Part of the case for these theories' joint truth relies on defences of the following metaphysical theses: (i) *Thorough Serious Actualism*, the thesis that no things could have been related while being nothing, and (ii) *Higher-Order Necessitism*, the thesis that necessarily, every higher-order entity is necessarily something. It is shown that *Thorough Serious Actualism* and *Higher-Order Necessitism* are both implicit commitments of very weak logical theories. The defence of *Higher-Order Necessitism* constitutes a powerful challenge to Stalnaker's [2] *Thorough Contingentism*, a theory committed to, among other things, the view that there could have been some individuals as well as some entities of any higher-order that could have been nothing.

In the dissertation it is argued that *Plantingan Moderate Contingentism* and *Williamsonian Thorough Necessitism* are in fact equivalent, even if they appear to be jointly inconsistent. The case for this claim relies on the *Synonymy account*, a novel account of theory equivalence developed and defended in the dissertation. According to this account, theories are equivalent just in case they have the same commitments and conception of logical space.

By way of defending the *Synonymy account*'s adequacy, the account is applied to the debate between noneists, proponents of the view that some things do not exist, and Quineans, proponents of the view that to exist just is to be some thing. The *Synonymy account* is shown to afford a more nuanced and better understanding of that debate by revealing that what noneists and Quineans are really disagreeing about is what expressive resources are available to appropriately describe the world.

By coupling a metatheoretical result with tools from the philosophy of language, it is argued that *Plantingan Moderate Contingentism* and *Williamsonian Thorough Necessitism* are synonymous theories, and so, by the lights of the *Synonymy account*, equivalent. Given the defence of their extant commitments made in the dissertation, it is concluded that *Plantingan Moderate Contingentism* and *Williamsonian Thorough Necessitism* are both correct. A corollary of this result is that the dispute between Plantingans and Williamsonians is, in an important sense, merely verbal. For if two theories are equivalent, then they "require the same of the world for their truth."

Thus, the results of the dissertation reveal that if one speaks as a Plantingan while advocating *Plantingan Moderate Contingentism*, or as a Williamsonian while advocating *Williamsonian Thorough Necessitism*, then one will not go wrong. Notwithstanding, one will still go wrong if one speaks as a Plantingan while advocating *Williamsonian Thorough Necessitism*, or as a Williamsonian while advocating *Plantingan Moderate Contingentism*.

On the basis of a conception of the individual constants and predicates of second-order modal languages as *strongly Millian*, i.e., as having *actually* existing entities as their semantic values, in the appendix are presented second-order modal logics consistent with Stalnaker's *Thorough Contingentism*. Furthermore, it is shown there that these logics are strong enough for applications of higher-order modal logic in mathematics, a result that constitutes a reply to an argument to the contrary by Williamson [3]. Finally, these logics are proven to be complete relative to particular "thoroughly contingentist" classes of models.

[1] A. Plantinga, ***The Nature of Necessity***, Oxford University Press, Oxford, 1974.

[2] R. Stalnaker, ***Mere Possibilities: Metaphysical Foundations of Modal Semantics***, Princeton University Press, Princeton, 2012.

[3] T. Williamson, ***Modal Logic as Metaphysics***, Oxford University Press, Oxford, 2013.

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Yong Liu, ***The Structure of d.r.e. Degrees***, National University of Singapore, Singapore, 2017. Supervised by Yue Yang. MSC: 03D28, 03D55. Keywords: Turing degree, d.r.e. degree, lattice embedding.

Abstract

This dissertation is highly motivated by d.r.e. Nondensity Theorem, which is interesting in two perspectives. One is that it contrasts Sacks Density Theorem, and hence shows that the structures of r.e. degrees and d.r.e. degrees are different. The other is to investigate what other properties a maximal degree can have.

In Chapter 1, we briefly review the backgrounds of Recursion Theory which motivate the topics of this dissertation.

In Chapter 2, we introduce the notion of (m,n)-cupping degree. It is closely related to the notion of maximal d.r.e. degree. In fact, a $(2,2)$-cupping degree is maximal d.r.e. degree. We then prove that there exists an isolated $(2,\omega)$-cupping degree by combining strategies for maximality and isolation with some efforts.

Chapter 3 is part of a joint project with Steffen Lempp, Yiqun Liu, Keng Meng Ng, Cheng Peng, and Guohua Wu. In this chapter, we prove that any finite boolean algebra can be embedded into d.r.e. degrees as a final segment. We examine the proof of d.r.e. Nondensity Theorem and make developments to the technique to make it work for our theorem. The goal of the project is to see what lattice can be embedded into d.r.e. degrees as a final segment, as we observe that the technique has potential be developed further to produce other interesting results.

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Patrick Lutz. ***Results on Martin's Conjecture***, University of California, Berkeley, CA, USA, 2021. Supervised by Theodore Slaman. MSC: 03D28, 03D30, 03E60, 03D55. Keywords: computability, Turing degrees, determinacy, Martin's conjecture, Rudin-Keisler order, countable Borel equivalence relations.

Abstract

Martin's conjecture is an attempt to classify the behavior of all definable functions on the Turing degrees under strong set theoretic hypotheses. Very roughly it says that every such function is either eventually constant, eventually equal to the identity function or eventually equal to a transfinite iterate of the Turing jump. It is typically divided into two parts: the first part states that every function is either eventually constant or eventually above the identity function and the second part states that every function which is above the identity is eventually equal to a transfinite iterate of the jump. If true, it would provide an explanation for the unique role of the Turing jump in computability theory and rule out many types of constructions on the Turing degrees.

In this thesis, we will introduce a few tools which we use to prove several cases of Martin's conjecture. It turns out that both these tools and these results on Martin's conjecture have some interesting consequences both for Martin's conjecture and for a few related topics.

The main tool that we introduce is a basis theorem for perfect sets, improving a theorem due to Groszek and Slaman. We also introduce a general framework for proving certain special cases of Martin's conjecture which unifies a few pre-existing proofs. We will use these tools to prove three main results about Martin's conjecture: that it holds for regressive functions on the hyperarithmetic degrees (answering a question of Slaman and Steel), that part 1 holds for order preserving functions on the Turing degrees, and that part 1 holds for a class of functions that we introduce, called measure preserving functions.

This last result has several interesting consequences for the study of Martin's conjecture. In particular, it shows that part 1 of Martin's conjecture is equivalent to a statement about the Rudin-Keisler order on ultrafilters on the Turing degrees. This suggests several possible strategies for working on part 1 of Martin's conjecture, which we will discuss.

The basis theorem that we use to prove these results also has some applications outside of Martin's conjecture. We will use it to prove a few theorems related to Sacks' question about whether it is provable in ZFC that every locally countable partial order of size continuum