CS1231–Midterm 1, 2014

Name: **Matric No:**

1. [2 marks] Using a truth table, determine whether or not the following is a tautology.

$$((p \to q) \wedge (q \to r)) \to (p \to r)$$

p	q	r	$p \to q$	$q \to r$	$p \to r$	$((p \to q) \wedge (q \to r)) \to (p \to r)$
T	T	T				
T	T	F				
T	F	T				
F	T	T				
T	F	F				
F	T	F				
F	F	T				
F	F	F				

Ans: [yes / no]

2. [2 marks] Simplify $(p \to (p \wedge q)) \to q$ to an expression without $\to$.

3. [2 marks] The negation of $p \to q$ is (a) $\neg p \to \neg q$; (b) $q \to p$; (c) $\neg p \wedge q$; (d) $\neg q \wedge p$.

Ans: [ ]

4. [2 marks] Let $P(x)$ be "x can learn new tricks" and $D(x)$ be "x is an old dog". For each of the following, translate into a logical expression with domain all the dogs;

(a) Some old dogs cannot learn new tricks.

(b) Every old dog can learn new tricks.

Answers:

5. [4 marks] For each expression in the previous question, write down its negation. Translate the negation into English.

(a)

English:

(b)

English:

6. [3 marks] Translate the following into a logical expression using quantifiers and logical connectives. Use P, the set of all programmers and Q, the set of all programs as the domains. Also let $W(x, y)$ be "x writes program y" and $T(y)$ be "program y terminates".

"Some programmers only write programs that do not terminate."

7. [5 marks] You are given the following. Use it to prove that superman does not exist. (You need to use argument forms.)

"If Superman were able and willing to prevent evil, he would do so. If Superman were unable to prevent evil, he would be impotent; if he were unwilling to prevent evil, he would be malevolent. Superman does not prevent evil. If Superman exists, he is neither impotent nor malevolent."

Use the first letters of able, willing, prevent, impotent, malevolent and exist to denote the various attributes of a Superman. For example 'a' is Superman is able to prevent evil.

List the 5 hypotheses:

Provide the proof: