Project Description - Part B[1]

Advanced Artificial Intelligence Techniques for Analysis and Design of System Components Based on Trustworty BlockChain Technology (AI4TrustBC)

1.1. Participants (applicants)

- a short[2] description of each Science and Research Organization (SRO) and its main tasks, with an explanation of how its profile matches the tasks in the proposal;

The **Mathematical Institute of the Serbian Academy of Sciences and Arts** (**MISANU**), (http://www.mi.sanu.ac.rs/) was founded in 1946 as the first institute of the Academy. Today, as an institutional member of the European Mathematical Society, MISANU is the unique center for mathematically-oriented fundamental and technological research in Serbia, with more than 70 full-time employed researchers. According to the Webometrics Ranking, http://research.webometrics.info/en, MISANU is the most influential Serbian institute at Internet. MISANU has a number of experts doing high-quality research in several areas of mathematics and computer sciences. The strongest research groups within MISANU (which are also the most internationally recognized: see, for example, https://www.scimagojr.com) are in mathematical logic and discrete mathematics (optimization, cryptology). The proposed project will be implemented by the members of these research groups, which already have successfully collaborated and published interdisciplinary papers.

The **Faculty of Technical Sciences (FTN)**, established in 1960, is the largest faculty of the University of Novi Sad. The Faculty provides studies at all three levels of higher education in five areas: technical sciences and engineering, mathematics and natural sciences, arts and humanities, arts, as well as medical sciences. The Faculty is organized as a unique complex institution comprising smaller organizational units with appropriate scientific fields and laboratories. Scientific activities at the Faculty are oriented to the realization of research projects in the field of fundamental research, innovative projects and technological development projects funded by national and international organizations. The wide scope of expertise and high competence of researchers provide a driving force for tackling the demanding challenges in Artificial Intelligence.

Please provide, for each member of the project team, the following (where available):

- a short curriculum vitae of each member of the project team[3], including:

[1] All of the information in Part B is mandatory (including the filled out form). Inaccurate and/or incomplete information will result with disqualification.
[2] Provide key information about the SRO(s) participating on the project; use up to 1,000 characters per each SRO.
[3] The role on the Project should be clearly stated for each member of the Project team (PI, researcher). The short curriculum vitae should contain information about education, employment, research or academic title, research field/area, number of citations (excluding self-citations) and Hirsch index from SCOPUS or WoS citation databases. Research or academic title should refer to the List of Research or Academic Titles in Higher Education available at the: http://fondzanauku.gov.rs/poziv/2019/11/ai/ Awards, prizes, skills and other information which is relevant to the Project, but which is not included into other parts of Section 1.1 of this document, can be entered where applicable.
In the case that the Project proposal includes a participant from diaspora, that participant should be presented in the table, including the projection of the monthly Project engagement of that participant.

- a list of up to 5 publications[4] relevant to the Project for each member of the project team[5];
- a list of up to 5 relevant previous projects or activities, connected to the subject of this proposal for each member of the project team[6];
- if available, a list of up to five products, services (including widely-used datasets or software), or other achievements relevant to the call content.

Tatjana Davidović, (PI), (http://www.mi.sanu.ac.rs/~tanjad/) is a principal research fellow at the Mathematical Institute of the Serbian Academy of Sciences and Arts. She is also engaged in doctoral courses on Parallel Programming, Metaheuristics, and Optimization at the Faculty of Technical Sciences, University of Novi Sad, Serbia. She received her B.Sc. degree at Faculty of Mathematics, University of Belgrade, in 1987. and M.Sc. degree at the same faculty, in 1992, with the thesis *An Approach to Parallelization of Symbolic Robot Model*. In 2006 she obtained PhD degree at Faculty of Mathematics, University of Belgrade with the thesis *Scheduling Tasks to Multiprocessor Systems by Applying Metaheuristics*. Dr. DavidoviĹ participated in a number of scientific projects, national, bilateral, and Tempus. She is a member of the Program Committees for several international conferences related to optimization, computer science and information technology fields. Her main research interests include parallel computing, scheduling, combinatorial optimization, mathematical programming, metaheuristics. She has published 3 chapters in international monographs, 25 papers in refereed international journals, more than 50 papers in conference proceedings and she delivered three invited talks at the international conferences. According to SCOPUS database, her results were cited (excluding self-citations) 228 times and her Hirsch index is 8. Based on her scientific background, within the project she will contribute to the project realization in the domain of development and application of sequential and parallel metaheuristics to data analytics and consistency analysis in BlockChain technology.

