SYNTHESIZED SCHOOL PROGRAM

ACADEMIC UNIT: Escuela Superior de Cómputo

ACADEMIC PROGRAM: Ingeniería en Sistemas Computacionales

LEARNING UNIT: Artificial Intelligence **LEVEL:** III

AIM OF THE LEARNING UNIT:
The student develops applications based on artificial intelligence techniques.

CONTENTS:
  I.   Introduction to artificial intelligence
  II. Tree searching
  III. Knowledge representation
  IV. Machine learning

TEACHING PRINCIPLES:
This unit will be addressed using the project-oriented learning strategy and the heuristic method, therefore, the student will carry out activities that will guide the development of skills of abstraction, analysis and design of efficient algorithms, using artificial intelligence techniques, implementing computer programs that demonstrate the concepts of the learning unit. The activities to be carried out in class, these will encourage in students some techniques, such as: collaborative and participatory work, brainstorming, graphic organizers, documentary research, worksheets, exposition of complementary topics, led discussion and implement a software project. It is the responsibility of the teacher to decide the features of the project and the developed programs, setting the time for preparation and delivery.

EVALUATION AND PASSING REQUIREMENTS:
This learning unit will be evaluated from the project portfolio, which is formed of: formative and summative, evaluation, self-evaluation and cooperative evaluation rubrics.

Other means to approve this learning unit:
  • Evaluation of previously acquired knowledge, based on the guidelines established by the academy..
  • Accreditation in another academic unit of the IPN or other national or international educational institution. in addition to the IPN.

REFERENCES:
  • Araujo, L. Cervigon, C. (2009). *Algoritmos Evolutivos, Un Enfoque Práctico*. Spain. Ed. Alfaomega. ISBN 978-84-7897-911-0.

  • Isasi, P. Galván, I. (2004). *Redes de Neuronas Artificiales, Un enfoque Práctico*. Spain. Ed. Pearson Education. ISBN 978-84-2054-025-2.

  • Pajares, M. Sanz G, De La Cruz, J. (2010). *Aprendizaje Automático Un Enfoque Práctico*. Spain. Ed. Alfaomega. ISBN 978-84-9964-011-2.

  • Ponce, P. (2010). I*nteligencia Artificial con Aplicaciones a la Ingeniería*. Mexico. Ed. Alfaomega. ISBN 978-607-7854-83-8.

  • Russell, S. Norvig P. (2009., *Artificial Intelligence: A Modern Approach (3rd Ed.),* USA. Ed. Prentice Hall. ISBN 978-01-3604-259-4.

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SECRETARÍA ACADÉMICA

DIRECCIÓN DE EDUCACIÓN SUPERIOR

SYNTHESIZED SCHOOL PROGRAM

ACADEMIC UNIT: Escuela Superior de Cómputo.
ACADEMIC PROGRAM: Ingeniería en Sistemas Computacionales
LATERAL OUTPUT: Analista Programador de Sistemas de Información.
FORMATION AREA: Professional.
MODALITY: Presence.

LEARNING UNIT: Artificial Intelligence
TYPE OF LEARNING UNIT: Theorical - Practical, Optative.
VALIDITY: August, 2011
LEVEL: |||.
CREDITS: 7.5 Tepic, 4.39 SATCA

ACADEMIC AIM

This learning unit contributes to the output profile of the Engineer in Computer Systems, to develop the skills of analysis, design, implementation and evaluation of intelligent systems, also developed strategic thinking, creative thinking, collaborative and participative work and assertive communication.

Requirements: Discrete Mathematics, ability to demonstrate the validity of arguments by rules of formal logic, from Algorithms and Structured Programming and Object Oriented Programming, the ability to program solutions in a high-level language, from Data structure, use of appropriate structures to manipulate data efficiently.

AIM OF THE LEARNING UNIT:

The student develops applications based on artificial intelligence techniques.

