Internship at IRIF: Daily journal

# 14/03/2**2 – 25/03/22**

- Went through chapters 1 to 4.4 of the « Duality book » curently being written by Sam and M. Gehrke. Practised on a lot of exercises. Got to a deep understanding of all the dualities explained in the book – I believe. This took most of my time, although there is not a lot to say about it.

- Attended a seminar on automata (more game theory, actually). Felt more like a quick presentation of a research topic, by a researcher to other researchers who have studied the subjects. Did not motivate me to attend other seminars, unless they touch a subject I am close to.

- Attended a couple Coq working sessions with Sam, Vincent, and Sam’s collegue Hugo. Quite stimulating, but too much time-consuming as I practised Coq on the weekend, trying to focus on my actual subject during the week. I do not think I will attend the next, but I am happy nevertheless that I could handle the proof langage a bit, might serve me in the future. Were I to go back to it, I should try to learn automated tactics.

# 28/03/22 – 01/04/22

Went back to the proof of completeness of the « LTL paper » by Sam and S. Ghilardi. More easily understandable after all the work on duality. On Sam’s advice, used LaTeX for the first time to produce my own proof of Theorem 3.5 in this paper, using all I have learnt from the Duality book to give my own view of the proof, although it is close to what was done originally. Took a bit of time; less productive week. Understood the end of the proof, broadly speaking. Exceptionally took a day off on Friday.

# 04/04/22

- Learnt basics of BibLaTeX, and used them to update and correct my mini-article. Created my GitLab repo, and began writing this (hopefully daily) internship diary. Goal will be to occasionally write in LaTeX, to facilitate my work on the report this summer (Sam’s advice).

- Appointment with Sam, went through details of the proof in the « LTL paper ». Still, proof of (Con) and (Dum) is hard to grasp, should spend time on this next time. I understand better the idea of the proof of Lemma 3.9, with the idea of simulation (sigma), also that of « balloon » and the use of the linear order for the proof. Should spend time doing proof of Claim 1 again, especially point (viii). Useful notion of intended semantics (integers for LTL) and idealized semantics (the Boolean Algebra, or the space, for LTL).

# 05/04/22

- Morning: proof of (Con). Did not get to proof of (Dum) and linearity entirely, but it is not too bad. Began going through proofs in claim 1.

- Afternoon: finished going through proof of Claim 1, did everything myself again. Then, understood the construction of the surjective simulation, and proof of Claim 2 (for the most part). I think I should not spend more time on this paper, as the details take time but are not really related to the topic. For example, the proof of a few points in Claim 2 is just technical but not very interesting. Now I can say I get the whole path that the proof undertakes. The difficulty is that the proofs are not trivial to me (e.g. (Dum) axiom or point (vii) in Claim 1), even with a good understanding of what the orders mean. Next time: go back to the paper on binary trees to understand the definitions well fore going too deep. Maybe look at the global scheme of the proof. Sam said this paper could take time to understand.