MATH 201 SOLUTIONS: QUIZ I 25 JANUARY 2019

1. *[10 pts]* Let p = "Aldo is Italian" and q = "Frederick is British."
Write each of the following as a statement in sentential logic.

(a) Aldo is not Italian.

$$\sim p$$

(b) Aldo is Italian, or if Aldo is not Italian, then Frederick is British.

$$p \vee (\sim p \Rightarrow q)$$

(c) Either Aldo is Italian and Frederick is British, or neither Aldo is Italian nor Frederick is British.

$$(p \wedge q) \vee (\sim p \wedge \sim q)$$

2. *[10 pts]* Use a truth table to determine if the following statement is always true:

$$\sim p \Rightarrow \big((p \wedge \sim q) \Rightarrow (p \wedge q)\big)$$

p	**q**	$\sim p$	$\sim q$	$p \wedge \sim q$	$p \wedge q$	$((p \wedge \sim q) \Rightarrow (p \wedge q))$	$\sim p \Rightarrow ((p \wedge \sim q) \Rightarrow (p \wedge q))$
T	T	F	F	F	T	T	T
T	F	F	T	T	F	F	T
F	T	T	F	F	F	T	T
F	F	T	T	F	F	T	T

So our statement is a tautology.

3. *[10 pts]* Let X = {cat, dog, llama, wombat}. Find each of the following cardinalities. (You need not justify your answers.)

(a) $|P(X)| = 2^4 = \mathbf{16}$

(b) $|P(X) - \emptyset| = 2^4 - 1 = \mathbf{15}$ since $\emptyset \in P(X)$

(c) $|P(X) \times \{cat, dog\}| = (2^4)(2) = \mathbf{32}$ since $|A \times B| = |A|\,|B$

(d) $|P(X) - \{cat, dog\}| = \mathbf{15}$ since $\{cat, dog\} \in P(X)$

(e) $|P(X - \{llama\})| = 2^3 = \mathbf{8}$ since $X - \{llama\} = \{cat, dog, wombat\}$

“Todd, trust math. As in Matics, Math E. First-order predicate logic. Never fail you. Quantities and their relation. Rates of change. The vital statistics of God or equivalent. When all else fails. When the boulder's slid all the way back to the bottom. When the headless are blaming. When you do not know your way about. You can fall back and regroup around math. Whose truth is deductive truth. Independent of sense or emotionality. The syllogism. The identity. Modus Tollens. Transitivity. Heaven's theme song. The night light on life's dark wall, late at night. Heaven's recipe book. The hydrogen spiral. The methane, ammonia, H2O. Nucleic acids. A and G, T and C. The creeping inevibatility. Caius is mortal. Math is not mortal. What it is is: listen: it's true.”

– David Foster Wallace, **Infinite Jest**