Selected publications:

1. Jakšić Kruger, T., Davidović, T., Teodorović, D., Šelmić, M., The Bee Colony Optimization Algorithm and its Convergence, *Int. J. Bio-Inspired Computation*, 8(5), pp. 340-354, 2016.
2. Stojanović, T., Davidović, T., Ognjanović, Z., Bee Colony Optimization for the Satisfiability Problem in Probabilistic Logic, *Applied Soft Computing*, 31, pp. 339-347, 2015.
3. Alfandari, L. **Davidović, T.,** Furini, F., LjubiĹ, I., Marąg, V., Martin, S., Tighter MIP Models for Barge Container Ship Routing, *OMEGA: International Journal of Management Science* , 82, pp. 38-54, 2019.
4**. Davidović, T.,** JakģiĹ, T., Ramljak, D., ĠelmiĹ, M., TeodoroviĹ, D., Parallelization strategies for bee colony optimization based on message passing communication protocol, OPTIMIZATION, 62(8), pp. 1113-1142, 2013
5. Marąg, V., LaziĹ, J., **Davidović, T.,** MladenoviĹ, N., Routing of Barge Container Ships by Mixed-Integer Programming Heuristics, *Applied Soft Computing*, 13(8), pp. 3515-3528, 2013.

[4] Please provide a list of up to 5 selected publications relevant to the Project. Do not attach or list a full bibliography.
[5] One selected paper which is published in an international scientific journal (M21 or M21a) in the field of artificial intelligence should be marked in bold text (only for the Principle investigator in the Subprogram PRVI_O).
[6] One selected participation at an international scientific conference in the field of artificial intelligence and the published paper from the conference should be marked in bold text (only for the Principle investigator in the Subprogram PRVI_P).

Previous projects or activities, connected to the subject of this proposal:

1. Participant (and Principal Investigator as of 2016) of the project ñGraph theory and mathematical programming with applications to chemistry and computer scienceò ON 174033 - Ministry of Education, Science and Technological Development of Serbia (2011-2019)

2. Participant of the bilateral project "The application of optimization methods in biomedicine", between Serbia and Croatia, 2019-2021.

3. Principal Investigator of the bilateral project "The Development of Hybrid Heuristics for Combinatorial Optimization Problems", between Serbia and France, 2016-2017.

4. T. DavidoviĹ, Bee Colony Optimization: Recent Developments and Applications, (plenary talk), Proc. Balkan Conference on Operational Research, BALCOR 2015, Constanta, Romania, Sept. 9-12, 2015. Mircea cel Batran Naval Academy Scientific Bulletin, Volume XVIII, Issue 2, Dec. 2015, pp. 225-235.

Sivlia Ghilezan, (researcher), (http://imft.ftn.uns.ac.rs/~silvia) is a full professor of mathematics at the University of Novi Sad and Mathematical Institute, Belgrade. On several occasions, she has held visiting positions at University of Oregon, USA, École Normale Supérieure de Lyon, France, University of Turin, Italy, Radboud University, The Netherlands and McGill University, Canada. She is lecturing at all three levels of higher education in Serbia, as well as abroad. Major lines of her research, professional work and expertise are in formal methods and mathematical logic with application to programming languages, theoretical computer science, concurrent and distributed systems and mathematical linguistics. Her most recent research interests focuses on formal methods for privacy in large scale systems, computer assisted mathematical reasoning, formal methods in artificial intelligence, effective tools and novel teaching-learning methodologies, open data and open science technologies. She has initiated, assembled consortia, project managed and successfully completed several scientific and educational projects under national and international programs (FP, COST, Erasmus+, Tempus, bilateral). Dr. Ghilezan has provided both scientific and technical consultancy and undertaken several international project reviews and evaluations. Her numerous research articles with over fifty co-authors are published in leading scientific journals and have been communicated at renowned conference. She acts as a program committee member of prestigious international conferences and is a guest speaker at leading universities worldwide. She has supervised several doctoral theses, including two theses en-cotutelle, and serves as an international jury member for doctoral theses. She has significant activities in popularization and dissemination of science with wider impact on society. Dr. Ghilezan has provided advisory consultancy for ARVR enterprises and industry. In 2013, she was knighted in the Chevalier de l'Ordre des Palmes Académiques of the French Republic. She will contribute to the project within the development of knowledge reasoning techniques and formal methods for data privacy management based on trustworthy BC technology.

Selected Publications:

1. Svetlana JakġiĹ, Jovanka PantoviĹ and **Silvia Ghilezan**: Linked Data Privacy, Mathematical Structures in Computer Science 27(1): 33-53 (2017).

2. **Silvia Ghilezan**, Svetlana Jakġiĺ, Jovanka Pantoviĺ, Jorge A. Pérez and Hugo Torres Vieira: Dynamic Role Authorisation in Multiparty Conversations, Formal Aspects of Computing 28 (4): 643ï 667 (2016).
3. Massimo Bartoletti, Ilaria Castellani, Pierre-Malo Denielou, Mariangiola Dezani-Ciancaglini, **Silvia Ghilezan**, Jovanka Pantovic, Jorge A. Perez, Peter Thiemann, Bernardo Toninho, Hugo Torres Vieira: Combining behavioural types with security analysis, Journal of Logical and Algebraic Methods in Programming 84: 763ï 780 (2015).
4. Mariangiola Dezani-Ciancaglini, **Silvia Ghilezan**, Jovanka Pantoviĺ, Daniel Varacca: Security types for dynamic web data, Theoretical Computer Science 402 (2-3): 156-171 (2008).
5. **Silvia Ghilezan**, Jovanka Pantovic and Jovisa Zunic: Separating Points by Parallel Hyperplanes - Characterization Problem, IEEE Transactions of Neural Networks 18 (5): 1356-1363 (2007).

