CS1231/CS1231S Assignment #1

AY2019/20 Semester 1

Deadline: 4:30pm on Thursday, 19 September 2019

Please read the instructions below

This is a graded assignment worth 10% of your final grade. Please work on it by yourself, not in a group or in collaboration with anybody.

Write your answers on A4-size papers (foolscap papers acceptable too), properly stapled if you use multiple sheets. A handwritten submission is fine; there is no need to use Word or Latex to typeset. Please write legibly and neatly, or marks may be deducted for untidiness or illegible writing.

At the top of the first page, please write your **Name**, **Student Number** and **Tutorial Group** prominently. You can check out which tutorial group you are in by referring to the class list on LumiNUS or the Midterm test seating arrangement document posted on LumiNUS Files. If no tutorial group is written in your submission, it will not be graded.

We are **VERY** strict about deadlines, so please submit on time. Late submissions will not be accepted.

Please hand in your answers to the SoC Undergraduate Studies office (COM1-02-19). There are two drop boxes, one for CS1231 and one for CS1231S. Drop your submission into the correct box.

You may hand in your work directly to your tutor before the deadline.

You do not need to submit this question paper. Also, do keep a copy of your submission with you just in case your submission gets lost in transition.

If you have any queries about this assignment, please raise them on the LumiNUS forum.

Question 1. (3 marks)

Prove or disprove the following statements. To prove, show each step with justification using Theorem 2.1.1 and the implication law (if necessary). To disprove, just cite a counter-example, do not use truth table.

(a) $(p \vee q) \rightarrow r \equiv (p \rightarrow r) \wedge (q \rightarrow r)$
(b) $(p \wedge q) \rightarrow (r \vee s) \equiv (p \rightarrow r) \wedge (q \rightarrow s)$

Question 2. (5 marks)

Aiken and Dueet want to invite three friends Xes, Yul, and Zam to their party but are given these constraints:

1. Xes comes only if Yul does not come.
2. Yul comes if Zam or Xes (or both) comes.
3. Xes comes if Zam does not come.

Aiken and Dueet want to know who will come to the party and who will not. Express the above constraints in propositional logic, and explain how you arrive at your conclusion.

Question 3. (6 marks)

Given the following claim:

"**All cats are liked by some dogs**. **No dog likes a socialist**. Therefore, **no cat is a socialist**."

(a) Write each of the three sentences in both above into predicate logic statements. You have to define appropriate predicates such as $Cat(x)$,etc. You may omit the domain, i.e. you may write $\forall x$ instead of $\forall x \in U$. Do not begin your answer with a negation (i.e. $\sim\forall$ or $\sim\exists$).

(b) Write a proof for the claim. What type of proof is that?

Question 4. (6 marks)

For the following parts, you do not need to provide justification for each step (but you may still do so) as long as each step is based on the relevant definitions.

(a) Prove that for every set A, if $A \subseteq \emptyset$, then $A = \emptyset$.

(b) Show that $\wp(A \cap B) = \wp(A) \cap \wp(B)$ for all sets A, B.