also use our results to build models with no P-points and with arbitrarily large continuum, which was also an open question. These results were obtained with David Chodounský.

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KLEIDSON ÊGLICIO CARVALHO DA SILVA OLIVEIRA, ***Paraconsistent Logic Programming in Three and Four-Valued Logics***, University of Campinas, Brazil, 2017. Supervised by Marcelo Esteban Coniglio. MSC: 03B53. Keywords: Logic programming, Paraconsistent logic, Many-valued logics.

Abstract

From the interaction among areas such as Computer Science, Formal Logic, and Automated Deduction arises an important new subject called Logic Programming. This has been used continuously in the theoretical study and practical applications in various fields of Artificial Intelligence. After the emergence of a wide variety of non-classical logics and the understanding of the limitations presented by first-order classical logic, it became necessary to consider logic programming based on other types of reasoning in addition to classical reasoning. A type of reasoning that has been well studied is the paraconsistent, that is, the reasoning that tolerates contradictions. However, although there are many paraconsistent logics with different types of semantics, their application to logic programming is more delicate than it first appears, requiring an in-depth study of what can or cannot be transferred directly from classical first-order logic to other types of logic.

Based on studies of Tarcisio Rodrigues on the foundations of Paraconsistent Logic Programming (2010) for some Logics of Formal Inconsistency (**LFI**s), this thesis intends to resume the research of Rodrigues and place it in the specific context of **LFI**s with three- and four-valued semantics. This kind of logics are interesting from the computational point of view, as presented by Luiz Silvestrini in his Ph.D. thesis entitled “A new approach to the concept of quase-truth” (2011), and by Marcelo Coniglio and Martín Figallo in the article “Hilbert-style presentations of two logics associated to tetravalent modal algebras” [***Studia Logica*** (2012)]. Based on original techniques, this study aims to define well-founded systems of paraconsistent logic programming based on well-known logics, in contrast to the *ad hoc* approaches to this question found in the literature.

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ANA CLAUDIA DE JESUS GOLZIO, ***Non-Deterministic Matrices: Theory and Applications to Algebraic Semantics***, University of Campinas, Brazil, 2017. Supervised by Marcelo Esteban Coniglio. MSC: 03G27. Keywords: Algebraic logic, Non-classical logic, Multialgebras, Non-deterministic semantics, Universal algebra, Category theory.

Abstract

We call multioperation any operation that return for even argument a set of values instead of a single value. Through multioperations we can define an algebraic structure equipped with at least one multioperation. This kind of structure is called multialgebra. The study of them began in 1934 with the publication of a paper of Marty. In the realm of Logic, multialgebras were considered by Avron and his collaborators under the name

https://doi.org/10.1017/bsl.2021.35 Published online by Cambridge University Press

of non-deterministic matrices (or Nmatrices) and used as semantics tool for characterizing some logics which cannot be characterized by a single finite matrix. Carnielli and Coniglio introduced the semantics of swap structures for **LFI**s (Logics of Formal Inconsistency), which are Nmatrices defined over triples in a Boolean algebra, generalizing Avron's semantics. In this thesis, we will introduce a new method of algebraization of logics based on multialgebras and swap structures that is similar to classical algebraization method of Lindenbaum-Tarski, but more extensive because it can be applied to systems such that some operators are non-congruential. In particular, this method will be applied to a family of non-normal modal logics and to some **LFI**s that are not algebraizable by the very general techniques introduced by Blok and Pigozzi. We also will obtain representation theorems for some **LFI**s and we will prove that, within out approach, the classes of swap structures for some axiomatic extensions of **mbC** are a subclass of the class of swap structures for the logic **mbC**.

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RENÉ GAZZARI, ***Formal Theories of Occurrences and Substitutions***, University of Tübingen, Germany, 2020. Supervised by Peter Schroeder-Heister and Reinhard Kahle. MSC: 03F03, 00A30, 03F07. Keywords: Occurrence, substitution, substitution function.

Abstract

Gazzari provides a mathematical theory of occurrences and of substitutions, which are a generalisation of occurrences constituting substitution functions. The dissertation focusses on term occurrences in terms of a first order language, but the methods and results obtained there can easily be carried over to arbitrary kinds of occurrences in arbitrary kinds of languages.

The aim of the dissertation is twofold: first, Gazzari intends to provide an adequate formal representation of philosophically relevant concepts (not only of occurrences and substitutions, but also of substitution functions, of calculations as well as of intuitively given properties of the discussed entities) and to improve this way our understanding of these concepts; second, he intends to provide a formal exploration of the introduced concepts including the detailed development of the methods needed for their adequate treatment.

The dissertation serves as a methodological fundament for consecutive research on topics demanding a precise treatment of occurrences and as a foundation for all scientific work dealing with occurrences only informally; the formal investigations are complemented by a brief survey of the development of the notion of occurrences in mathematics, philosophy and computer science.

The notion of occurrences. Occurrences are determined by three aspects: an occurrence is always an occurrence *of* a syntactic entity (its *shape*) *in* a syntactic entity (its *context*) *at* a specific *position*. Context and shape can be any meaningful combination of well-known syntactic entities as, in logic, terms, formulae or formula trees. Gazzari's crucial idea is to represent the position of occurrences by *nominal forms*, essentially as introduced by Schütte [2]. The nominal forms are a generalisation of standard syntactic entities in which so called *nominal symbols* $*_k$ may occur. The position of an occurrence is obtained by eliminating the intended shape in the context, which means to replace the intended shape by suitable nominal symbols.

Standard occurrences. Central tool of the theory of nominal terms (nominal forms generalising standard terms) is the *general substitution function* mapping a nominal term $\mathtt{t}$ and a sequence $\vec{\mathtt{t}}$ of them to the result $\mathtt{t}[\vec{\mathtt{t}}]$ of replacing simultaneously the