Previous projects or activities, connected to the subject of this proposal:

1. Principal Investigator ñRepresentations of logical structures and formal languages and their application in computingò ON 174026 - Ministry of Education, Science and Technological Development of Serbia (2011-2019)
2. Management Committee member, Core Group member, STSM coordinator ñThe European research network on types for programming and verification - EUTYPESò COST CA 15123 (2015-2020)
3. Core team member Boosting Engagement of Serbian Universities in Open Science, BE-OPEN, Erasmus + KA2 (2016-2020)
4. co Principal Investigator Computational Logic and Higher Algebra ï CoLoHA, Bilateral project France-Serbia (2016-2017)
5. site coordinator, Types for Proofs and Programs ï TYPS FP6 (2004-2008).

Other achievements relevant to the call content:

1. **PC member of** FSCD 2020 - 5th International Conference on Formal Structures for Computation and Deduction, 29 June - 5 July 2020, Paris, France

2. **PC member of** FM 2019 - 3rd World Conference on Formal Methods and the 23rd Symposium on Formal Methods, 7-11 October 2019, Porto, Portugal

3. Co-editor (with Herman Geuvers and Jelena Ivetic) TYPES 2016 Post-proceedings, Leibniz International Proceedings in Informatics LIPICS 97 (2018)

4. **Invited speaker at** NII Shonan meeting**,** Logic and Verification Methods in Security and Privacy, October 26-29, 2015, Japan

5. **PC member of** ICFP 2013- 18th ACM SIGPLAN International Conference on Functional Programming, September 25 ï 27, 2013, Boston, Massachusetts, USA.

Miodrag Mihaljević, (researcher), has received his B.Sc. and M.S. degrees in electrical engineering from University of Belgrade, Serbia (Yugoslavia), and received his Ph.D. degree in 1990. He is a Principal Research Fellow, Deputy Director and the projects leader at the Mathematical Institute, Serbian Academy of Sciences and Arts, Belgrade. His main research areas are: (i) cryptology & information security (in particular design and security evaluation of lightweight techniques), (ii) blockchain technology and (iii) elements of coding & information theory. He has published more than 100 research papers in the leading international journals,

conference proceedings, and as certain book chapters (including over 50 papers in IEEE journals, IET Information Security, Journal of Cryptology, Phys. Rev. A, Computing, Inform. Process. Lett., LNCS, IEICE Transactions, Entropy), and over 200 publications in total. He is co-inventor of 6 granted patents in U.S, Japan and China. Dr. MihaljeviĹ is also author/coauthor of over 30 technical reports prepared for industrial and other institutions in Serbia and abroad. His research results have been cited more than 2000 times in the leading international publications (over 2800 citation at Google Scholar, about 1400 citations at Scopus, over 1000 citations at WoS). He has participated in over 10 international and over 20 national research projects (where he has served as the Project Leader and Principal Researcher over 15 time), and has served over 200 times as the reviewer for the leading international journals and conferences. Dr. Mihaljevic is an Associate Editor of Springer journal *SN Computer Science*, and has served a number of times as a Guest Editor (*Security & Communication Networks*, *CommSIS*, é).

He has held long-term visiting positions at: The University of Tokyo, IMAI Lab (1997-2001 and 2004-2005); Sony Computer Science Labs (2001-2002), Sony Corporation Labs (2002-2003), Tokyo; Invited Senior Researcher at the Research Center for Information Security (RCIS), National Institute of Advanced Industrial Science and Technology (AIST), Tokyo, Japan (2006-2012) and the Research Institute for Secure Systems (RISEC), National Institute AIST, Tsukuba, Japan (2012-2013); Invited Researcher and Professor at the Chuo University, IMAI Lab., Tokyo, Japan (2013-2014); and Project Professor at Institute of Industrial Science, The University of Tokyo (2014-2019), and short term visiting positions at University of Hawaii at Manoa, US, Nanjang Technological University, Singapore, Indian Statistical Institute, Kolkata/New Delhi, India.

Dr. MihaljeviĹ is a recipient of the 2013 Award of Serbian Academy of Sciences and Arts for ten years achievements, and is an elected member of the Academia Europaea from 2014.

