

(1.) Course Title: INFPHD606 Artificial intelligence (complex exam preparatory)	Credits: 6
Course Classification: Mandatory chosen	
Theoretical or Practical Nature of the Course, 'training character'¹³: (credit%)	
Type of Class: consultation and number of hours: - in the given semester, <i>(If the course is not (only) taught in Hungarian, then the language: English)</i> Additional (specific) methods and characteristics² used in delivering the knowledge <i>(if any)</i> : -	
Assessment Method (Exam / Midterm Grade / Other³): practical course mark Additional (specific) methods⁴ applied in knowledge assessment <i>(if any)</i> : theme elaborations	
Course Placement in Curriculum (Semester Number): -	
Prerequisites <i>(if any)</i> : -	
Course Description: A concise yet informative description of the knowledge to be acquired.	
Modeling and search. Problem representation methods (state-space representation, problem decomposition, constraint satisfaction, logical representations) which make a problem possible to be viewed as a path-finding problem. Graph representation of a path-finding problem. AND/OR graphs. General scheme of the search system. Control strategy of search system and heuristics. Heuristic search. Famous irrevocable strategies: hill-climbing search, tabu search, algorithm of simulated annealing. Tentative strategies: the backtracking algorithm and graph-search algorithms (best-first, A, A*, Ac, B algorithm). Evolutionary algorithm. Two-player games. Representation of the games. The winner strategy. Sub-tree evaluations: minimax algorithm and alpha-beta pruning. Knowledge and reasoning. Inference in first-order logic: resolution and rule-based reasoning. Answer extraction process. Uncertainty, Bayesian networks. Fuzzy reasoning. Machine learning. Supervised learning and some examples (the k-nearest neighbor method, decision trees, deep learning). Unsupervised learning and some examples (k-mean algorithm, principal component analysis). Reinforcement learning: Markov decision problems, Bellman operator. Estimation of value functions using Monte-Carlo and temporal difference methods.	
2-5 Most Important Required and Recommended Literature List of required and recommended literature (notes, textbooks) with bibliographic data (author, title, publication details, (possibly pages), ISBN).	
S. Russel, P. Norvig: Artificial Intelligence: A Modern Approach, 4th Edition, Pearson, 2020. N. Nilsson: Principles of Artificial Intelligence, Springer-Verlag, 1982.	
List of Prescribed Professional Competencies and Competency Elements (knowledge, skills, etc., KKK Section 8) that the course significantly contributes to developing (highlight the most important ones). a) Knowledge	

- Has a research-level understanding of the general and specific characteristics, major directions, and precisely developed boundaries of the subject area within the discipline, as well as the agreed and debated interrelations.
- Creatively comprehends the interrelations, theories, and conceptual frameworks and terminologies of the given field of study.¹
- Possesses research methodology knowledge necessary for independent research in the given discipline/field.

b) Skills

- Capable of creative analysis of the field, synthesizing comprehensive and specific interrelations with a new perspective, and conducting appropriate evaluative and critical activities.
- Able to apply and further develop the specialized learning and problem-solving methods of the field.
- Can creatively elaborate on the novel, previously unknown practical implications of theoretical issues.
- Capable of planning and executing new projects, conducting research in the field, and developing new techniques and approaches.
- Able to identify unforeseen professional problems and uncover the detailed theoretical and practical background necessary for their resolution at a research level.
- Can construct and communicate new relations relevant to the field, as well as comprehensive interrelations significant for personal and communal existence.

c) Attitudes

- Represents and further develops the relations that contribute to the process of human self-creation based on the field's characteristics.
- Possesses an interest and learning ability that enable identifying and solving currently unpredictable research problems in the field.
- Demonstrates a firm professional commitment, a continuous dedication to exploring new approaches, and an acceptance of the necessity for persistent effort.

d) Autonomy and Responsibility

- Builds and initiates new knowledge areas with creative independence and proposes new practical solutions.
- Participates in formulating theoretical and practical questions with a leadership role and high-level cooperation.

¹**Section 108**, Article 37 of the National Curriculum Act (Nftv.) 37. lesson: a session (lecture, seminar, exercise, consultation) requiring the personal involvement of the instructor to fulfil the academic requirements specified in the curriculum, the duration of which is at least forty-five minutes and not more than sixty minutes.

² e.g. case studies, role play, thematic presentations, etc.

³ e.g. continuous debriefing, mid-year report

⁴ e.g. request for case studies, thematic papers, essays, business, organisational plans, etc.

- Engages as an equal discussion partner with professionals in the field.
- Takes responsibility for raising and addressing new ethical questions concerning theoretical and practical aspects of the profession.

Course responsible (name, position, academic degree): **János Botzheim, Ph.D., Associate Professor**

Instructor(s) involved in teaching the course (if any) (name, position, academic degree):
-