Lassonde Faculty of Engineering
EECS
MATH1090. Problem Set No. 2
Posted: Oct. 4, 2017

Due: Oct. 23, 2017, by 3:00pm; in the course assignment box.

It is worth remembering (from the course outline):

The homework must be each individual's own work. While consultations with the instructor, tutor, and among students, are part of the learning process and are encouraged, nevertheless, *at the end of all this consultation* each student will have to produce an individual report rather than a copy (full or partial) of somebody else's report.

"Show that —or prove that— $\Gamma \vdash A$" means "write a Γ-proof that establishes A". The proof can be Equational or Hilbert-style. Equational is rather easier in Boolean Logic.

The concept of "late assignments" does not exist in this course.

A brief but full justification of each proof step is required!
Do all the following problems; (5 Points Each).

You may *NOT* use ***any of these tools***: **Deduction Theorem, Resolution, Post's Theorem, Cut Rule**. *Any solutions that use these tools will be discarded (grade 0).*

1. Show that $\vdash A \to (B \to C) \equiv (A \to B) \to (A \to C)$

2. Show that $\vdash A \wedge B \vee A \wedge \neg B \equiv A$

3. Show that $A \to C \vdash A \to (B \to C)$

Limitation: *Do not use problem 1!*

4. Show that $\vdash A \equiv B \equiv (A \wedge B) \vee (\neg A \wedge \neg B)$

5. Show that $A \vee A \vee A \vee A \vdash B \rightarrow A$

6. Suppose you are given for some formulae A and B and set Γ that $\vdash A$ and $\Gamma \vdash B$. Show that $\Gamma \vdash A \vee B \rightarrow A \wedge B$.

7. For any formula A show that $A, \neg A \vdash \perp$

Two separate proofs are required: One in Hilbert style and one in Equational style.

8. Prove that $\vdash A \vee B \equiv A \vee \neg B \equiv A$.

9. Prove that $\vdash A \vee A \wedge B \equiv A$.