Project 2: Boolean Algebra

INSTRUCTIONS

1. This project must be done and submitted individually.
2. Submit one ZIP file, called `<student number>.zip` to the folder "Project 2 Submissions" in Luminus by **Friday 22 February midnight**.
3. The ZIP file contains the file `<student number>.v`, a coq program with your answer (modify the name and content of the template program `project_Boolean_algebra.pl`).
4. There is no option for late submissions for this project.

Coq is an interactive theorem prover. It allows the definition of types and the assertion of axioms, the expression of theorems and of the interactive construction and mechanical checking of their proofs. In this tutorial we use Coq to define Boolean expressions and to implement an axiomatization of Boolean Algebra with 10 laws as in the lecture. Read the Coq program `tutorial_Boolean_algebra.v` and try and understand what is happening by interacting with it in the Coq IDE, pressing the `Forward one` and `Backward one` commands (downward and upward green arrow, respectively, in the top-left corner of the Coq IDE).

Question 1 [2 marks]
Write and prove the theorems for Annihilator of $\times$ and of $+$. Reuse previously proven theorems.

Question 2 [2 marks]
Write and prove the theorem for Absorption of $\times$ and of $+$. Reuse previously proven theorems.

Question 3 [1 marks]
(This question is difficult, not everyone is expected to find the answer) Prove the following theorem (Unicity of 0). Do a direct proof (not a proof by contradiction). You may need to use other Coq tactics than rewrite.

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Theorem Unicity_F:
forall (X:Boolean), forall (FF:Boolean),
(or X FF) = X /\ (and X (not X)) = FF -> FF=F.
```

– END OF PAPER –