(more information available at: http://www.mi.sanu.ac.rs/cv/cvmihaljevic.htm**)**

Selected Publications:

1. **M.J. Mihaljevic,** "A Security Enhanced Encryption Scheme and Evaluation of Its Cryptographic Security", *Entropy*, vol. 21 (7), July 2019 (11 pages); https://doi.org/10.3390/e21070701 , https://www.mdpi.com/1099-4300/21/7/701
2. **M.J. Mihaljevic** and F. Oggier, "Security Evaluation and Design Elements for a Class of Randomized Encryptions", *IET Information Security*, vol. 13, no. 1, pp. 36-47, Jan. 2019, https://ieeexplore.ieee.org/document/8611527
3. **M.J. Mihaljevic**, ñA Blockchain Consensus Protocol Based on Dedicate Time-Memory-Data Trade-Offò, arXiv: 1911.07689 [cs.CR], Nov. 2019. (https://arxiv.org/pdf/1911.07689.pdf)
4. **M.J. Mihaljevic**, A. Kavcic and K. Matsuura, "An Encryption Technique for Provably Secure Transmission from a High Performance Computing Entity to a Tiny One", *Mathematical Problems in Engineering*, vol. 2016, Article ID 7920495, 10 pages, http://dx.doi.org/10.1155/2016/7920495
5. F. Oggier and **M.J. Mihaljevic**, "An Information-Theoretic Security Evaluation of a Class of Randomized Encryption Schemes", *IEEE Transactions on Information Forensics and Security*, vol. 9, no. 2, pp. 158-168, Feb. 2014. (DOI: 10.1109/TIFS.2013.2294763).

Previous projects or activities, connected to the subject of this proposal:

1. M.J. Mihaljevic, "On Some Advanced Techniques for Lightweight Blockchain Technology and Certain Applications" Invited Talk at the *International Supercomputing Industry Expo* 2019, Jinan, China, Dec. 26-28, 2019.

2. M.J. Mihaljevic, K. Matsuura, "On the Consensus Protocols for Public Blockchains", Invited Talk at a Panel of *Interop Tokyo 2019* , 12-14 June 2019, Tokyo, Japan
3. M.J. Mihaljevic, "Blockchain Technology and Cyber Security", Invited talk at the *Second Regional Cyber Security Conference*, Podgorica, Montenegro, May 2019.
4. M.J. Mihaljevic, ñBlockchain Technology and Cyber Trust & Privacyò, Invited talk, *International Conference KES 2018*, Belgrade, 3-5, Sept. 2018.
5. M.J. Mihaljevic, ñOn Certain Challenges of Blockchain Technology Deploymentò, Invited talk, *ETRAN (IcETRAN) 2018* PaliĺĹ, Serbia, June 11 - 14, 2018. https://www.etran.rs/2018/IcETRAN/Recorded_events/, *5th International Conference IcETRAN* 2018 PaliĺĹ, 11-14.06.2018. ISBN 978-86-7466-752-1

Other achievements relevant to the call content:

M.J. Mihaljević, M. Todoroviĺ, M. Kneġeviĺ, S. Tomoviĺ, M. Saviĺ, N. Vukġa, A. Arsiĺ, ñAdvanced ICT Services Employing Blockchain Technologyò, *Collection of the Technical Reports (with Software) for TELECOM Serbia*, MI-SANU, 2019 (over 1000 pages & 5 software)

Zoran Ognjanović, (researcher), (http://www.mi.sanu.ac.rs/~zorano/) is a principal research fellow at the Mathematical Institute of the Serbian Academy of Sciences and Arts. He was/is a visiting professor at universities in Belgrade, Novi Sad and Kragujevac (Serbia). He received his B.Sc. degree at Faculty of Mathematics, University of Belgrade, in 1987. He received his M.Sc. degree at Faculty of Mathematics, University of Belgrade, in 1993, with the thesis ĂA theorem prover for modal logic S4 based on the dual tableau methodò. In 1999 he got PhD degree with the thesis ĂSome probabilistic logics and their application in computer sciencesñ at Faculty of Science, University of Kragujevac. Since 2002 he has been the leader of three national fundamental research projects. He participated in a number of international FP, H2020, COST and Tempus-projects. He was a Program Committee member of international conferences and the co-chair of the 15th European Conference on Symbolic and Quantitative Approaches to Reasoning with Uncertainty (ECSQARU 2019, Belgrade, Serbia, September 18-20, 2019). His research interests are: mathematical logic and its applications in computer science, artificial intelligence and uncertain reasoning, verification of protocols, automated theorem proving, applications of heuristics to satisfiability problem, and digitization of cultural and scientific heritage. He is a co-author of the monograph Probability Logics - Probability-Based Formalization of Uncertain Reasoning published by Springer, several chapters in monographs, more than 50 papers in refereed international journals, and more than 40 papers in international conference proceedings. His number of citations (excluding self-citations) and Hirsch index from SCOPUS are 241 and 8, respectively. He received the Award of Serbian Academy of Sciences and Arts in the Field of Mathematics and Related Sciences for the Year 2013 and the annual award of Serbian Ministry of Science for results in fundamental research in 2004. His role in the project concerns development of Knowledge reasoning techniques based on a formal logic and their applications for analyzing the BlockChain protocol.

Selected publications:

1. Bojan Marinkoviĺ, Paola Glavan, **Zoran Ognjanović**, Thomas Studer, A Temporal Epistemic Logic with a Non-rigid Set of Agents for Analyzing the Blockchain protocol, Journal of logic and computation, 29(5), 803-830, 2019.
2. Bojan Marinkoviĺ, Paola Glavan, **Zoran Ognjanović**, Proving properties of the Chord protocol using the ASM formalism, Theoretical Computer Science, 756, 64-93, 2019.

