

Ilić-Stepić, Angelina; Ognjanović, Zoran; Ikodinović, Nebojša; Perović, Aleksandar
A p -adic probability logic. (English) Zbl 1251.03027
Math. Log. Q. 58, No. 4-5, 263-280 (2012).

In this paper a propositional logic $\mathcal{L}_{\mathbb{Q}_p}$ is introduced which is a generalization of Khrennikov's p -adic probability theory. It is shown that $\mathcal{L}_{\mathbb{Q}_p}$ is sound and complete with respect to appropriate notions.

The first sections give background and motivation.

Thereafter, the main notions, such as $\mathcal{L}_{\mathbb{Q}_p}$ -model and the satisfiability relation, are introduced.

The main content of Section three are five axioms and six inference rules, and a short discussion of these axioms and rules is given. In the next section, soundness and strong completeness of $\mathcal{L}_{\mathbb{Q}_p}$ with respect to these axioms and rules are shown.

Section five contains decidability considerations. In the sixth and final section, the authors give their conclusions.

Reviewer: Jürgen Landes (Canterbury)

MSC:

- 03B48 Probability and inductive logic
- 03B25 Decidability of theories and sets of sentences
- 03B42 Logics of knowledge and belief (including belief change)
- 68T27 Logic in artificial intelligence

Cited in **1** Review
Cited in **6** Documents

Keywords:

probability logics; p -adic numbers; soundness; completeness

Full Text: [DOI](#)

References:

- [1] Adams, A Primer of Probability Logic, CSLI Publications Vol. 68 (1998) · [Zbl 0910.68202](#)
- [2] Albeverio, Representation of the Weyl group in spaces of square integrable functions with respect to p -adic valued Gaussian distributions, *J. Phys. A* 29 pp 5515– (1996) · [Zbl 0903.46073](#) · [doi:10.1088/0305-4470/29/17/023](#)
- [3] Albeverio, A representation of quantum field Hamiltonians in a p -adic Hilbert space, *Theor. Math. Phys* 112 (3) pp 355– (1997) · [Zbl 0968.46519](#) · [doi:10.1007/BF02583040](#)
- [4] Albeverio, Memory retrieval as p -adic dynamical system, *BioSystems* 49 pp 105– (1999) · [doi:10.1016/S0303-2647\(98\)00035-5](#)
- [5] Aref'eva, The wave function of the Universe and p -adic gravity, *Int. J. Mod. Phys. A* 6 (24) pp 4341– (1991) · [Zbl 0733.53039](#) · [doi:10.1142/S0217751X91002094](#)
- [6] De Finetti, Probability, induction and statistics, *The art of guessing*, Wiley Series in Probability and Mathematical Statistics (1972) · [Zbl 0275.60001](#)
- [7] De Grande De Kimpe, Non-Arcimedean Laplace transform, *Bull. Belg. Math. Soc* 3 pp 225– (1996) · [Zbl 0845.46047](#)
- [8] Fagin, A logic for reasoning about probabilities, *Inf. Comput* 87 (1-2) pp 78– (1990) · [Zbl 0811.03014](#) · [doi:10.1016/0890-5401\(90\)90060-U](#)
- [9] Gaifman, Concerning measures in first order calculi, *Isr. J. Math* 2 pp 1– (1964) · [Zbl 0192.03302](#) · [doi:10.1007/BF02759729](#)
- [10] H. Gaifman 275 292
- [11] Hájek, *The Blackwell Guide to Philosophical Logic*, Blackwell Philosophy Guides pp 362– (2001) · [Zbl 0983.03001](#)
- [12] Hensel, Über eine neue Begründung der Theorie der algebraischen Zahlen, *Jahresber. Dtsch. Math.-Ver* 6 (3) pp 83– (1897) · [Zbl 30.0096.03](#)
- [13] N. Ikodinović M. Rašković Z. Marković Z. Ognjanović 128 138
- [14] Keisler, Probability quantifiers, in *Model Theoretic Logics, Perspectives in Mathematical Logic* pp 509– (1985)
- [15] Keisler, A completeness proof for adapted probability logic, *Ann. Pure Appl. Log* 31 pp 61– (1986) · [Zbl 0601.03004](#) · [doi:10.1016/0168-0072\(86\)90062-X](#)

