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|  **UNIVERSITY OF NIŠ** |
| **Course Unit Descriptor** | **Faculty**  | Faculty of Sciences and Mathematics |
| **GENERAL INFORMATION** |
| Study program  | **Computer Science, PhD studies** |
| Study Module (if applicable) |  |
| Course title | I332 Operations research |
| Level of study | [ ] Bachelor [ ]  Master’s [x]  Doctoral |
| Type of course | [ ]  Obligatory [x]  Elective |
| Semester  |  [x]  Autumn [ ] Spring |
| Year of study  | 1 |
| Number of ECTS allocated | 12 |
| Name of lecturer/lecturers | Predrag S. Stanimirović |
| Teaching mode |  [x] Lectures [ ] Group tutorials [ ]  Individual tutorials [ ] Laboratory work [ ]  Project work [x]  Seminar [ ] Distance learning [ ]  Blended learning [ ]  Other |
| **PURPOSE AND OVERVIEW (max. 5 sentences)** |
| *• Investigate the basic ideas underlying optimization techniques;* *• Investigate some of the most common standard models of linear programming;* *• Apply mathematical optimization models to a range of practical problems;* *• Formulate and solve large-scale Linear and Integer Programming problems.* *• Develop logical thinking in problem solving.* |
| **SYLLABUS (brief outline and summary of topics, max. 10 sentences)** |
| **Nonlinear programming.** Unconstrained optimization, One-dimensional search methods, Line search methods, Trust-region methods, gradient methods, accelerated gradient descent methods, steepest descent, Newton’s method, Line Search Newton methods, Conjugate Gradient methods: The Linear Conjugate Gradient method, Nonlinear Conjugate Gradient Methods (The Fletcher–Reeves Method, the Polak–Ribiėre Method), Quasi-Newton Methods: BFGS method, the SR1 method, the DFP method, The Broyden class.**Linear Programming. Basic Solutions,** A geometric view of linear programs, Simplex method: Geometric interpretation, the simplex algorithm, the two-phase Simplex method, the revised Simplex method, starting point of the Simplex method, The Revised Simplex method, degenerate steps and cycling, Finite Termination of the Simplexmethod, dualproblem, modification of the simplex method, the programming Package LINDO. Modifications of the Simplex method. Primal-dual Interior-point methods: Mehrotra's predictor-corrector algorithm, Potential-reduction methods, normal nad augmented system of equations, modifications of the package PCx. **Game theory.** Matrix games, optimal strategy, the Minimax theorem.**Applications of linear programming.** Integer programming, scheduling problems, the Transportation problem. The assignment problem, Dynamical programming, the Traveling Salesman problem. **Application of nonlinear programming.** Computation of generalized inverses using optimization methods, solving system of linear equations by optimization methods.**Constrained optimization.** Penalty methods Projected gradient methods, Barrier methods, Augmented Lagrangian methods. **Multi-objective optimization.** Methods for defining noninferior solutions, interactive methods, goal programming.**Discrete and continuous location problems. Network optimization.** |
| **LANGUAGE OF INSTRUCTION** |
| [x] Serbian (complete course) [ ]  English (complete course) [ ]  Other \_\_\_\_\_\_\_\_\_\_\_\_\_ (complete course)[ ] Serbian with English mentoring [ ] Serbian with other mentoring \_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **ASSESSMENT METHODS AND CRITERIA** |
| **Pre exam duties** | **Points** | **Final exam** | **points** |
| **Activity during lectures** | **10** | **Written examination** | **30** |
| **Practical teaching** |  | **Oral examination** | **60** |
| **Teaching colloquia** |  | **OVERALL SUM** | **100** |
| **\*Final examination mark is formed in accordance with the Institutional documents** |