MATH1005/MATH6005 Semester 1 2021

Assignment 1

Workshop Details:

Number	Day	Time	Demonstrator name
16B	**Friday**	12/03 2pm	

Student Details:

ID	Surname	Given name	Preferred name
u7235649	Zhang	Han	Han

Instructions:

This assignment has four questions. Write your solutions in the spaces provided. Hand-writing is preferable to typesetting unless you are fast and accurate with LaTeX, and even then typesetting will take you longer. Also, be aware that typesetting will not be allowed on exams.

Except for multiple-choice questions, or where answer boxes are provided (one question of this type each week), **show all working**.

Question numbers indicate the corresponding questions from the workshop. Since the workshop has six questions, questions on this assignment may not be sequentially numbered.

Declaration:

I declare that while I may have discussed some or all of the questions in this assignment with other people, the write-up of my answers herein is entirely my own work. I have not copied or modified the written-out answers of anyone else, nor allowed mine to be so used.

Signature: Han Zhang Date: 16/03/2021

This document must be submitted by 11pm on the THURSDAY following your workshop.

Sign, date, then scan this completed document (5 pages) and save as a pdf file with name format uXXXXXXXAssXX.pdf (*e.g.* u6543210Ass01.pdf).
Upload the file via the link from which you downloaded this document.

If copying is detected, and/or the document is not signed, no marks will be awarded.

This document has five pages in total.

Question 1* Define the logical variables C, E and r as follows:

$$\begin{aligned} C &= \text{“Cathy will win”} \\ E &= \text{“Ewen wil win”} \\ r &= \text{“The result will be challenged”} \end{aligned}$$

Express each of the following in symbols, **as succinctly as you can.**

(a) There can be only one winner, and it will be either Cathy or Ewen.

(b) Whoever wins, the result will be challenged.

(c) If Cathy wins, the result won't be challenged, but if not, it will.

(a) $C \oplus E$

(b) ~~$(C \wedge E) \rightarrow r$~~ $(C \vee E) \rightarrow r$

(c) ~~$(C \rightarrow \neg r) \wedge (\neg C \rightarrow r)$~~ $(C \rightarrow \neg r) \vee (\neg C \rightarrow r)$

Question 2$^+$ Negate each of the statements below.
Use as natural sounding English as you can manage, and try to avoid using the word 'not'. Do not use symbols in your answer, but they may help you to reach your answer.

(a) He'll play soccer or tennis

(b) If he plays tennis, he'll give up soccer.

(c) He'll play just one sport from soccer and tennis.

(a) He'll neither play soccer nor tennis.

(b) He ~~N~~ plays soccer and tennis.

(C) ~~He'll play soccer and tennis both, or neither~~ neither.
If he plays soccer. he'll play tennis, but if he plays tennis. he'll plays soccer.

Question 4† Circle the correct answers.

For this question, working is not required and will not be marked.

Consider the statement:

If the equation is correct it has a positive solution.

(a) For each of the statements below, decide on its relationship to the statement above:

- The equation is not correct if it has a negative solution.

  CONVERSE / INVERSE / CONTRAPOSITIVE / NONE OF THESE

- The equation has a positive solution only if it is correct.

  CONVERSE / INVERSE / CONTRAPOSITIVE / NONE OF THESE

- If the equation is incorrect it has no positive solution.

  CONVERSE / INVERSE / CONTRAPOSITIVE / NONE OF THESE

- No positive solution is a necessary condition for the incorrectness of the equation.

  CONVERSE / INVERSE / CONTRAPOSITIVE / NONE OF THESE

- Given that the equation has no positive solutions, it must be incorrect.

  CONVERSE / INVERSE / CONTRAPOSITIVE / NONE OF THESE

(b) How many of the statements in (a) are equivalent to the original statement?

0 / 1 / 2 / 3 / 4 / 5

Question 6#

inputs		output
X	Y	
1	1	0
1	0	0
0	1	0
0	0	1

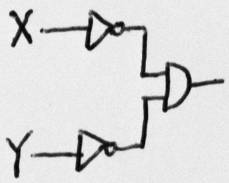
(a) Using only NOT and AND gates, construct a circuit diagram representing the NOR connective ($p \,\text{NOR}\, q \equiv \neg(p \vee q)$). Do this by employing the standard method of first writing out a logical expression that has the truth table for NOR (at right), and then converting this to a circuit.

(b) Construct an alternative circuit for a NOR gate using only NOT and OR gates.

(c) (*Challenge*) Construct a circuit diagram for a NOR gate but this time using only NAND gates. Try to use as few gates as you can.

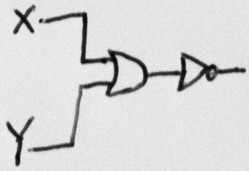
(a) Logical expression: $\neg X \wedge \neg Y$

Circuit:



(b) Logical expression: $\neg(X \vee Y)$

Circuit:



(c) Logical expression: $\neg X \uparrow \neg Y \equiv (X \uparrow X) \uparrow (Y \uparrow Y)$

Circuit: