Proof Assistants (L81) – Assignment 2

This is the second marked assignment for the "Proof Assistants" course (L81), covering the Coq part of the course. The assignment comprises three exercises around simply typed lambda-calculus as seen in the course, as well as a short write-up.

The due date for this assignment is Wednesday, 11 December 2024, 23pm. You must work on this assignment as an individual; collaboration is not allowed. Copying material found elsewhere counts as plagiarism. Please use the Moodle page for the course to submit an archive containing your files and write-up by the deadline.

The assignment is provided as an archive, containing a `Makefile`, a `_CoqProject` file, a `stlc.v` file, and an `assignment.v` file. Using `make` in the unpacked archive will build the `stlc.v` file, and make it accessible to import for the `assignment.v` one. You should hand in an archive containing the same files, the extra `stlc_prod.v` file for exercise 2 if you attempted it, and your write-up as a PDF file. It is OK to leave unfinished proofs (e.g. using `Admitted`), but please make sure the files you hand in compile to the end.

Each of the two assignments is worth 100 marks, distributed as follows:

- 50 marks for completing basic formalisation and verification tasks assessing grasp of the material taught in the lecture. You are allowed to use any definition, lemma or tactic that is available via Coq's standard library. The main assessment criteria are correctness and completeness of the specifications and proofs, although please try to keep your proofs tidy if you can. You might want to test your specifications to check that they work as intended.
- 20 marks for completing the tasks designated as "advanced", which might require more creativity when designing specifications and proof strategies. Completing these advanced tasks can help you achieve a distinction grade, but you should focus on completing the main tasks before attempting them.
- 30 marks for a clear write-up, where 10 of these marks will be reserved for write-ups of exceptional quality, e.g. demonstrating particular in- sight. Your write-up should explain the design decisions you made during the formalisation and the strategies you used for the proofs. It might also discuss proof attempts that failed in interesting ways and lessons you learned from them, if that happens. The maximum length of the write-up is 2,500 words, although it could be much shorter, especially if you add comments to your theory files (which is highly encouraged).