

To Do List

December 4, 2023

This chapter contains some material about relations and constructions with them. Notably, we discuss and explore:

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1 Notes to Self

1.1 Things To Ask On MO/Zulip

REMARK 1.1.1 ► THINGS TO ASK ON MO/ZULIP

Here is a list of things to be asked on MO/Zulip.

1. What are
 - (a) Cartesian bicategories
 - (b) Double categories of relations (<https://arxiv.org/abs/2107.07621>)
 - (c) Categories of relations

(d) Allegories

(e) 1-Category equipped with relations (<https://ncatlab.org/nlab/show/1-category+equipped+with+relations>)

good for? What have these notions been developed for, why are they important, and what have they lead to?

1.2 Things To Explore

REMARK 1.2.1 ► THINGS TO EXPLORE

Here is a list of things to be explored.

1. internal adjunctions in \mathbf{Mod} as in [Y21, Section 6.3]; see [Y21, Example 6.2.6].
2. write the “profunctors” equivalent of the relations chapter
3. change χ_B notation throughout the notes
4. maybe note that skew monoidal structures on $\mathbf{Rel}(A, B)$ satisfy coherence trivially since the 2-morphisms are inclusions
5. reconsider notation $\mathbf{FreeAlg}_{\mathcal{P}}$ in [Relations](#)
6. Constructions With Sets: Isbell duality for powersets
7. Categories: comma category notation as in <https://mathoverflow.net/questions/455630>
8. Universal property of the bicategory of spans, <https://ncatlab.org/nlab/show/span>
9. Codensity monad $\mathbf{Ran}_J(J)$ of a relation (What about $\mathbf{Rift}_J(J)$?)
10. Relative comonads in \mathbf{Rel} .
11. Write proper sections on straightening for lax functors from sets to \mathbf{Rel} or \mathbf{Span} (displayed sets) when I study the corresponding notions for categories
12. Write about cospans.

13. CoCartesian fibration classifying $\mathrm{Fun}(F, G)$, <https://mathoverflow.net/questions/457533/cocartesian-fibration-classifying-mathrmfunf-g>

1.3 Omitted Proofs To Add

Не так благотворна истина, как
зловредна ее видимость.

Даниил Данковский

Truth does not do as much good in the
world as the appearance of truth does evil.

Daniil Dankovsky

REMARK 1.3.1 ► PROOFS TO ADD

Here is a list of omitted proofs that I want to eventually write up or add a reference to.

- [Relations](#), Item 1 of [Proposition 2.5.1](#)
- [Relations](#), Item 2 of [Proposition 2.5.1](#)
- [Relations](#), Item 9 of [Proposition 2.5.1](#)
- [Relations](#), Item 10 of [Proposition 2.5.1](#)

Appendices

A Other Chapters

Set Theory

1. [Sets](#)
2. [Constructions With Sets](#)
3. [Pointed Sets](#)
4. [Tensor Products of Pointed Sets](#)
5. [Indexed and Fibred Sets](#)

6. [Relations](#)

7. [Spans](#)

8. [Posets](#)

Category Theory

9. [Categories](#)

10. [Constructions With Categories](#)

11. Kan Extensions

Bicategories

12. Bicategories

13. Internal Adjunctions

Internal Category Theory

14. Internal Categories

Cyclic Stuff

15. The Cycle Category

Cubical Stuff

16. The Cube Category

Globular Stuff

17. The Globe Category

Cellular Stuff

18. The Cell Category

Monoids

19. Monoids

20. Constructions With Monoids

Monoids With Zero

21. Monoids With Zero

22. Constructions With Monoids With Zero

Groups

23. Groups

24. Constructions With Groups

Hyper Algebra

25. Hypermonoids

26. Hypergroups

27. Hypersemirings and Hyperrings

28. Quantaes

Near-Rings

29. Near-Semirings

30. Near-Rings

Real Analysis

31. Real Analysis in One Variable

32. Real Analysis in Several Variables

Measure Theory

33. Measurable Spaces

34. Measures and Integration

Probability Theory

34. Probability Theory

Stochastic Analysis

35. Stochastic Processes, Martingales, and Brownian Motion

36. Itô Calculus

37. Stochastic Differential Equations

Differential Geometry

38. Topological and Smooth Manifolds

Schemes

39. Schemes