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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 | I321 Symbolic and algebraic computation |
| Level of study | [ ] Bachelor [ ]  Master’s [x]  Doctoral |
| Type of course | [ ]  Obligatory [x]  Elective |
| Semester  |  [ ]  Autumn [x] 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)** |
| *Introduction to the basic ideas, concepts and results of symbolic computation. Possibility of package MATHEMATICA in symbolic computation and data manipulation. Apply symbolic processing in main algorithms.* |
| **SYLLABUS (brief outline and summary of topics, max. 10 sentences)** |
| **Basic concepts:** Computer Algebra systems. Integers. Rational number arithmetic. Polynomials: Elementary operations on polynomials. Single variable polynomials. Multivariate polynomials. Polynomial division and expansions. Polynomial decomposition. Polynomial simplification. Automatic simplification and expression structure. **MATHEMATICA as programming language:** Expressions and values of expressions. Prefix, postfix and infix notation. Lists. Patterns. Transformation Rules and Definitions. Functions and Programs. Functional operations. **Simplification.** Transformation rules and definitions. Functional operations. Functions as the first order data types. Repetitive applications of functions. Applications of functions on lists and other expressions. Pure functions. Higher order functions. **Solving equations and inequalities.** Complex polynomial systems. The MATHEMATICA functions Reduce, Resolve, and FindInstance; Advanced string patterns: Regular expressions and string expressions, **String manipulation functions. Unconstrained and Constrained optimization in Mathematica,** Methods for local minimization. Methods for solving nonlinear equations. Linear programming. Numerical nonlinear local and global optimization. Exact global optimization. Data manipulation:Files, Streams and external operations. Importing and exporting, Image processing. **DatabaseLink in MATHEMATICA. Dynamic interactivity. Linear algebra.** Constructing matrices. Getting and setting pieces of matrices. Operations on scalars, vectors and matrices. **Visualization and Graph drawing.** Graphics and sound. 2D and 3D graphics. General graph drawing. Tree drawing. **Symbolic computation in MATHEMATICA.** Standard form of expressions. Expressions as trees. Part and levels of expressions. Pattern matching. Functions with options and default arguments. Symbolic list manipulation. Transformation rules. Array objects. Memoization. Advanced numerical differential equation solving. |
| **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** |