Fall 2009 Examination 1 CMSC 203

1. Circle **T** for True or **F** for False as they apply to the following statements:

T F Every compound statement is either a tautology or a contradiction.

T F A set with n elements has $(2^n - 1)$ non-empty subsets.

T F The empty set has no subsets.

T F Onto functions map smaller sets to bigger sets.

T F If A and B are sets, then $|A \cup B| = |A| + |B|$.

T F In Logic, the Implication process is, in reality, a Disjunctive process.

T F The Bi-conditional and Exclusive-OR are negations of one another.

T F Bijective functions map sets of the same cardinality to one another.

T F The converse and inverse of a conditional statement are logically equivalent.

T F The Integers are countably infinite.

2. Use the Laws of Logic to show: $p \vee (\neg q \rightarrow r) \equiv r \vee (\neg p \rightarrow q)$

3. Find the negation of the following Universal Conditional:

For all Integers, *n*, if *n* is odd, then *n* is not divisible by 2.

4. Use the rules of inference to show the following is a valid argument:

$p \rightarrow s$

$r \wedge \neg s$

$(\neg p \wedge t) \rightarrow \neg r$

$\therefore \neg t$

5. Find $\Sigma^2 \times \Sigma^1$ for the alphabet $\Sigma = \{a, z\}$.

6. Using the Properties of Sets, show for any sets A and B, $A \cap (A \cup B) = A$

7. Given the function F = {(1,g), (2,d), (3,a), (4,b), (5,b)}

(a) What is the Domain of F? **(b)** What is the Image of F?

(c) What is the Inverse of F?

(d) Why or why not is the Inverse in **(c)** a function?

8. Find F(F(F(x))) for F(x) = {(0, 3), (1, 0), (2, 5), (3, 4), (4, 2), (5, 1)}.

9. For the given argument, circle **MP** if it is an example of Modus Ponens, **MT** if it is an example of Modus Tollens, **CE** if it is an example of Converse Error, and **IE** if it is an example of Inverse Error.

MP MT CE IE *All cats are fast* and *Fluffy is fast*, therefore *Fluffy is a cat.*

MP MT CE IE *All cats are fast* and *Fluffy is not fast*, therefore *Fluffy is not a cat.*

MP MT CE IE *All cats are fast* and *Fluffy is not a cat*, therefore *Fluffy is not fast.*

MP MT CE IE *All cats are fast* and *Fluffy is a cat*, therefore *Fluffy is fast.*