3. Dragan Doder, **Zoran Ognjanović**, Probabilistic Logics with Independence and Confirmation, Studia Logica, 105, 943ï 969, 2017.
4. **Zoran Ognjanović**, Miodrag Raġkoviĺ, Zoran Markoviĺ, Probability Logics: Probability-Based Formalization of Uncertain Reasoning, Springer, 2016.
5. **Zoran Ognjanović**, Discrete Linear-time Probabilistic Logics: Completeness, Decidability and Complexity, Journal of Logic Computation, 16(2), 257-285, 2006.

Previous projects or activities, connected to the subject of this proposal:

1. Co-chair (with Gabriele Kern-Isberner) of the The 15th European Conference on Symbolic and Quantitative Approaches to Reasoning with Uncertainty ECSQARU 2019, Belgrade (Serbia), September 18 - 20, 2019, http://www.mi.sanu.ac.rs/~ecsqaru2019/
2. Co-editor (with Gabriele Kern-Isberner) of the, Proceedings of the 15th European Conference, ECSQARU 2019, Lecture Notes in Computer Science book series, volume 11726, 2019.
3. Co-editor (with Gabriele Kern-Isberner of the special issue of the journal International Journal of Approximate Reasoning with selected extended papers from the 15th European Conference on Symbolic and Quantitative Approaches to Reasoning with Uncertainty (ECSQARU 2019), 2020.
4. Member of the Program committee of European Conference on Artificial Intelligence ECAI 2012 Workshop on Weighted Logics for AI, Montpellier (France), 2012, http://www.iiia.csic.es/wl4ai/organizing_committee
5. Leader of the Project III 044006 ñDevelopment of new information and communication technologies, based on advanced mathematical methods, with applications in medicine, telecommunications, power systems, protection of national heritage and educationò (2011-2019) funded by the Ministry of education, science and technological development of the Republic of Serbia, http://www.mi.sanu.ac.rs/novi_sajt/research/projects/044006e.php

Dragan Urošević, (researcher), is a principal research fellow at the Mathematical Institute of the Serbian Academy of Sciences and Arts. He was/is a visiting professor at university in Novi Sad (Serbia). He received his B.Sc. degree at Faculty of Mathematics, University of Belgrade, in 1987. He received his M.Sc. degree at Faculty of Mathematics, University of Belgrade, in 1994, with the thesis ĂHeuristics for scheduling Parallel programs on Multiprocessor systemsò. In 2004 he got PhD degree with the thesis ĂSolving problems on graphs by using Variable neighborhood searchñ at Faculty of Mathematics, University of Belgrade. Since 2001 he participated in a number of scientific projects, national, bilateral. He is a member of the Program Committees for several international conferences related to optimization and computer science fields. He also was the co-chair of the XIII Balkan Conference on Operational Research (BALCOR, Belgrade, Serbia, May 22-25, 2918). His main research interests include combinatorial optimization, mathematical programming, metaheuristics and computational complexity. He is a co-author of three chapters in monographs, more than 35 papers in refereed international journals, and more than 20 papers in international conference proceedings. His number of citations (excluding self-citations) and Hirsch index from SCOPUS are 936 and 17, respectively. He will contribute to the project in the domain of development and application of metaheuristics to data analytics, privacy and consistency analysis in BlockChain technology

Selected publications:

1. Brimberg J, Hansen P, Mladenoviĺ N, **Urošević D**, Solving large p-median clustering problems by primal-dual variable neighborhood search, *Data Mining and Knowledge Discovery*, 19, 351-375, 2009.

2. Brimberg J, Janicijevic S, Mladenovic N and **Urosevic D**, Solving the clique partitioning problem as a maximally diverse grouping problem, *Optimisation letters*, 11(6), 1123-1135, 2017.
3. Todosijevic R, **Urošević D**, MladenoviĹ N, Hanafi S. A general variable neighborhood search for solving the uncapacitated r-allocation p-hub median problem, *Optimization letters*, 11(6), 1109-1121, 2017.
4. Brimberg J, MladenoviĹ N, **Urošević D**, Solving the Maximally Diverse Grouping Problem by Skewed General Variable Neighborhood Search, *Information Sciences*, 295, 650-675, 2015.
5. MladenoviĹ N, TodosijeviĹ R, **Urošević D**, Less is more: Basic variable neighborhood search for minimum differential dispersion problem, *Information Sciences*, 326, 160-171, 2016.

Previous projects or activities, connected to the subject of this proposal:

1. Co-chair (with Milorad VidoviĹ and Milan MartiĹ) of the Programme Committee of the 13th Balkan Conference on Operational Research BALCOR 2018, Belgrade (Serbia), May 22 - 25, 2018, http://balcor2018.fon.bg.ac.rs/index.php?page=committees.
2. Member of the Editorial Board of the journal Computer Science and Information Systems/ComSIS (ISBN 1820-0214, IF 0.620).
3. Participant of the project ñMathematical Models and Methods of Optimization of Large Scale Systemsò ON 174010 - Ministry of Education, Science and Technological Development of Serbia (2011-2019).

Angelina Ilić-Stepić, (researcher), was born on the 19.02.1980 in Belgrade. She has completed high school "Matematiļka gimnazija" in 1999, and graduated in 2004 at University of Belgrade, Faculty of Mathematics, with the major in "Theoretical Mathematics and Applications" with the GPA 9,57. She obtained master degree in 2008 at University of Belgrade, Faculty of Mathematics, module "Mathematical Logic and Theoretical Computer Science" with the paper "Application of Model Theory in the Field Theory". She has completed her PhD in 2012 at University of Belgrade, Faculty of Mathematics with the paper "Formalization of p-adic Qualitative and Conditional probablity". Since October 2004 until October 2012 she was a Teaching Assistant at University of Belgrade, Since November 2012 until September 2013 she was employed at the Mathematical Institute of Belgrade as a research assistant and from September 2013 as a research associate. Her main research area is mathematical logic, specially probability logics. Her role in the project concerns development of Knowledge reasoning techniques based on formal logic and their applications for analyzing the Block Chain protocol. She published 9 papers in refereed international journals and more than 10 papers in international conference proceedings. According to SCOPUS database, her results were cited (excluding self-citations) 19 times and her Hirsch index is 2. She was a member of the project ***"****Representations of logical structures and formal languages and their applications in computin scinces, ON 174026"* financed by the Serbian Ministry of Education, Science and Technological Development.

Selected publications:

1. **Angelina Ilić-Stepić**, Zoran OgnjanoviĹ, Logics to formalise p-adic valued probability and their applications, International Journal of Parallel, Emergent and Distributed Systems, 257-275, 2018.

2. **Angelina Ilić-Stepić**, Zoran Ognjanović, Logics for Reasoning About Processes of Thinking with Information Coded by p-adic Numbers, Studia Logica, 103, 145-174, 2015.
3. **Angelina Ilić-Stepić**, Zoran Ognjanović, Nebojša Ikodinović, Conditional p-adic probability logic, International Journal of Approximate Reasoning, 55(9), 1843-1865, 2014.
4. **Angelina Ilić-Stepić**, Zoran Ognjanović, Nebojša Ikodinović, Aleksandar Perović, A p-adic probability logic, Mathematical Logic Quarterly, vol. 58 (4-5), 263-280, 2012.
5. **Angelina Ilić-Stepić**, A Logic for Reasoning About Qualitative Probability, Publications de l'Institut Mathématique, (N.S.) 87 (101), 97-108, 2010.

Previous projects or activities, connected to the subject of this proposal:

1. Member of the Project 174026 ñRepresentations of logical structures and formal languages and their application in computingò, (2011-2019) funded by the Ministry of education, science and technological development of the Republic of Serbia
2. Participation with an accepted paper in the European Conference on Artificial Intelligence ECAI 2012 Workshop on Weighted Logics for AI, Montpellier (France), 2012, http://www.iiia.csic.es/wl4ai/programme

Šejla Dautović, (researcher), is a junior research assistant at the Mathematical Institute of the Serbian Academy of Sciences and Arts. She received her B.Sc. degree at Faculty of Mathematics, State University of Novi Pazar, in 2015. She received her M.Sc. degree at Faculty of Mathematics, State University of Novi Pazar, in 2016. She is currently PhD student at Faculty of Mathematics, University of Belgrade. She is a co-author of two papers from 2019- one paper in international conference proceeding and one paper in a journal. Her number of citations (excluding self-citations) and Hirsch index from SCOPUS are 0 and 0. She was an Organizing Committee member of international conferences- the 15th European Conference on Symbolic and Quantitative Approaches to Reasoning with Uncertainty (ECSQARU 2019, Belgrade, Serbia, September 18-20, 2019). Her research interests are: mathematical logic and its applications in computer science, artificial intelligence and uncertain reasoning. Her role in the project concerns development of Knowledge reasoning techniques based on a formal logic and their applications for analyzing the BlockChain protocol.

Selected publications:

1. **Šejla Dautović**, Dragan Doder, Probabilistic Logic for Reasoning About Actions in Time, Lecture Notes in Artificial Intelligence 11726, 385-396, 2019.

Previous projects or activities, connected to the subject of this proposal:

1. Member of the Project 174026 ñRepresentations of logical structures and formal languages and their application in computingò, (2011-2019) funded by the Ministry of education, science and technological development of the Republic of Serbia
2. Participation with an accepted paper in the 15th European Conference on Symbolic and Quantitative Approaches to Reasoning with Uncertainty ECSQARU 2019

Tatjana Jakšić Krüger (researcher) is a research associate at the Mathematical Institute of the Serbian Academy of Sciences and Arts. She has received her B.Sc. and M.Sc. degree at Faculty of Mathematics, University of Belgrade and received her Ph.D. degree in applied mathematics at the University of Novi Sad, Faculty of Technical Sciences in 2017. Her primary

research interests include population and nature-inspired meta-heuristics, their theoretical and experimental analysis and development of parallelization strategies for shared and distributed-memory systems. Current research activities she concentrated on design and development of meta-heuristic optimization methods that incorporate machine learning techniques for big data problems. She has participated in projects of digitization of cultural and scientific heritage and has helped to initialize digitization in Serbian astronomy. She has been a participant in number of domestic projects and she is the secretary for two seminars at MISANU. According to SCOPUS database, her results were cited (excluding self-citations) 20 times and her Hirsch index is 2. Her role in the project is to develop new AI-based tools for implementation and analysis of BC technology.

