ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΕΙΡΑΙΩΣ
ΤΜΗΜΑ ΨΗΦΙΑΚΩΝ ΣΥΣΤΗΜΑΤΩΝ

Ω.Π.Μ.Σ. ΤΕΧΝΗΤΗ ΝΟΗΜΟΣΥΝΗ

ΕΚΕΦΕ ΔΗΜΟΚΡΙΤΟΣ
ΙΝΣΤ. ΠΛΗΡΟΦΟΡΙΚΗΣ ΚΑΙ ΤΗΛΕΠΙΚΟΙΝΩΝΙΩΝ

Course: Intelligent Agents and Multiagent Systems

Assignments 2024-2025

Students must deliver[1]:

- A report describing theory / algorithms, with evaluation/experimental results where it applies
- A presentation describing thoroughly theory / algorithms with specific examples, and with evaluation/experimental results, where it applies
- Code, where it applies

- **Students must declare their topic and team by a message sent via Lefkippos by December 20, 2024.**

- **1st version of the assignments will be discussed in a meeting in the week 27-31 January 2025 (the exact date will be announced in due time). This will provide feedback and steer students to be aligned with the objectives of the chosen topic.**

- **The final presentation will be given within the exams period I.e. by the Feb 15, 2025**

A. **Distributed scheduling via auctions**
3 persons: 50% theory and 50% implementation
-Specification of the distributed scheduling problem using agents' valuation functions
- Connection with competitive equilibria
- Specification and implementation of the ascending auction algorithm (convergence and termination)
- Experimental results

B. **Computing solution concepts of Normal form Games**
2 persons: 100% theory
- Computing Nash equilibria
- LCP formulation and Lemke-Howson algorithm
- Computing minmax and maxmin values
- Computing dominating strategies

C. **Congestion games**
2 persons: 80% theory and 20% implementation
- Definitions and congestion games as potential games

[1] Important notes:

1. Percentages show **rough** estimations of the expected distribution of effort to theory and implementation.
2. The number of persons per assignment is the maximum, however **I strongly discourage you working solo**.
3. Presentations and reports **should be of high quality and must reflect your deep understanding of the topic**.

- Non-atomic congestion games (NCG)
- Nash equilibria
- Specification and implementation of an algorithm for computing Nash equilibria in NCG
- The price of anarchy

D. **Stochastic and dynamic games**

2 persons: 80% theory and 20% implementation

- Definitions and examples of stochastic and dynamic games
- Computation of equilibria
- Specification and implementation of an algorithm for computing equilibria in a dynamic game

E. **Fictitious play and reinforcement learning for computing equilibria**

2 persons: 30% theory and 70% implementation

- Repeated & zero sum (stochastic) games
- Fictious play (FP) (theory and implementation)
- Reinforcement Learning (RL) (theory and implementation)
- Experimental results comparing FP and RL

F. **DCOP**

3 persons: 60% theory and 40% implementation

- Distributed Constraints Optimization Problems: Problem specification (discrete vs continuous)
- Algorithms for discrete and continuous DCOP problems
- Solving a DCOP (implementation and results)

Bibliography (basic sources)

Basic material for assignments A-E is provided in
Y.Shoham and K.Layton-Brown, " Multiagent systems, Algorithmic, Game-Theoretic and Logical Foundations, Cambridge University Press, 2009.

For assignment F please consult

1. T.Voice et al, "A Hybrid Continuous Max-Sum Algorithm for Decentralised Coordination", ECAI 2010, https://dl.acm.org/doi/abs/10.5555/1860967.1860981
2. A. Farinelli et al., "Decentralised coordination of low-power embedded devices using the max-sum algorithm", AAMAS 2008, https://dl.acm.org/doi/10.5555/1402298.1402313
3. A. Sarker et al, " A Local Search Based Approach to Solve Continuous DCOPs, AAMAS /doi/10.5555/3463952.3464083