To Do List

December 4, 2023

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

Contents

1 Notes to Self

1.1 Things To Ask On MO/Zulip

Remark 1.1.1.1. 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 1.2.1.1. Here is a list of things to be explored.

1. internal adjunctions in Mod as in [JY21, Section 6.3]; see [JY21, 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 $\mathsf{FreeAlg}_{\mathcal{P}}$ 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 $\mathrm{Ran}_J(J)$ of a relation (What about $\mathrm{Rift}_J(J)$?)
10. Relative *co*monads in **Rel**.
11. Write proper sections on straightening for lax functors from sets to Rel or Span (displayed sets) when I study the corresponding notions for categories
12. Write about cospans.
13. CoCartesian fibration classifying $\mathsf{Fun}(F, G)$, https://mathoverflow.net/questions/457533/cocartesian-fibration-classifying-mathrmfun-f-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 1.3.1.1. Here is a list of omitted proofs that I want to eventually write up or add a reference to.

- Relations, Item 1 of Proposition 2.5.1.1
- Relations, Item 2 of Proposition 2.5.1.1
- Relations, Item 9 of Proposition 2.5.1.1
- Relations, Item 10 of Proposition 2.5.1.1

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