MAT 299 - Proofs and Problem Solving

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Quiz 1 - Sunday, November 18th, 2018

Problem 1 *(20 points) Let W represent that a car is white, let N represent that a car is new, and let M represent that a car is mine. Analyze the logical form of the following statements:*

1. *If the car is not white and new, then it is mine.*
   $(\neg W \wedge N) \to M$

2. *The car being white or new is a sufficient condition for it being not mine.*
   $(W \vee N) \to \neg M$

3. *The car is mine if and only if it is new and not white.*
   $M \leftrightarrow (N \wedge \neg W)$

Problem 2 *(20 points) Make a truth table for $\neg P \to (Q \wedge \neg R)$.*

P	Q	R	$\neg P$	$\neg R$	$(Q \wedge \neg R)$	$\neg P \to (Q \wedge \neg R)$
T	T	T	F	F	F	T
T	T	F	F	T	T	T
T	F	T	F	F	F	T
T	F	F	F	T	F	T
F	T	T	T	F	F	F
F	T	F	T	T	T	T
F	F	T	T	F	F	F
F	F	F	T	T	F	F

Problem 3 *(20 points) Consider the statement $\forall x \exists!\, y(2x - 3y = 1)$.*

1. *Is this true or false if the universe of discourse is $x, y \in \mathbb{Q}$? Either provide a proof to show that this is true or provide a counterexample to show that this is false.*

2. *Is this true or false if the universe of discourse is $x, y \in \mathbb{N}$? Either provide a proof to show that this is true or provide a counterexample to show that this is false.*

Problem 4 *(20 points). Let $A = x, y, z$ and $B = w, x, y$.*

1. *List the elements of $\wp A$.*