Selected publications:

1. Davidoviĺ, T., **Jakšić Krüger**, **T**., "Convergence Analysis of Swarm Intelligence Meta-heuristic Methods", *Proc. The 7th International Conference on Optimization Problems and Their Applications*, OPTA 2018, Omsk, Russia, July 08-14, 2018, pp. 251-266.
2. **Jakšić Kruger**, **T**., Davidoviĺ, T., Teodoroviĺ, D., Ġelmiĺ, M., "The Bee Colony Optimization Algorithm and its Convergence", International Journal of Bio-Inspired Computation, 8(5), pp. 340-354, 2016.
3. **Jakšić Krüger**, **T**., Davidoviĺ, T**., "**Sensitivity analysis of the Bee Colony Optimization Algorithm", in *Proceedings of the 7th International Conference on Bioinspired Optimization Methods and their Applications* (*BIOMA 2016*), Bled, Slovenija, Maj 18-20, 2016, pp. 64-80.
4. Saviĺ, M., Ivanoviĺ, M., Radovanoviĺ, M., Ognjanoviĺ, Z., Pejoviĺ, A., **Jakšić Krüger**, **T**., "The structure and evolution of scientific collaboration in Serbian mathematical journals", Scientometrics, 101(3), pp. 1805-1830, 2014
5. Davidoviĺ, T., **Jakšić**, **T**., Ramljak, D., Ġelmiĺ, M., Teodoroviĺ, D., "Parallelization strategies for bee colony optimization based on message passing communication protocol", Optimization, 62(8), pp. 1113-1142, 2013.

Previous projects:

1. Advanced Techniques of Cryptology, Image Processing and Computational Topology for Information Security (2011-2017).
2. Development of new information and communication technologies, based on advanced mathematical methods, with applications in medicine, telecommunications, power systems, protection of national heritage and education (2011-2019).
3. Graph theory and mathematical programming with applications to chemistry and computer science (2017-2019).

Luka Matijević, (researcher), received his bachelor's and master's degree in Computer Science at the University of Belgrade, Faculty of Mathematics. Since 2019 he has been attending doctoral studies at the Faculty of Technical Sciences, University of Novi Sad, program Mathematics in Engineering. He is employed at the Mathematical Institute of the Serbian Academy of Sciences and Arts from 2018 as a junior research assistant, where he was engaged in the project ñRepresentations of logical structures and formal languages and their application in computingò (ON 174026) financed by the Ministry of Education, Science and Technological Development. He works on several projects in the field of digitization, and he was also a member of the organizing committees for several international conferences. He published two conference papers in the field of operational research and optimization. His main fields of interest include optimization, machine learning, and bioinformatics.

Selected publications:

1. V. Ilin, **L. Matijević**, T. DavidoviĆ, P. M. Pardalos, Asymmetric Capacitated Vehicle Routing Problem with Time Window, Proc. XLV International Symposium on Operational Research SYM-OP-IS 2018, Zlatibor 16-18. September 2018, pp. 174-179. ISBN 978-86-403-1567-8

2. V. Ilin, **L. Matijević**, T. DavidoviĆ, P. M. Pardalos, General Variable Neighborhood Search for Asymmetric Vehicle Routing Problem, Proc. XLVI International Symposium on Operational Research SYM-OP-IS 2019, Kladovo 15-18. September 2019, pp. 185-190. ISBN: 978-86-7680-363-7

Đorđe Jovanović, (researcher), **),** is a junior research assistant at the Mathematical Institute of the Serbian Academy of Sciences and Arts. He received his B.Sc. degree at School of Electrical Engineering, University of Belgrade, in 2017, with the thesis *SDN-based Virtual Networks* and M.Sc. degree at the same faculty, in 2018, with the thesis *Implementation of Laboratory Environment for Software Defined Networks Using a Class of Zodiac FX Switches*. His main research interests include network security, parallel programming, optimization algorithms.

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1.2. Ethics and Security

1.2.1. Ethics

- Fill-out the Ethics issues table (Table 1.2.1).

Table 1.2.1 Ethics issues table.

