1. (20 pts.) Circle T if the statement is true or F if the statement is false.

T F N ∪ Z = Q.
T F \{1,2,3\} ∈ \mathcal{P}(\{1,2,3,4\}). (Note: \mathcal{P}(A) denotes the Power Set of A.)
T F The negation of the statement All students are motivated and not lazy is the statement Some students are either not motivated, or are lazy, or both.
T F The inverse of the statement If I pass CMSC 203, then I get a good job is: I pass CMSC 203, but I do not get a good job.
T F If d divides n, then n/d = n mod d.
T F For all integers x > 1, if x is prime, then x is odd.
T F A set with 8 elements has 255 non-empty subsets.

2. (6 pts.) Use the Euclidean Algorithm to find gcd(744,122).

3. (10 pts.) Find the truth table of the Boolean Polynomial F(x,y,z) = xy’ + (x’ + z)’.

4. (7 pts.) Show the following is a valid argument:

If x is not rational, then xy is real
z is an even integer and xy is real
x is rational or z is a prime integer
\therefore z is a prime integer.

5. (10 pts.) Given the quantified statement: For all x ∈ Z, if x is odd, then (x + 1) is even, find its:
Converse: ____________________________________________________________
Inverse: ______________________________________________________________
Contrapositive: _________________________________________________________
Negation: ______________________________________________________________

6. (7 pts.) For the sets A = \{1,2,3,4,5\}, B = \{2,4,6\}, and C = \{1,2,4,8\} from the Universal Set U = \{0,1,2,3,4,5,6,7,8,9\}, show that: (A ∩ B)^c − (A ∩ B) = A^c.

7. (40 pts.) Prove 2 of the 4 theorems:
Theorem 1: For all integers n, if n^3 is even, then n is even.
Theorem 2: \sqrt{2} is irrational. (Hint: Assume Theorem 1 is true.)
Theorem 3: If n and d are positive integers and (n \text{ div } d) = (n \mod d), then (d+1) | n.
Theorem 4: For all non-zero integers a and b, if a | b and b | a, then a = b.