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INFINITE-VALUED FIRST-ORDER ŁUKASIEWICZ LOGIC: HYPERSEQUENT CALCULI WITHOUT STRUCTURAL RULES AND PROOF SEARCH FOR SENTENCES IN THE PRENEX FORM

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The rational first-order Pavelka logic is an expansion of the infinite-valued first-order Łukasiewicz logic Ł∀ by truth constants. For this logic, we introduce a cumulative hypersequent calculus G^1Ł∀ and a noncumulative hypersequent calculus G^2Ł∀ without structural inference rules. We compare these calculi with the Baaz–Metcalfe hypersequent calculus GŁ∀ with structural rules. In particular, we show that every GŁ∀-provable sentence is G^1Ł∀-provable and a Ł∀-sentence in the prenex form is GŁ∀-provable if and only if it is G^2Ł∀-provable. For a tableau version of the calculus G^2Ł∀, we describe a family of proof search algorithms that allow us to construct a proof of each G^2Ł∀-provable sentence in the prenex form.

Key words and phrases: infinite-valued first-order Łukasiewicz logic, fuzzy logic, rational first-order Pavelka logic, hypersequent calculus, proof search algorithm.

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