Meetings with Anthony: Notes

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Summer 2025

Meeting 1 **Monday, April 28**

TODO (from memory :0)

Meeting 2 **Wednesday, May 14**

TODO (memory again :0)

Meeting 3 **Tuesday, May 27**

Topics Discussed ⊕ Things Learned ⊕ Mentioned

- discussed some of my proofs, I should do case analysis on **infer** $\Gamma\, T_1$ and rewrite hypotheses in the opposite direction for `Typing` proofs (walked through `Valid.unique` today)
- briefly went over dependent type theory, Curry–Howard correspondence, proof objects for $\wedge$, $\vee$, $\to$
- Anthony recommended me the first chapter of the "Homotopy Type Theory" book (I can learn about the things Lean abstracts away/low level type theory)
- learned how to rewrite the `bind_pure` proof, correct the use of the `Rose.rec` induction principle and `List.map_nil` and `List.map_cons` cases
- constructing evidence for function types, conjunctions, disjunctions and normalization in equality checking
- (to be self-studied) why continuity arises in probabilistic semantics + an outline of constructing ω-chains for recursive domain equations

What We Did

- walked through `Syntax.lean` proofs that were done, some advice on readability for example using `congr` with step size so that we can debug it easier in case we change other proofs
- learned how to use `specialize` to collapse the proof (`->`) adds a new hypothesis with the same name `h := h` $\texttt{a}_1$ `...` $\texttt{a}_n$ and tries to clear the previous one
- Anthony committed updates to the repo today:
  - `gen_type` and `simplify` hints
  - better QTerm.map compute proof
  - simplification rules for genType and thunkType

Next Steps

- I should commit my completed proofs for `Syntax.lean` (update: just commited!) + finish the couple remaining ones (should be done by the end of the week)
- maybe start looking into formalizing ω-chain limits for domain equations and prove semantic lemmas (continuity of projection maps)
- for semantics: define syntax-to-domain interpretation and verify equational properties (basic probabilistic and laws shrinking laws for generators)
- I should do manual practice with main tactics
- hopefully discuss recurring meetings on Tuesdays (5/6 PM) since it seems to work for both of us