- [16] Keisler, Hyperfinite models of adapted probability logic, *Ann. Pure Appl. Log* 31 pp 71– (1986) · [Zbl 0601.03005](#) · [doi:10.1016/0168-0072\(86\)90063-1](#)
- [17] Keynes, *A Treatise on probability* (1921)
- [18] Khrennikov, Mathematical methods of the Non-Archimedean physics, *Usp. Mat. Nauk* 45 (4) pp 79– (1990) · [Zbl 0722.46040](#)
- [19] Khrennikov, *Interpretations of probability*, second edition (2009) · [Zbl 1369.81014](#) · [doi:10.1515/9783110213195](#)
- [20] Khrennikov, p-adic valued distributions in mathematical physics, *Mathematics and Its Applications* Vol. 309 (1994) · [doi:10.1007/978-94-015-8356-5](#)
- [21] Khrennikov, p-adic probability interpretation of Bell's inequality, *Phys. Lett. A* 200 (3-4) pp 219– (1995) · [Zbl 1020.81534](#) · [doi:10.1016/0375-9601\(95\)00163-W](#)
- [22] Khrennikov, Non-Archimedean analysis: quantum paradoxes, dynamical systems and biological models, *Mathematics and Its Applications* (1997) · [Zbl 0920.11087](#) · [doi:10.1007/978-94-009-1483-4](#)
- [23] Khrennikov, p-adic discrete dynamical systems and collective behaviour of information states in cognitive models, *Discrete Dyn. Nat. Soc* 5 pp 59– · [Zbl 1229.37128](#) · [doi:10.1155/S1026022600000406](#)
- [24] Khrennikov, Toward theory of p-adic valued probabilities, *Stud. Log. Gramm. Rhetor* 14 (27) pp 137– (2008)
- [25] Kyburg, *Uncertain Inference* (2001) · [Zbl 1023.03002](#) · [doi:10.1017/CBO9780511612947](#)
- [26] Lehmann, What does a conditional knowledge base entail, *Artif. Intell* 55 pp 1– (1992) · [Zbl 0762.68057](#) · [doi:10.1016/0004-3702\(92\)90041-U](#)
- [27] Macintyre, *Logic Colloquium '84*, Proceedings of the colloquium held at the University of Manchester, Manchester, July 15-24, 1984, *Studies in Logic and the Foundations of Mathematics* pp 121– (1986)
- [28] Marković, *Math. Log. Q* 49 (4) pp 415– (2003) · [Zbl 1022.03011](#) · [doi:10.1002/malq.200310044](#)
- [29] Milošević, A propositional p-adic probability logic, *Publ. Inst. Math. (Beogr.)* 87 (101) pp 75– (2010) · [Zbl 1265.03011](#) · [doi:10.2298/PIM1001075M](#)
- [30] Nilsson, Probabilistic logic, *Artif. Intell* 28 pp 71– (1986) · [Zbl 0589.03007](#) · [doi:10.1016/0004-3702\(86\)90031-7](#)
- [31] Ognjanović, A logic with higher order probabilities, *Publ. Inst. Math. (Beogr.)* 60 (74) pp 1– (1996) · [Zbl 1009.03513](#)
- [32] Ognjanović, *Theor. Comput. Sci* 247 (1-2) pp 191– (2000) · [Zbl 0954.03024](#) · [doi:10.1016/S0304-3975\(98\)00341-7](#)
- [33] Ognjanović, Completeness Theorem for a Logic with imprecise and conditional probabilities, *Publ. Inst. Math. (Beogr.)* 78 (92) pp 35– (2005) · [Zbl 1144.03019](#) · [doi:10.2298/PIM0578035O](#)
- [34] Ognjanović, A logic with higher order conditional probabilities, *Publ. Inst. Math. (Beogr.)* 82 (96) pp 141– (2007) · [Zbl 1203.68206](#) · [doi:10.2298/PIM0796141O](#)
- [35] Ognjanović, Probability logics, *Zb. Rad. Beogr* 12 (20) pp 35– (2009)
- [36] Paris, *The uncertain reasoner's companion: a mathematical perspective*, Cambridge Tracts in Theoretical Computer Science (1994) · [Zbl 0838.68104](#)
- [37] Paris, Proof systems for probabilistic uncertain reasoning, *J. Symb. Log* 63 (3) pp 1007– (1998) · [Zbl 0918.03015](#) · [doi:10.2307/2586724](#)
- [38] Rašković, Classical logic with some probability operators, *Publ. Inst. Math. (Beogr.)* 53 (67) pp 1– (1993)
- [39] Rašković, A first order probability logic LPQ, *Publ. Inst. Math. (Beogr.)* 65 (79) pp 1– (1999)
- [40] Rašković, A logic with approximate conditional probabilities that can model default reasoning, *Int. J. Approx. Reasoning* 49 (1) pp 52– (2008) · [Zbl 1184.68520](#) · [doi:10.1016/j.ijar.2007.08.006](#)
- [41] Schikhof, *Ultrametric calculus. An introduction to p-adic analysis*, Cambridge Studies in Advanced Mathematics (1984) · [Zbl 0553.26006](#)
- [42] Scott, Aspects of inductive logic pp 219– (1966) · [doi:10.1016/S0049-237X\(08\)71672-0](#)
- [43] van der Hoek, Some considerations on the logic PFD: a logic combining modality and probability, *J. Appl. Non-Class. Log* 7 (3) pp 287– (1997) · [Zbl 0885.03022](#) · [doi:10.1080/11663081.1997.10510916](#)
- [44] Vladimirov, The spectral theory in the p-adic quantum mechanics, *Izv. Akad. Nauk SSSR Ser. Mat* 54 (2) pp 275– (1990)
- [45] Williamson, *Handbook of the Logic of Argument and Inference: the Turn Toward the Practical* pp 397– (2002) · [doi:10.1016/S1570-2464\(02\)80011-8](#)

This reference list is based on information provided by the publisher or from digital mathematics libraries. Its items are heuristically matched to zbMATH identifiers and may contain data conversion errors. It attempts to reflect the references listed in the original paper as accurately as possible without claiming the completeness or perfect precision of the matching.