CREDITS HOURS	LEARNING UNIT DESIGNED BY: Academia de Ingeniería de Software.	AUTHORIZED BY: Comisión de Programas Académicos del Consejo General Consultivo del IPN
THEORETICAL CREDITS / WEEK: 3.0		
PRACTICAL CREDITS / WEEK: 1.5	**REVISED BY:** **Dr. Flavio Arturo Sánchez Garfias.** **Subdirección Académica**	
THEORETICAL HOURS / SEMESTER: 54		
PRACTICAL HOURS / SEMESTER: 27		**Ing. Rodrigo de Jesús Serrano Domínguez**
AUTONOMOUS LEARNING HOURS: 54	**APPROVED BY:** **Ing. Apolinar Francisco Cruz Lázaro.** **Presidente del CTCE**	**Secretario Técnico de la Comisión de Programas Académicos**
CREDITS HOURS / SEMESTER: 81		

THEMATIC UNIT: I **TITLE:** Introduction to artificial intelligence.

UNIT OF COMPETENCE

The student explains artificial intelligence concepts based on intelligent agents.

No.	CONTENTS	Teacher led-instruction HOURS		Autonomous Learning HOURS		REFERENCES KEY
		T	P	T	P	
1.1	Introduction to artificial intelligence					5B, 4C
1.1.1	What is artificial intelligence?	0.5		0.5		
1.1.2	Fundamentals of artificial intelligence	0.5		0.5		
1.1.3	Applications and prospects of artificial intelligence	0.5		0.5		
1.2	Intelligent agents					
1.2.1	Definitions of intelligent agents	0.5		0.5		
1.2.2	Environment and structure of an agent	0.5		0.5		
1.2.3	Classification of intelligent agents	0.5		0.5		
1.2.3	Building intelligent agents	1.0	0.5	0.5	1.0	
	Subtotals:	4.0	0.5	3.5	1.0	

TEACHING PRINCIPLES

Framing course and the team building.
This unit will address the strategy of project-oriented learning and heuristics, enabling the consolidation of the following learning techniques: brainstorming worksheet, documentary research, led discussion, concept mapping, project protocol and practicals.

LEARNING EVALUATION

Diagnostic test
Project portfolio:
Reporting practicals   30%
Worksheet   5%
Concept map   5%
Project protocol   20%
Self-evaluation rubrics   5%
Cooperative evaluation rubrics   5%
Written evidence of learning   30%

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THEMATIC UNIT: II | **TITLE:** Tree searching

UNIT OF COMPETENCE
The student implements algorithms based on the different tree search techniques.

No.	CONTENTS	Teacher led-instruction HOURS		Autonomous Learning HOURS		REFERENCES KEY
		T	P	T	P	
2.1	Problems and search spaces	1.0	0.5	0.5	1.0	5B
2.2	Uninformed search algorithms					
2.2.1	Breadth-first search	0.5		0.5		
2.2.2	Depth-first search	0.5		0.5		
2.2.3	Comparison of search algorithms	0.5	0.5	0.5	1.5	
2.3	Informed search algorithms					
2.3.1	What is heuristic?	0.5		0.5		
2.3.2	Hill climbing search	0.5		0.5		
2.3.3	Best-first search	0.5		0.5		
2.3.4	A* Search	0.5	0.5	0.5	1.5	
2.4	Adversarial search					
2.4.1	MiniMax algorithm	0.5		0.5		
2.4.2	Alpha-beta pruning	0.5	0.5	0.5	1.5	
	Subtotals:	5.5	2.0	5.0	5.5	

TEACHING PRINCIPLES
This unit will address the strategy of project-oriented learning and heuristics, enabling the consolidation of the following learning techniques: brainstorming worksheet, documentary research, led discussion, concept mapping, project implementation and practicals.

LEARNING EVALUATION

Project portfolio:
Reporting practicals	30%
Worksheet	5%
Concept Map	5%
Advance of Project	20%
Self-evaluation rubrics	5%
Cooperative evaluation rubrics	5%
Written evidence of learning	30%

THEMATIC UNIT: III				**TITLE:** Knowledge representation

UNIT OF COMPETENCE

The student builds knowledge representation systems based on various modeling techniques.

