Lassonde School of Engineering

Dept. of EECS

Professor G. Tourlakis

MATH1090 A. Problem Set No2

Posted: Oct. 5, 2024

Due: Oct. 25, 2024; by 2:00pm, in eClass.

Q: **How do I submit?**

A:

(1) **Submission must be a SINGLE *standalone* file to eClass. Submission by email is not accepted.**

(2) **Accepted File Types: PNG, JPEG, PDF, RTF, MS WORD, OPEN OFFICE, ZIP**

(3) **Deadline is strict, electronically limited.**

(4) **MAXIMUM file size = 10MB**

It is not allowed to use truth tables (or any of their shortcuts) in ANY of the problems below. Such methods get zero marks.

ALL the Problems Below Require a particular Proof-Style. Any other Proof-Style maxes at 0 points.

1. (4 MARKS) Prove **Equationally** that $\vdash A \to B \to A$.

2. (4 MARKS) Prove **in Hilbert-style** that for any A,

$$\bot \vdash A$$

3. (4 MARKS) Prove **in Hilbert-style** that, for any B, we have $B, \neg B \vdash \bot$.
You may NOT use the cut rule or any of its derivatives in this problem # 3.

4. (4 MARKS) Prove **Equationally** that $\vdash A \vee (A \wedge B) \equiv A$.

5. (3 MARKS) Prove **Equationally** that $A, B, C \vdash A \wedge B \wedge C$.

Hint. Insert implied brackets first (but not outermost brackets).

6. (3 MARKS) Prove **Equationally** that $A \wedge B \vdash A \vee B$.

7. (4 MARKS) Use the Deduction Theorem and a **Hilbert-style proof** to prove, for any A, B, C, that $\vdash (A \to B) \to (A \vee C \to B \vee C)$

8. (4 MARKS) Use the Deduction Theorem and a **Hilbert-style proof** to prove, for any A, B, C, that $\vdash (A \to B) \to ((B \to C) \to (A \to C))$.