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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 | | | | I352 Computation of generalized inverses | | |
| Level of study | | | | Bachelor  Master’s  Doctoral | | |
| Type of course | | | | Obligatory  Elective | | |
| Semester | | | | Autumn Spring | | |
| Year of study | | | | 1 | | |
| Number of ECTS allocated | | | | 12 | | |
| Name of lecturer/lecturers | | | | Predrag S. Stanimirović | | |
| Teaching mode | | | | Lectures Group tutorials  Individual tutorials  Laboratory work  Project work  Seminar  Distance learning  Blended learning  Other | | |
| **PURPOSE AND OVERVIEW (max. 5 sentences)** | | | | | | |
| *- Investigate direct and iterative methods for computing generalized inverses.*  *- Symbolic computation of generalized inverses using a Computer Algebra System*  *- Applications of generalized inverses*  *- Qualify students to develop their own methods.* | | | | | | |
| **SYLLABUS (brief outline and summary of topics, max. 10 sentences)** | | | | | | |
| **Introduction.** Introduction to basic and advanced methods for symbolical and numerical matrix generalized inverses (Moore-Penrose, weighted Moore-Penrose, Drazin, Group and {i,j,k} inverses) computation.  **Direct methods.** Methods based on full-rank factorization, LU decomposition, QR decomposition, Singular value decomposition, URV decomposition. Gauss-Jordan methods for computing generalized inverses. Partitioning methods and Greville partitioning method. Determinant representation. Leverrier-Faddev method.  **Iterative methods.** Groetch theorem, generalizations and special cases. Methods based on the first and the second order gradient methods. Methods based on the conjugate-gradient method. Limit representations. Hyperpower and Schultz-type iterative methods.  **Generalized inverses of rational and polynomial matrices.** Methods based on QDR decomposition, Partitioning method for rational and polynomial matrices. Leverrier-Faddeev method for polynomial matrices. Effective partitioning and Leverrier-Faddeev-type methods. Interpolation methods for polynomial matrices. Generalized inverses of multivariable rational and polynomial matrices.  **Generalized inverses of sparse and structured matrices.** Sparse-matrix representations. Partitioning method for sparse matrices. Determinant representation methods for sparse matrices. Iterative methods.  **Recurrent Neural Network approach to computation of generalized inverses.**  **Implementation.** Symbolic implementation in Mathematica. Implementation in procedural programming language (C, C++). Implementation based on the linear algebra packages (for example Matlab).  **Applications of generalized inverses.** Applications in statistics. Application in image deblurring. | | | | | | |
| **LANGUAGE OF INSTRUCTION** | | | | | | |
| 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** | | | | | | |