No.	CONTENTS	Teacher led-instruction HOURS		Autonomous Learning HOURS		REFERENCES KEY
		T	P	T	P	
3.1 3.1.1	Knowledge-Based Systems Knowledge and its representation	0.5		0.5		5B
3.1 3.2.1 3.2.2 3.2.3 3.2.4	Propositional logic Syntax and semantics, validity, satisfiability Logical equivalence, logical consequence Laws of propositional logic Logical Reasoning	1.0 0.5 0.5 0.5		0.5 0.5 0.5 0.5		
3.2 3.3.1 3.3.2 3.3.3	First-order logic The language of predicate logic Normal Forms Resolution	1.0 1.0 1.0	0.5	0.5 0.5 1.5	2.5	
3.4 3.4.1 3.4.2 3.4.3 3.4.4	Knowledge representation Inference Rules Forward and backward chaining Semantic networks and frames Ontologies	1.0 1.0 1.0 1.0	0.5 0.5	0.5 0.5 0.5 1.5	2.5 2.5	
	Subtotals:	10.0	1.5	8.0	7.5	

TEACHING PRINCIPLES

This unit will address the strategy of project-oriented learning and heuristics, enabling the consolidation of the following learning techniques: brainstorming worksheet, documentary research, led discussion, concept mapping, project implementation and practicals.

LEARNING EVALUATION

Project portfolio:
Reporting practicals	30%
Worksheet	5%
Concept Map	5%
Advance of Project	20%
Self-evaluation rubrics	5%
Cooperative evaluation rubrics	5%
Written evidence of learning	30%

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DIRECCIÓN DE EDUCACIÓN SUPERIOR

THEMATIC UNIT: IV	**TITLE:** Machine learning

UNIT OF COMPETENCE
The student builds intelligent systems based on different machine learning techniques and approaches.

No.	CONTENTS	Teacher led-instruction HOURS		Autonomous Learning HOURS		REFERENCES KEY
		T	P	T	P	
4.1	Introduction to Machine Learning					1B,2B,3B,4C,4B
4.1.1	Concepts and basics	0.5		0.5		
4.2	Decision-tree learning					
4.2.1	Decision-tree representation	1.0		0.5		
4.2.2	Learning algorithms					
4.2.2.1	ID3	0.5		0.5		
4.2.2.2	C4.5	0.5	0.5	0.5	2.5	
4.3	Learning neural networks					
4.3.1	Introduction to Neural Networks	1.0		0.5		
4.3.2	Perceptron, multilayer networks, BAM, Hopfield	0.5		0.5		
4.3.3	Training algorithms	1.0		1.0		
4.3.4	Applications	1.0	0.5	0.5	2.5	
4.4	Genetic algorithms					
4.4.1	Introduction	0.5		0.5		
4.4.2	Elements, operators, parameters	0.5		1.0		
4.4.3	Applications	1.0	0.5	0.5	2.5	
4.5	Other types of learning					
4.5.1	Bayesian Learning	0.5		1.0		
4.5.2	Hidden Markov Models	1.0		1.0		
	Subtotals:	9.5	1.5	8.5	7.5	

TEACHING PRINCIPLES

This unit will address the strategy of project-oriented learning and heuristics, enabling the consolidation of the following learning techniques: brainstorming worksheet, documentary research, led discussion, concept mapping, project implementation and practicals.

LEARNING EVALUATION

Project portfolio:
Reporting practicals	30%
Worksheet	5%
Concept Map	5%
Project Report	50%
Self-evaluation rubrics	5%
Cooperative evaluation rubrics	5%

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RECORD OF PRACTICALS

No.	NAME OF THE PRACTICAL	THEMATIC UNITS	DURATION	ACCOMPLISHMENT LOCATION
1	Intelligent agent	I	1.5	Laboratorio de Cómputo.
2	Searching solutions	II	1.5	
3	Blind search	II	2.0	
4	Heuristic search	II	2.0	
5	Adversarial search	II	2.0	
6	Logic Programming	III	3.0	
7	Knowledge representation	III	3.0	
8	Knowledge based system	III	3.0	
9	Decision trees	IV	3.0	
10	Neural network	IV	3.0	
11	Genetic algorithm	IV	3.0	
		TOTAL OF HOURS	27.0	

EVALUATION AND PASSING REQUIREMENTS

The practicals worth 30% in each thematic unit.
The practicals are considered mandatory to approve this learning unit.

PERIOD	UNIT	EVALUATION TERMS
1	I y II	Continuous evaluation　　　　70% Written evidence of learning　　30%
2	III	Continuous evaluation　　　　70% Written evidence of learning　　30%
3	IV	Continuous evaluation　　　　100% The learning unit I and II is 30% worth of the final score The learning unit III is 30% worth of the final score The learning unit IV is 40% worth of the final score Other means to approve this Learning unit: • Evaluation of previously acquired knowledge, based on the guidelines established by the academy. • Accreditation in another academic unit of the IPN or other national or international educational institution, in addition to the IPN. If accredited by Special Assessment or a certificate of proficiency, it will be based on guidelines established by the academy on a previous meeting for this purpose.

KEY	B	C	REFERENCES
1	X		Araujo, L. Cervigon, C. (2009). *Algoritmos Evolutivos, Un Enfoque Práctico*. Spain. Ed. Alfaomega. ISBN 978-84-7897-911-0.
2	X		Isasi, P. Galván, I. (2004). *Redes de Neuronas Artificiales, Un enfoque Práctico*. Spain. Ed. Pearson Education. ISBN 978-84-2054-025-2.
3	X		Pajares, M. Sanz G, De La Cruz, J. (2010). *Aprendizaje Automático Un Enfoque Práctico*. Spain. Ed. Alfaomega. ISBN 978-84-9964-011-2.
4		X	Ponce, P. (2010). I*nteligencia Artificial con Aplicaciones a la Ingeniería*. Mexico. Ed. Alfaomega. ISBN 978-607-7854-83-8.
5	X		Russell, S. Norvig P. (2009., *Artificial Intelligence: A Modern Approach (3rd Ed.),* USA. Ed. Prentice Hall. ISBN 978-01-3604-259-4

TEACHER EDUCATIONAL PROFILE PER LEARNING UNIT

1. **GENERAL INFORMATION**

ACADEMIC UNIT: Escuela Superior de Cómputo.

ACADEMIC PROGRAM: Ingeniería en Sistemas Computacionales.   **LEVEL**   III

FORMATION AREA:

Institutional	Basic Scientific	Professional	Terminal and Integration

ACADEMY: Ingeniería de Software   **LEARNING UNIT:**   Artificial Intelligence

SPECIALTY AND ACADEMIC REQUIRED LEVEL: Masters Degree or Doctor in Computer Science.

2. **AIM OF THE LEARNING UNIT:**
   The student develops applications based on artificial intelligence techniques.

3. **PROFESSOR EDUCATIONAL PROFILE:**

KNOWLEDGE	PROFESSIONAL EXPERIENCE	ABILITIES	APTITUDES
• Lógic • Intelligent agents • Search techniques • Knowledge-Based Systems • Machine learning • Neural networks • Evolutionary algorithms • Knowledge of the Institutional Educational Model. • English	• Experiencia de dos años diseñando e implementando sistemas computacionales. • Experiencia de un año diseñando e implementando Sistemas inteligentes. • Experiencia de un año como Docente de Nivel Superior. • Experiencia de un año en manejo de grupos y trabajo colaborativo.	• Analysis and synthesis • Leadership • Decision making • Conflict Management • Group management • verbal fluency of ideas • Teaching skills • Information and Communication Technologies skills	• Responsible. • Tolerant. • Honest. • Respectful. • Collaborative. • Participative. • Interested to learning. • Assertive. • Social and institutional commitment

DESIGNED BY	**REVISED BY**	**AUTHORIZED BY**
_____ M. en C. Marcario Hernández Cruz COORDINATING PROFESOR	_____ Dr. Flavio Arturo Sánchez Garfias Subdirector Académico	_____ Ing. Apolinar Francisco Cruz Lázaro Director
Dr. Benjamín Luna Benoso COLLABORATING PROFESSOR		

Date: 2011