PRBX Reflections

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Project: “A Formal Requirements Engineering Toolkit”
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1 Reflections on Project Specification

The allocated project was self-defined. It posed the Research Question (RQ) of whether a first-order logic inference engine could be realistically combined with industry-standard tooling (production of audit logs, lifecycle traceability, cross-platform front-end GUIs, etc.) to build a requirements management system for aggregating and analysing formal system requirements. To answer the RQ, the described system was to be designed, implemented, tested, and evaluated against a set of product requirements enumerated at the time of project allocation.

These product requirements did not change from the initial project proposal, which categorised requirements into four groups:

1. Graphical front-end allowing the specification, organisation, and manipulation of user-defined system requirements, with formal requirement semantics expressed in first-order logic.
2. Capability for automated inference over the knowledge base of defined requirements, wherein the users may query the mutual consistency of project requirements, and also the consistency of arbitrary query expressions.
3. Capability for automated inference over the knowledge base of defined requirements, wherein the users may query the mutual consistency of project requirements, and also the consistency of arbitrary query expressions.
4. Capability for production of audit logs, or human-readable reports, based on defined requirements and results of queried deductions.

A full index of requirements can be found in the dissertation report in which each category is further segregated into a number of functional requirements.

Overall, the project requirements were met to completion. Four functional requirements specified in the dissertation were not met, but due to the use of the Spiral lifecycle, de-scoped components were not highly desirable and did not materially impact the ability to fully evaluate the product. The dissertation enumerates each of the four unmet requirements and provides a detailed justification for its exclusion from the submitted product.

In particular, integration with unit-testing was completed only for Google Test backends, despite the original plan indicating support for J-Unit and other testing and mocking frameworks. Production of HTML was also de-scoped to allow focus on LaTeX/PDF document production, and graphical deduction traces were not included in the reports due to complications with issuing Ti*k*Z from the application’s intermediary representation of proofs.

Finally, low-risk optional components of the application were not covered with unit-testing, as the available time was allocated to constructing and verifying tests for medium-risk and higher-risk subsystems.

2 Professional Skills Development

The software artefact was developed on a part-time commitment from November 2024 to April 2026, while the dissertation was completed between January and April 2026. During these periods of time, I developed a range of soft and hard skills that will undoubtedly contribute positively to my future career.

Beginning the design and implementation work long prior to the PRBX start date was a conscious decision: I knew that I wanted to undertake a substantially larger project than would be possible in two academic semesters for an undergraduate with minimal research experience. Due to the long-term approach, the principal skill that I felt was improved is time management.

Work on the project took place alongside a full-time job whilst on placement; the placement work occurred on-site Monday to Friday, often 6am to 5pm (sometimes later), and so project work was relegated to evenings and weekends. Maintaining this schedule for an entire year took substantial commitment and planning, which is a skill I believed that I lacked prior to 2024.

Given the scale of the project, and myself as the sole developer, I took complete responsibility for the project and its progression. During the course of development, a significant number of technical issues were encountered which required radical changes to the software architecture and re-engineering of dependent components. In one instance, during integration testing of the persistence capability (originally backed with a PostgreSQL database), it became apparent that efficient storage of data in a relational model would require a far more complex schema that initially envisioned: the C++ object model would have to be overhauled to support the relational model. As a result, I took the decision to re-organise the project priorities, which culminated in removing persistence from the project scope and focusing on the theorem-proving capabilities.

These difficulties, while stressful at the time, allowed me to become more confident in my ability to make long-term decisions on technical issues to increase the probability of overall success.

I also had the opportunity to develop a number of soft skills. These were primarily evident following the main development cycle, in which I began to meet regularly with my supervisor, Dr Simon Foster, and his postdoctoral researcher, Dr Fang Yan. Clear and concise communication was important from the outset; as the project was self-defined, I had the responsibility to describe the RQ to Dr Foster and pose the topic as a realistic and level-appropriate dissertation proposal. I have historically lacked soft skills, and although these were significantly improved during my placement year, I felt that the regular meetings with Dr Foster and Dr Yan continued to build on those foundations.

I attended every scheduled meeting and kept in regular email contact with all involved parties, which was integral to maintaining a productive working relationship. Each session involved the review of a working draft chapter of the dissertation, which were always submitted by the formative deadlines to allow for ample review time.

Meetings also occasionally involved demonstrations of the software and its various capabilities. Demos were always prepared in advance such that the maximum amount of capability could be conferred in the limited time available.

This learning will have a direct impact on my future career. The evidence of technical benefits is immediate, but the challenges faced during development will also serve as an answer to typical interview scenarios which query my ability to solve a problem under time pressure.

Upon reflection, I believe that the process of undertaking the project was very successful. It provided the opportunity for intellectual stimulation outside of work, allowed large amounts of time to produce a polished product which can be demonstrated, and enabled my personal, interpersonal, and professional skills to develop quickly.