Name: _____ Student Number: _____	CISC 203 Discrete Mathematics for Computing Science Test 2 Fall 2010 Professor Mary McCollam

This test is 50 minutes long and there are 40 marks. **Please write in pen and only in the box marked "Answer".**
This is a closed-book exam. No computers or calculators are allowed.

Question 1: [10 marks]

Let $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 1 & 0 \\ 1 & 1 & 0 \end{bmatrix}$

(a) Find $A \vee B$ (Recall that $\vee$ denotes the Boolean *join* operation)

Answer:

(b) Find $B^{[2]}$ (Recall that $B^{[2]} = B \odot B$, where $\odot$ denotes the Boolean *product* operation)

Answer:

Question 2: [10 marks]

(a) Use the Euclidean algorithm to find gcd(3003, 357).

Answer:

(b) Convert the integer 295 from decimal notation to binary notation.

Answer:

Question 3: [10 marks] For each of the following, show the steps leading to the solution.

(a) Find an inverse of 7 modulo 31.

Answer:

(b) Solve the congruence $7x \equiv 13 \pmod{31}$. Give the answer modulo 31.

Answer:

Question 4: [10 marks] Use *proof by contradiction* to show that the square root of 2 is irrational.

Recall that a real number x is *rational* if there exist integers p and q with $q \neq 0$ such that $x = p/q$. A real number that is not rational is called *irrational*.

HINT: Use the following facts in your proof.

- If a number is rational, it can be expressed as a fraction p/q in lowest terms, where p and q are integers, at least one of which is odd (otherwise, it wouldn't be in lowest terms, since 2 would divide both p and q).
- The square of an odd number is odd.

Answer: