

SYLLABUS / FIȘA DISCIPLINEI
1. Information on the study programme / Date despre programul de studii

1.1. Institution / Instituția de învățământ superior	Universitatea de Vest din Timișoara
1.2. Faculty / Facultatea	Matematică și Informatică
1.3. Department / Departamentul	Computer Science (Informatică)
1.4. Study program field	Computer Science (Informatică)
1.5. Study cycle/ Ciclul de studii	Bachelor / Licență
1.6. Study programme / Programul de studii / calificarea*	Computer Science / Informatică în limba engleză / Database administration / <i>Administrator baze de date - 252101; Computer network administration / Administrator de rețea de calculatoare - 252301; Analyst / Analist - 251201; Research assistant in computer science / Asistent de cercetare în informatică - 214918; Teacher in secondary schools / Profesor în învățământul gimnazial - 233002; Programmer / Programator - 251202; Software systems designers / Proiectant sisteme informatice - 251101</i>

2. Information on the course / Date despre disciplină

2.1. Title of the course / Denumirea disciplinei	Artificial Intelligence						
2.2. Teacher in charge of the course / Titularul activităților de curs	Lect. Dr. Popa Andreescu Horia-Emil						
2.3. Teacher in charge of the seminar / Titularul activităților de seminar	Lect. Dr. Popa Andreescu Horia-Emil						
2.4. Study year / Anul de studii	3	2.5. Semester / Semestrul	1	2.6. Examination type / Tipul de evaluare: E(xam)	E	2.7. Course type / Regimul disciplinei: M(andatory)	MI

3. Estimated study time (number of hours per semester) /Timpul total estimat (ore pe semestru al activităților didactice)

3.1. Attendance hours per week / Număr de ore pe săptămână	4	out of which/ din care: 3.2 lecture/ curs	2	3.3. seminar/laborator	2
3.4. Attendance hours per semester / Total ore din planul de învățământ	56	out of which: 3.5 lecture / curs	28	3.6. seminar/laborator	28
Distribution of the allocated amount of time / Distribuția fondului de timp*					hours/ore
Individual study /Studiu după manual, suport de curs, bibliografie și notițe					20
Supplementary documentation at library or using electronic repositories / Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate					10
Preparing for laboratories, homework, reports etc. /Pregătire seminarii/laboratoare, teme, referate, portofolii și eseuri					30
Exams / Examinări					8
Tutoring / Tutorat					10

3.7. Total number of hours of individual study / Total ore studiu individual	78
3.8. Total number of hours per semester / Total ore pe semestru	134
3.9. Number of credits (ECTS) / Număr de credite	5

4. Prerequisites (if it is the case) / Precondiții (acolo unde e cazul)

4.1. curriculum / de curriculum	Programming 3/Algorithms
4.2. skills / de competențe	Mathematics basis and the ability to solve problems / Cunoștințe elementare de matematica și abilități de rezolvarea a problemelor

5. Requirements (if it is the case) / Condiții (acolo unde e cazul)

5.1. for the lecture / de desfășurare a cursului	Room with whiteboard and videoprojector/ Sala de curs cu tabla și videoproiector
5.2. for the seminar, laboratory / de desfășurare a seminarului/laboratorului	Laboratory with computers with Eclipse installed and possibility to install new packages in it/ Sala de laborator cu calculatoare cu Eclipse instalate și posibilitatea de a instala noi pachete în el

6. Acquired skills / Competențe specifice acumulate

Professional skills / Competențe profesionale	<ul style="list-style-type: none"> • Become familiar with various branches of Artificial Intelligence / Familiarizare cu diversele ramuri ale Inteligenței artificiale • Notions about the manner of designing an expert system / Notiuni despre modul de realizare al unui sistem expert • Notions about the manner of knowledge representation specific to Artificial Intelligence / Notiuni despre modurile de reprezentare a cunoștințelor specifice Inteligenței Artificiale • The ability to solve complex problems / Abilitatea de a identifica metoda de rezolvare a unei probleme complexe • The ability to describe the algorithm and to analyse the correctness and efficiency of the algorithm / Abilitatea de a descrie algoritmic metoda și de a analiza corectitudinea și eficiența algoritmului
Transversal skills / Competențe transversale	<ul style="list-style-type: none"> • The ability to decompose a problem into subproblems / Abilitatea de descompune o problemă în sub-probleme • The ability to build complex structures starting

	from simple building blocks / Abilitatea de a construi structuri complexe pornind de la blocuri elementare <ul style="list-style-type: none"> The development of an inquiring spirit and curiosity regarding the manner the computer programs are built / Dezvoltarea spiritului de cunoaștere și curiozitate relativ la modul în care sunt realizate programele pentru mașinile de calcul
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7. Objectives of the course / Obiectivele disciplinei (reieșind din grila competențelor specifice acumulate)

7.1. General objective / Obiectivul general al disciplinei	Combining the teoretical aspects with the practical ones in: problem solving in AI using heuristics; knowledge representation and reasoning; logical reasoning; pattern-oriented programming / Combinarea aspectelor teoretice cu cele practice in: rezolvarea problemelor in IA utilizand euristici; reprezentarea cunostintelor si rationament; rationamentul logic, programare orientata pattern-uri.
7.2. Specific objectives / Obiectivele specifice	Applying the concepts previously developed for: problem solving, planning, games, constraints, machine learning, expert systems /Aplicarea conceptelor dezvoltate anterior in: rezolvarea problemelor, planificare, jocuri, constrangeri, invatare automata, sisteme expert

8. Content / Conținuturi*

8.1. Lecture / Curs	Teaching strategies / Metode de predare	Remarks, details / Observații
C1. Artificial Intelligence: definitions. History. Domains. Applications	Lecture, conversation, illustration / Prelegere, conversatie, exemplificare	References/Referinte: 1) Russel S., Norvig P. – Artificial Intelligence – A Modern Approach, 2nd ed. Prentice Hall, 2003 2) Stuart Russel – Course slides (http://aima.cs.berkeley.edu/instructors.html#homework) 3) Lecture on Google meet
C2. Problem representation. Uninformed search algorithms.	Lecture, conversation, illustration / Prelegere, conversatie, exemplificare	References/Referinte: 1) Russel S., Norvig P. – Artificial Intelligence – A Modern Approach, 2nd ed. Prentice Hall, 2003 2) Stuart Russel – Course slides (http://aima.cs.berkeley.edu/instructors.html#homework) 3) Lecture on Google meet
C3. Blind search and heuristic algorithms.	Lecture, conversation, illustration / Prelegere, conversatie, exemplificare	References/Referinte: 1) Russel S., Norvig P. – Artificial Intelligence – A Modern Approach, 2nd ed. Prentice Hall, 2003 2) Stuart Russel – Course slides (http://aima.cs.berkeley.edu/instructors.html#homework) 3) Lecture on Google meet
C4. Search algorithms	Lecture,	References/Referinte:

applied in games.	conversation, illustration / Prelegere, conversatie, exemplificare	<ol style="list-style-type: none"> 1) Russel S., Norvig P. – Artificial Intelligence – A Modern Approach, 2nd ed. Prentice Hall, 2003 2) Stuart Russel – Course slides (http://aima.cs.berkeley.edu/instructors.html#homework) 3) Lecture on Google meet
C5. Constraint Propagation	Lecture, conversation, illustration / Prelegere, conversatie, exemplificare	<p>References/Referinte:</p> <ol style="list-style-type: none"> 1) Russel S., Norvig P. – Artificial Intelligence – A Modern Approach, 2nd ed. Prentice Hall, 2003 2) Stuart Russel – Course slides (http://aima.cs.berkeley.edu/instructors.html#homework) 3) Lecture on Google meet
C6. Planning	Lecture, conversation, illustration / Prelegere, conversatie, exemplificare	<p>References/Referinte:</p> <ol style="list-style-type: none"> 1) Russel S., Norvig P. – Artificial Intelligence – A Modern Approach, 2nd ed. Prentice Hall, 2003 2) Stuart Russel – Course slides (http://aima.cs.berkeley.edu/instructors.html#homework) 3) Lecture on Google meet
C7. Knowledge types and representation modes. Logic. Procedural representation. Production rules.	Lecture, conversation, illustration / Prelegere, conversatie, exemplificare	<p>References/Referinte:</p> <ol style="list-style-type: none"> 1) Russel S., Norvig P. – Artificial Intelligence – A Modern Approach, 2nd ed. Prentice Hall, 2003 2) Stuart Russel – Course slides (http://aima.cs.berkeley.edu/instructors.html#homework) 3) Lecture on Google meet
C8. Knowledge representation based on inheritance – semantic networks, frames, object oriented representation.	Lecture, conversation, illustration / Prelegere, conversatie, exemplificare	<p>References/Referinte:</p> <ol style="list-style-type: none"> 1) Russel S., Norvig P. – Artificial Intelligence – A Modern Approach, 2nd ed. Prentice Hall, 2003 2) Stuart Russel – Course slides (http://aima.cs.berkeley.edu/instructors.html#homework) 3) Lecture on Google meet
C9. Reasoning. Logical reasoning.	Lecture, conversation, illustration / Prelegere, conversatie, exemplificare	<p>References/Referinte:</p> <ol style="list-style-type: none"> 1) Russel S., Norvig P. – Artificial Intelligence – A Modern Approach, 2nd ed. Prentice Hall, 2003 2) Stuart Russel – Course slides (http://aima.cs.berkeley.edu/instructors.html#homework) 3) Lecture on Google meet
C10. The architecture of expert systems. Rule	Lecture, conversation, illustration /	<p>References/Referinte:</p> <ol style="list-style-type: none"> 1) Russel S., Norvig P. – Artificial Intelligence – A Modern Approach, 2nd ed. Prentice Hall, 2003

based expert systems - how does the inference engine works.	Prelegere, conversatie, exemplificare	2) Stuart Russel – Course slides (http://aima.cs.berkeley.edu/instructors.html#homework) 3) Lecture on Google meet
C11. Expert system frameworks (Clips, Jess). Pattern oriented programming.	Lecture, conversation, illustration / Prelegere, conversatie, exemplificare	References/Referinte: 1) Russel S., Norvig P. – Artificial Intelligence – A Modern Approach, 2nd ed. Prentice Hall, 2003 2) Stuart Russel – Course slides (http://aima.cs.berkeley.edu/instructors.html#homework) 3) Lecture on Google meet
C12. Natural language understanding.	Lecture, conversation, illustration / Prelegere, conversatie, exemplificare	References/Referinte: 1) Russel S., Norvig P. – Artificial Intelligence – A Modern Approach, 2nd ed. Prentice Hall, 2003 2) Stuart Russel – Course slides (http://aima.cs.berkeley.edu/instructors.html#homework) 3) Lecture on Google meet
C13. Machine learning.	Lecture, conversation, illustration / Prelegere, conversatie, exemplificare	References/Referinte: 1) Russel S., Norvig P. – Artificial Intelligence – A Modern Approach, 2nd ed. Prentice Hall, 2003 2) Stuart Russel – Course slides (http://aima.cs.berkeley.edu/instructors.html#homework) 3) Lecture on Google meet
C14. Distributed AI. Multi-agent systems.	Lecture, conversation, illustration / Prelegere, conversatie, exemplificare	References/Referinte: 1) Russel S., Norvig P. – Artificial Intelligence – A Modern Approach, 2nd ed. Prentice Hall, 2003 2) Stuart Russel – Course slides (http://aima.cs.berkeley.edu/instructors.html#homework) 3) Lecture on Google meet
Recommended bibliography / Bibliografie		
8.2. Seminar, lab / Seminar, laborator	Teaching/learning strategies / Metode de predare/ învățare	Remarks, details / Observații
L1. Uninformed search	Questioning, dialogue,	<ul style="list-style-type: none"> The students choose the first assignment

algorithms in AI (hill-climbing, depth-first variants, breadth-first, iterativ deepening etc).	collaborative learning / Problematizare, dialog, învățare prin colaborare	theme and can get clarifications regarding their specific algorithm. Algorithms of the type from lectures 1 and 2 are presented. The teacher gives details/explains, answers to the students questions and checks/evaluates the way how the students have solved the exercises. <ul style="list-style-type: none"> • Lab on Google Meet
L2. Informed search algorithms: A*, heuristics.	Questioning, dialogue, collaborative learning / Problematizare, dialog, învățare prin colaborare	The students choose the first assignment theme and can get clarifications regarding their specific algorithm. Algorithms of the type from lecture 3 are presented. The teacher gives details/explains, answers to the students questions and checks/evaluates the way how the students have solved the exercises. Lab on Google Meet
L3. Minmax algorithm, adversarial search algorithms.	Questioning, dialogue, collaborative learning / Problematizare, dialog, învățare prin colaborare	The students choose the first assignment theme and can get clarifications regarding their specific algorithm. Algorithms of the type from lectures 4 and 5 are presented. The teacher gives details/explains, answers to the students questions and checks/evaluates the way how the students have solved the exercises. Lab on Google Meet
L4. Individual work at the first project (A*, IDA*, AO*, SMA*, minimax, alphabeta, CSP), implementation indications..	Questioning, dialogue, collaborative learning / Problematizare, dialog, învățare prin colaborare	Case study on the student's first project. The teacher gives details/explains, answers to the students questions and checks/evaluates the way how the students have solved the exercises. Lab on Google Meet
L5. Search algorithms projects presentation and evaluation Constraints programming.	Questioning, dialogue, collaborative learning / Problematizare, dialog, învățare prin colaborare	Presentation and defense of the first project by the students. The teacher gives details/explains, answers to the students questions and checks/evaluates the way how the students have solved the exercises. Lab on Google Meet
L6. Evolving algorithms.	Questioning, dialogue, collaborative learning / Problematizare, dialog, învățare prin colaborare	Presentation and defense of the first project by the students. The teacher gives details/explains, answers to the students questions and checks/evaluates the way how the students have solved the exercises. Lab on Google Meet
L7. Project evaluation and presentation for evolving algorithms	Questioning, dialogue, collaborative learning / Problematizare, dialog, învățare prin colaborare	Presentation and defense of the first project by the students. The teacher gives details/explains, answers to the students questions and checks/evaluates the way how the students have solved the exercises. Lab on Google Meet
L8. Introduction to	Questioning, dialogue,	1. J. Giarratano, G. Riley - Expert Systems:

