RYERSON UNIVERSITY FALL 2011

Discrete Mathematics MTH 110

Midterm Test 60 Minutes

NAME (PRINTED) _____

Student Number _____ **SIGNATURE** _____

Circle your section:

Sec. 011 (Lab: Thursday 1pm) **Sec. 041** (Lab: Thursday 12pm)
Sec. 021 (Lab: Wednesday 1pm) **Sec. 051** (Lab: Monday 11am)
Sec. 031 (Lab: Tuesday 11am) **Sec. 061** (Lab: Thursday 9am)

Question	1	2	3	4	5	**Total**
Value	8	8	8	10	6	**40**
Marks						

Instructions:

- Answer all of the following FIVE questions. This test consists of SIX pages, including the title page.
- No aids allowed. Electronic devices such as calculators and cell-phones must be turned off and kept inaccessible during the test.
- Please keep your Ryerson photo ID card displayed on your desk during the test.
- In every question show all your work. The correct answer alone may be worth nothing.
- Delete all irrelevant and incorrect work because marks may be deducted for work which is misleading, irrelevant or incorrect, even if steps for a correct solution are also shown.
- Please write only in this booklet. Use of scrap paper or additional enclosures is not allowed. If you need more space continue on the back of the page, directing marker where the answer continues with a bold sign.
- **DO NOT** separate pages.

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1. [8 marks] Let p and q be three statements. Show that

$$\sim [p \to (q \wedge r)] \equiv \sim (\sim q \to \sim p) \vee \sim (p \to r)$$

using the method of your choice. Provide detailed justification.

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2. [8 marks] Suppose we are given the following set of premises

$$\begin{array}{ll} (1) & p \to q \\ (2) & p \wedge u \\ (3) & \sim q \vee s \\ (4) & r \to \sim s \end{array}$$

Use standard argument forms (Modus Ponens, Modus Tollens, etc) and logical equivalences to deduce the following conclusion:

$$\sim r \wedge s.$$

Be sure to justify each step, making clear which of the standard valid forms or logical equivalences you have used.

3. [8 marks]

(a) Translate the following statement into logical form. In your translation you may only use variables and the symbols:

$$\exists, \forall, \wedge, \vee, \sim, <, >, \not<, \not>, =, \mathbf{Z}, \mathbf{Q}, \mathbf{R}, 0, \in, \notin, \text{ such that}$$

Statement: Every rational number is larger than some negative real number.

(b) Write the negation of the statement from (a) in symbolic form. Your answer should not start with $\sim$.

(c) Is the statement in (a) true?

4. [10 marks] (a) For the following I/O table,

P	Q	R	Output
1	1	1	0
1	1	0	1
1	0	1	0
1	0	0	0
0	1	1	1
0	1	0	0
0	0	1	0
0	0	0	0

construct a Boolean expression having the given table as its truth table. DO NOT simplify your answer, i.e., leave it in disjunctive normal form.

(b) Draw the corresponding logical circuit.

(c) Compute the hexadecimal value of the following bitwise arithmetic expression:

0xE3 XOR 0x85.

5. [6 marks] Prove the following statement:

The product of an even and an odd integer is even.