Exam 1 CMSC 203 Fall 2004

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

T F In logic, all compound statements are either a tautology or a contradiction.
T F The Rational numbers are all infinite decimal expansions.
T F A set with 10 elements has 1024 subsets.
T F Sets that are disjoint have no elements in common.
T F H(010011000111, 110110110110) = d(100101110001).
T F The Rationals are closed under addition and multiplication.
T F The Irrationals are closed under addition and multiplication
T F If there is an ONTO function mapping set A to set B, then B is a subset of A.
T F Algorithms of polynomial order complexity are better than those of exponential order complexity.
T F That all dogs like bones and Spot likes bones implies Spot is a dog.

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

3. Find the **inverse** for the Universal Conditional Statement:

Every integer that is even has a square that is even.

4. Let f be function defined as: $f = \{(0, 3), (1, 2), (2, 4), (3, 1), (4, 0)\}$. Find $f \circ f \circ f$.

5. Let A = {1, 2, 4} and B = {0, 1, 2, 3, 4} and U = {0, 1, 2, 3, 4, 5, 6}

(a) Find A x (B^c) (b) Find the Power Set of A (c) Find $(A \cup B)^c \cap (A^c - B)$

6. Find the Big-O for the algorithm with complexity: $n^4(3n^3 + 5) + n^5(2n^2 + 8n)$

7. Show that the function f: **R** - **R** given by $f(x) = 7x + 4$ is a bijection.

8. Use Valid Reasoning to obtain the given conclusion:

$q \vee \neg r \vee t$
$s \rightarrow p$
$r \wedge s$
$q \rightarrow \neg p$

$\therefore t$

9. Prove TWO of the THREE theorems below:

Theorem 1: (by Contradiction) There is no greatest integer.
Theorem 2: The product of 3 consecutive integers is an even integer.
Theorem 3: (by Contaposition) For all integers, n, if n^2 is odd, then n is odd.