1. HUMAN EMBRYOS/FOETUSES	YES/NO	PAGE
Does the proposed research involve human Embryonic Stem Cells (hESCs)?	NO	
Does your research involve the use of human embryos?	NO	
Does your research involve the use of human fetal tissues / cells?	NO	
2. HUMANS	YES/NO	PAGE
Does your research involve human participants?	NO	
Does your research involve physical interventions on the study participants?	NO	
3. HUMAN CELLS / TISSUES	YES/NO	PAGE
Does your research involve human cells or tissues (other than from Human Embryos/Fetuses)?	NO	
4. PERSONAL DATA	YES/NO	PAGE
Does your research involve personal data collection and/or processing?	NO	
Does your research involve further processing of previously collected personal data (secondary use)?	NO	
5. ANIMALS	YES/NO	PAGE
Does your research involve animals?	NO	
6. ENVIRONMENT & HEALTH and SAFETY	YES/NO	PAGE
Does your research involve the use of elements that may cause harm to the environment, to animals or plants?	NO	
Does your research deal with endangered fauna and/or flora and/or protected areas?	NO	
Does your research involve the use of elements that may cause harm to humans, including research staff?	NO	
7. DUAL USE	YES/NO	PAGE
Does your research involve items that are normally used for civilian purposes, but may have military applications or may contribute to the proliferation of weapons of mass destruction, or involve other items for which an authorization is required?	NO	
8. EXCLUSIVE FOCUS ON CIVIL APPLICATIONS	YES/NO	PAGE
Could your research raise concerns regarding the exclusive focus on civil applications?	NO	
9. MISUSE	YES/NO	PAGE
Does your research have the potential for misuse of research results?	NO	
10. OTHER ETHICS ISSUES	YES/NO	PAGE
Are there any other ethics issues that should be taken into consideration? Please specify!	NO	

If you have entered any ethics issues in the ethical issue table, please provide the relevant page number in the Project description Part A.

In addition, you must submit an ethics self-assessment[7], which:

- describes how the proposal meets the national legal and ethical requirements of the country or countries where the tasks raising ethical issues are to be carried out;

  NOT RELEVANT

- explains in detail how you intend to address the issues in the ethical issues table, in particular as regards:
  - research objectives NOT RELEVANT
  - research methodology NOT RELEVANT

- provide documents that you need under the national law (if you already have them), e.g.:
  - an ethics committee opinion; NOT RELEVANT
  - document notifying activities raising ethical issues or authorising such activities. NOT RELEVANT

If these documents are not in English, you must also submit an English summary of the documents (containing, if available, the conclusions of the committee or authority concerned).

If you plan to request these documents specifically for the project you are proposing, your request must contain an explicit reference to the project title.

If you have initiated a request for these documents, which are pending at the time of submission of your proposal, please make a reference to the authority concerned and the expected decision date.

If you have obtained/prepared any of the above documents, you should attach them as an additional documentation.

1.2.2 Security[8]

Please indicate if your project will involve activities or results raising security issues.

This may include technologies that gather or use information for surveillance, technologies, ideas, products or other outputs intended for military use, other issues pertaining to security. (YES/NO) NO

If you have answered yes, please elaborate.

[7] For more guidance, see the document "How to complete your ethics self-assessment".

[8] For more information on the classification of Information, please refer to the Horizon 2020 guidance: https://ec.europa.eu/research/participants/data/ref/h2020/other/hi/secur/h2020-hi-guide-classif_en.pdf.

Note: Mandatory Project Documentation

- **Project Description Part A and Project Description Part B**
- **Budget** (Template provided in Program documentation: both sheets need to be completed).
- **Gantt Chart** (Template provided in Program documentation).
- **Applicant Info** (Template provided in Program documentation).
- **Attachments**:
    - Declaration of Scientific and Research Organisation(s)

      Prepare a declaration of the scientific and research institution (SRO) where the PI and the members of the project team will be employed during the implementation of the Project (in Serbian) following the template available at: http://fondzanauku.gov.rs/poziv/2019/11/ai/

      The declaration should include following information:
      The SRO shall confirm that the researchers are employed in the institution, or that they will be employed, and that the institution supports the application and the proposed Project.
      The SRO shall confirm that it will provide the space and equipment specified in the proposed Project. The SRO shall confirm that it accepts the responsibilities defined in the Project Contract with the Fund.
      Note. If the PI and the members of the project team will be employed in several SROs, prepare one document for each SRO. The declaration must be signed by the official representative of the SRO.

    - Joint Statement of all project participants

      Prepare a joint statement of the scientific and research institutions (SRO) where the PI and all the members of the project team will agree on the conditions of the Public Call and the content of the proposed Project (in Serbian) following the template available at: http://fondzanauku.gov.rs/poziv/2019/11/ai/
      The statement must be signed by official representatives of the involved SROs, PI and all engaged members of the project team.

    - Proof of the paper published in an international scientific journal (M21 or M21a) in the field of artificial intelligence ï only for the Principle investigator in the Subprogram PRVI_O;
    - Proof of the participation at an international scientific conference in the field of artificial intelligence ï only for the Principle investigator in the Subprogram PRVI_P;
    - Proof of research or academic title for all members of the project team;
- **Additional documentation** (in the form of one PDF document, may be attached if needed)

*All attachments should be created and attached as a one pdf document.
*Please note that the detailed information on preparation of the project documentation, including attachments, is explained in the Instructions for submission of project proposals (in Serbian language).