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| <b>Course title:</b> Agents and multiagent systems (code ID016)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |                            |
| <b>Lecturers:</b> Mirjana K. Ivanović, Zoran D. Budimac, Miloš M. Radovanović                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    |                            |
| <b>Status:</b> (obligatory/elective) Elective                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    |                            |
| <b>ECTS:</b> 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                            |
| <b>Requirements:</b> None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                    |                            |
| <b>Learning objectives</b><br>Introducing students to advanced methodologies and concepts of agents and multiagent systems. Analysis of modern research directions in the field of development and practical applications of agents and multiagent systems.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                            |
| <b>Learning outcomes</b><br>A successful student will be capable of: <ul style="list-style-type: none"> <li>• Demonstrating the thorough understanding of the principles behind agents and multiagent systems</li> <li>• Applying the appropriate concepts of agents and multiagent systems to real-world problems, through the process of critical analysis, evaluation, and implementation</li> <li>• Applying research methods to the field of agents and multiagent systems</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                    |                            |
| <b>Syllabus</b><br><i>Theoretical instruction</i><br>An overview of the most important agent architectures. Functionalities of multiagent systems, analysis of existing solutions and the possibilities for improvements. Logic foundations of agents and multiagent systems. Message exchange and the standard agent communication language. Models of agent interaction: cooperation, coordination, negotiation and argumentation, auctions. Agent-oriented programming and agent-oriented programming languages. Virtual organizations based on agents. Agent-driven resource management. Distributed artificial intelligence and machine learning in multiagent systems. Swarm intelligence. Application of agents in distributed systems. Mobility. Agents in grid systems. Agents in cloud. Agents and web services. Agent functionalities in the semantic web. Agent-supported e-learning. Security, trust and reputation in multiagent systems.<br><i>Practical instruction</i><br>--- |                    |                            |
| <b>Recommended literature</b> <ol style="list-style-type: none"> <li>1. Barbara Dunin-Keplicz, Rineke Verbrugge, Teamwork in MultiAgent Systems: A Formal Approach, John Wiley &amp; Sons, 2010.</li> <li>2. Fabio Luigi Bellifemine, Giovanni Caire, Dominic Greenwood, Developing Multi-Agent Systems with JADE, John Wiley &amp; Sons, 2007.</li> <li>3. Michael Wooldridge, An Introduction to MultiAgent Systems – Second Edition, John Wiley &amp; Sons, 2009.</li> <li>4. Rafael H. Bordini, Mehdi Dastani, Jürgen Dix, Amal El Fallah Seghrouchni, Multi-Agent Programming: Languages, Tools and Applications, Springer, 2009.</li> <li>5. Wei Ren, Yongcan Cao, Distributed Coordination of Multi-agent Networks: Emergent Problems, Models, and Issues, Springer, 2010.</li> </ol>                                                                                                                                                                                                   |                    |                            |
| <b>Weekly teaching load</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Lectures: 2</b> | <b>Student research: 0</b> |
| <b>Teaching methodology</b><br>Lectures are held using classical teaching methods involving a projector. Students independently handle specific research topics, present and discuss the results with other students and lecturer and write a seminar paper.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                    |                            |
| <b>Grading method (maximal number of points 100)</b><br>Seminar 60, Oral exam 40                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                    |                            |