CLIPS and JESS (inference engine, functioning cycle, ordered / unordered facts, rules). Deftemplate, LHS language (patterns)	collaborative learning / Problematizare, dialog, învățare prin colaborare	Principles and Programming, PWS Pbs. Comp., ITP, 4th edition, 2005 The teacher gives details/explains, answers to the students questions and checks/evaluates the way how the students have solved the exercises. Lab on Google Meet
L9. RHS language (actions), small examples of expert systems	Questioning, dialogue, collaborative learning / Problematizare, dialog, învățare prin colaborare	1. J. Giarratano, G. Riley - Expert Systems: Principles and Programming, PWS Pbs. Comp., ITP, 4th edition, 2005 The teacher gives details/explains, answers to the students questions and checks/evaluates the way how the students have solved the exercises. Lab on Google Meet
L10. Embedded CLIPS	Questioning, dialogue, collaborative learning / Problematizare, dialog, învățare prin colaborare	The teacher gives details/explains, answers to the students questions and checks/evaluates the way how the students have solved the exercises. Lab on Google Meet
L11. CLIPS/JESS project evaluation	Questioning, dialogue, collaborative learning / Problematizare, dialog, învățare prin colaborare	Presentation and defense of the CLIPS project by the students. The teacher gives details/explains, answers to the students questions and checks/evaluates the way how the students have solved the exercises. Lab on Google Meet
L12. Machine learning applications. Applications in computer vision.	Questioning, dialogue, collaborative learning / Problematizare, dialog, învățare prin colaborare	Presentation and defense of the CLIPS project by the students. Applications in computer vision of machine learning. The teacher gives details/explains, answers to the students questions and checks/evaluates the way how the students have solved the exercises. Lab on Google Meet
L13. Natural language understanding applications.	Questioning, dialogue, collaborative learning / Problematizare, dialog, învățare prin colaborare	Presentation and defense of the CLIPS project by the students. Presentation of the optional 3rd project by the students. The teacher gives details/explains, answers to the students questions and checks/evaluates the way how the students have solved the exercises. Lab on Google Meet
L14. Multiagent applications in JADE.	Questioning, dialogue, collaborative learning / Problematizare, dialog, învățare prin colaborare	Presentation and defense of the CLIPS project by the students. Presentation of the optional 3rd project by the students. Basic architecture of a JADE multi agent system. The teacher gives details/explains, answers to the students questions and checks/evaluates the way how the students have solved the exercises. Lab on Google Meet
Recommended bibliography / Bibliografie		
2. S.Russel, P. Norvig - Artificial Intelligence. A Modern Approach, second edition, Prentice Hall, 2003		

3. S. Russel, Course slides, <http://aima.cs.berkeley.edu/instructors.html#homework>
4. M. Watson – Practical Artificial Intelligence Programming With Java 3rd ed., 2008
5. J. Giarratano, G. Riley - Expert Systems: Principles and Programming, PWS Pbs. Comp., ITP, 4th edition, 2005
6. CLIPS online documentation, <http://clipsrules.sourceforge.net/OnlineDocs.html>
7. Jess, the Rule Engine for the Java Platform, <http://herzberg.ca.sandia.gov/jess/>
8. Ernest Friedman-Hill - Jess in action. Java rule-based systems, Manning Publ. Co., 2003
9. N. J. Nilson - Artificial Intelligence. A New Synthesis, Morgan Kaufmann Eds., 1998
10. G. F. Luger, W. A. Stubblefield - Artificial Intelligence, Structures and Strategies for Complex Problem Solving, third edition, Addison Wesley, 1998
11. A. Hopgood, Intelligent Systems for Engineering and Scientist, second edition, CRC Press, 2001
12. J. Pearl - HEURISTICS. Intelligent search strategies for computer problem solving, Addison-Wesley, 1984
13. M. Negnevitsky - Artificial Intelligence. A Guide to Intelligent Systems, Addison Wesley, 2002
14. D. I. Carstoiu - Sisteme expert, Editura ALL Bucuresti, 1994
15. D. Dumitrescu - Principiile Inteligentei artificiale, Editura Albastra, Cluj-Napoca, 2002

