201701 Math 122 [A01] Quiz #1

#V00:_____ Name: Key

This quiz has 2 pages and 6 questions. There are 15 marks available. The time limit is 25 minutes. Math and Stats standard calculators are allowed, but calculators will not help with these questions! Except when indicated, it is necessary to show clearly organized work in order to receive full or partial credit. Use the back of the pages for rough or extra work.

1. [2] Use the blank to indicate whether each statement is **true** (T) or **false** (F). No reasons are necessary.

   T If $p \vee \neg q$ is false, then $\neg p \wedge q$ is true.

   F If $p \to q$ is true, then $p \vee q$ is true.

   T If $s_1 \leftrightarrow s_2$ is true, then $\neg s_2 \leftrightarrow \neg s_1$ is true.

   F There are truth values for p and q so that the three statements $p \vee q$, $\neg p \vee q$, and $p \vee \neg q$ are all false.

2. Write each answer in English.

   (a) [1] Write the statement "*The Canucks lose unless Tanev and Edler play*" in the form "if p then q".

   If Tanev and Edler don't play, then the Canucks lose.

   (b) [3] For the statement "*If you don't eat your meat, you can't have any pudding*", write the

   Converse: If you can't have any pudding, then you don't eat your meat

   Negation: You don't eat your meat and you can have pudding

   Contrapositive: If you can have pudding, then you eat your meat

3. [2] Use a truth table to determine whether $\neg p \wedge (q \to \neg p)$ is logically equivalent to $\neg p$. Explain your conclusion.

p	q	$\neg p$	$q \to \neg p$	$\neg p \wedge (q \to \neg p)$ (= S)	$\neg p \leftrightarrow S$
F	F	T	T	T	T
F	T	T	T	T	T
T	F	F	T	F	T
T	T	F	F	F	T

Since $\neg p \leftrightarrow [\neg p \wedge (q \to \neg p)]$ is a tautology,

$\neg p \iff \neg p \wedge (q \to \neg p)$

4. Let m and n be integers, and let p, q, r, and s be the following statements:

p: m is even; q: n is even; r: $m+n$ is even; s: mn is even

Write each of the following in symbolic form using only $p, q, r, s, \neg, \wedge, \vee, \rightarrow, \leftrightarrow$.

(a) [1] If mn is odd, then m is odd and n is odd.

$\neg s \rightarrow (\neg p \wedge \neg q)$

(b) [1] $m+n$ is even if and only if m and n are both even, or m and n are both odd.

$r \leftrightarrow [(p \wedge q) \vee (\neg p \wedge \neg q)]$

(c) [1] $m+n$ and mn are not both odd.

$\neg(\neg r \wedge \neg s) \quad \Leftrightarrow \quad r \vee s$

5. [2] Suppose that the statement $p \leftrightarrow q$ is false. Find all possible truth values of the statement $(\neg p \rightarrow r) \vee \neg(\neg q \wedge r)$.

$p \leftrightarrow q$ false $\therefore$ p true & q false or p false & q true.

p	q	r	$\neg p$	$\neg q$	S_1: $\neg p \rightarrow r$	S_2: $\neg q \wedge r$	$\neg S_2$	$S_1 \vee \neg S_2$
T	F	F	F	T	T	F	T	T
T	F	T	F	T	T	T	F	T
F	T	F	T	F	F	F	T	T
F	T	T	T	F	T	F	T	T

As shown in the last column of the truth table, when $p \leftrightarrow q$ is false, $(\neg p \rightarrow r) \vee \neg(\neg q \wedge r)$ is true.

6. [2] Use the blank to indicate whether each statement is **true** (T) or **false** (F). No reasons are necessary.

T The statement $q \rightarrow (p \rightarrow q)$ is a tautology.

F If $s_1 \leftrightarrow s_2$ is a contradiction, then $s_1 \rightarrow s_2$ is a contradiction.

T The contrapositive of "*You must be at least 9 years old and at least 1 metre tall in order to ride the roller coaster*" is *"If you are less than 9 years old or less than 1 metre tall, then you can not ride the roller coaster"*.

F Statements which are not logically equivalent always have different truth values.