Introduction to Categorical Logic

80-514/814

Suggested Topics for Student Projects

Updated: March 17, 2022

1. Lawvere Duality
    - Adamek, Lawvere, Rosicky: On the duality between varieties and algebraic theories, Algebra Universalis, 2003.
    - Adamek, Rosicky, Vitale: Algebraic theories, Cambridge University Press, 2010.
2. Gabriel-Ulmer duality
    - Makkai, Pitts, Some results on locally finitely presentable categories, Transactions of the AMS 1987.
    - Adamek, Rosicky, Vitale: Algebraic theories, Cambridge University Press, 2010.
3. Stone-type duality for distributive lattices and Heyting algebras
    - P.T. Johnstone, Stone Spaces, Cambridge University Press, 1982.
    - M. Makkai and G. Reyes, Completeness results for intuitionistic and modal logic in a categorical setting, Annals of Pure and Applied Logic, Volume 72, Issue 1, 10 March 1995, Pages 25–101
4. Exact categories / exact completions
    - Carboni and Vitali, Regular and exact completions, Journal of Pure and Applied Algebra, March 1998, pp. 79–116.

- Carboni and Rosolini, Locally cartesian closed exact completions, Journal of Pure and Applied Algebra, December 2000, pp. 103–116.

5. Hyperdoctrines

   - F.W. Lawvere, Equality in hyperdoctrines and comprehension schema as an adjoint functor, Proceedings of the AMS Symposium on Pure Mathematics XVII (1970), 1–14.
   - R.A.G. Seely, Hyperdoctrines, natural deduction, and the Beck condition, Zeitschrift für math. Logik und Grundlagen der Math., Band 29, 505–542 (1983).

6. Bi-Heyting logic

   - F.W. Lawvere, Intrinsic Co-Heyting Boundaries and the Leibniz Rule in Certain Toposes, in A. Carboni, M. Pedicchio, G. Rosolini (eds.), Category Theory - Como 1990, LNM 1488 Springer Heidelberg 1991.
   - Gonzalo E. Reyes, Houman Zolfaghari, Bi-Heyting Algebras, Toposes and Modalities, J. Phi. Logic 25 (1996) pp. 25–43.

7. Joyal's embedding theorem

   - M. Makkai and G. Reyes, Completeness results for intuitionistic and modal logic in a categorical setting, Annals of Pure and Applied Logic, Volume 72, Issue 1, 10 March 1995, Pages 25–101

8. Set-valued completeness for regular theories, classical completeness for Boolean theories:

   - P.T. Johnstone, Sketches of an Elephant, section D1.5.

9. Lambda-calculus and CCCs

   - D.S. Scott. Relating theories of the λ-calculus. In R. Hindley and J. Seldin, editors, To H.B. Curry: Essays in Combinatory Logic, Lambda Calculus and Formalisms, pp. 403–450. Academic Press, 1980.

- D.S. Scott, Lambda Calculus: Some Models, Some Philosophy, Studies in Logic and the Foundations of Mathematics, Volume 101, 1980, pp. 223–265
- S. Awodey, Topological representation of the λ-calculus, Math. Struct. in Comp. Science, 2000.

10. Dependent type theory and LCCC (locally cartesian closed categories):

    - R. A. G. Seely. Locally cartesian closed categories and type theory. Math. Proc. Camb. Phil. Soc., 95:33-48, 1984.
    - S. Awodey and F. Rabe, Kripke Semantics for Martin-Löf's Extensional Type Theory, Log. Methods Comput. Sci., 2011.
    - S. Awodey, N. Gambino, S. Hazratpour, Kripke-Joyal forcing for type theory and uniform fibrations, arXiv:2110.14576.

11. Modal Logic

    - S. Awodey and K. Kishida, Topology and Modality: The Topological Interpretation of First-Order Modal Logic, Review of Symbolic Logic, 2008.
    - Modal Logic Project notes

12. Some more topics:

    - sheaves for a Grothendieck topology
    - HOL and toposes
    - Diaconescu cover
    - Kripke completeness of IFOL
    - algebraic models of IFOL
    - gluing for IHOL