9. Correlations between the content of the course and the requirements of the IT field / Coroborarea conținuturilor disciplinei cu așteptările reprezentanților comunității epistemice, asociațiilor profesionale și angajatorilor reprezentativi din domeniul aferent programului

The content is consistent with the structure of similar courses from other universities and covers the fundamental aspects necessary in order to become familiar with issues and subdomains of Artificial Intelligence. The ability to identify, design, implement and analyze algorithms is essential for any activity in the field of computer science. The skills offered by this discipline are needed for an IT specialist to identify effective solutions for solving concrete problems, regardless of their domain and are justified by a resurgence of AI application in industry, e.g. in computer vision and machine learning. / Conținutul este în concordanță cu structura cursurilor similare de la alte universități și acoperă aspectele fundamentale necesare familiarizării cu problematica proiectării și analizei algoritmilor. Abilitatea de a identifica, proiecta, implementa și analiza algoritmi este esențială pentru orice activitate din domeniul informaticii. Competențele oferite de această disciplină sunt necesare unui specialist IT pentru a identifica soluții eficiente de rezolvare a unor probleme concrete, indiferent de domeniul specific de activitate și care sunt justificate de o resurgență a aplicațiilor AI în industrie, de exemplu computer vision și machine learning.

10. Evaluation / Evaluare*

Activity / Tip de activitate	10.1. Evaluation criteria / Criterii de evaluare**	10.2. Evaluation methods / Metode de evaluare***	10.3. Weight in the averaged mark / Pondere din nota finală
10.4. Lecture / Curs	- Înțelegerea conceptelor de bază ale Inteligenței Artificiale, ale algoritmilor specifici și modurilor specifice de reprezentare a cunoștințelor - Înțelegerea și modificarea unor secvențe simple de cod	Written exam	50%
	Eventual practical exam if the grade from the projects is less than 50% of the maximum grade from 10.5		Up to 50%

10.5. Seminar/ lab	Solving and presentation of the individual projects 2-3 projects - needed knowledge to pass the lab part: at least 50% from the maximum grade obtainable from projects - knowledge for 100% of the grade from 10.5 – completion, and knowing to explain their functioning for the 2-3 projects from the lab If the student has not enough points from the lab projects he/she can pass the exam after attending an practical programming exam additional to the written exam.		50%
10.6. Minimal knowledge for passing / Standard minim de performanță			
<p>The final grade is calculated as a weighted average of the grades given for the components specified in 10.4 and 10.5. The exam is passed if the average is at least 5 and the lab grade or the eventual oral exam grade is greater than 5 (not necessary that the theory grade to be greater than 5). At each exam sessions the grade is calculated by the same rule.</p> <p>Remark: The students may attend office hours (one hour / week according to the schedule set out at the beginning of the semester) where the teacher of the course and / or laboratory answers to the students questions and provides further explanations related to the course content, and to the applications from laboratories.</p> <p>/ Nota finală se calculează ca medie ponderată a notelor acordate pentru componentele specificate la 10.4 și 10.5. Examenul se consideră promovat dacă media este cel puțin 5 și dacă la laborator (sau la eventualul examen oral) nota este peste 5 (nu e necesar ca la examenul teoretic nota sa fie mai mare de 5) . La fiecare dintre sesiunile de examen (inclusiv cele de restanță și măriri) nota se calculează după aceeași regulă.</p> <p>Obs: Studenții pot participa la orele de consultații (1 modul/săptămână conform planificării stabilite la începutul semestrului) în cadrul cărora titularul de curs și/sau seminar/laborator răspunde întrebărilor studenților și oferă explicații suplimentare legate de conținutul cursului, aplicațiile de la laborator și teme.</p>			

 Date/ Data completării
 23.09.2020

 Signature (lecture) /
 Semnătura titularului de curs
 Lect. Dr. Popa Andreescu Horia Emil

 Signature (seminar)
 Semnătura titularului de seminar
 Lect. Dr. Popa Andreescu Horia Emil

 Signature (director of the department)
 Semnătura directorului de departament