Ryerson University
Department of Electrical and Computer Engineering
COE 328 – Digital Systems and Microprocessors

Midterm Test **October 27, 2008**

Name: _____ **Student Number:** _____ **Section:** _____

Time limit: 1 hour 50 min Examiners: R. Sedaghat, N. Mekhiel

Notes:

a) Closed book.
b) No calculators.
c) Answer all questions **in the space provided**.
d) Circle your professor's name and hand in these sheets.

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1. Implement function $F = \left(\overline{x_1 \oplus x_3}\right)\overline{x_2} + \left(x_1 \oplus x_3\right) x_2$ using minimum number of multiplexers. Use 4-to-1 and 2-to-1multiplexer. The inputs can be connected to either 1 or 0, or to any logic signal. **(8 marks)**

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2. **(10 marks)**

a) Implement the following logic function using NAND gates only (Do not simplify)

$F(x_1,x_2,x_3,x_4) = \sum m(0,2,5,7,8,10)$

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b) Simplify the above function

c) Find the complement of the optimized function using DeMorgan theorem

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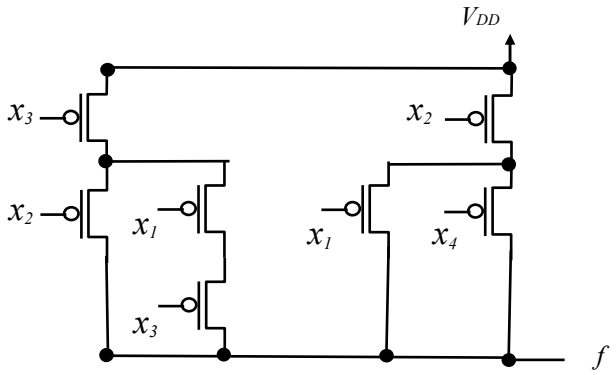
3.

a) Find the logic equation for the function *f* implemented in CMOS. Its PMOS circuit is shown below.

(8 marks)



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b) Simplify the above function

c) Implement the optimized function using CMOS

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4. Given the binary 8 bit number 11101001, find the following: **(8 marks)**

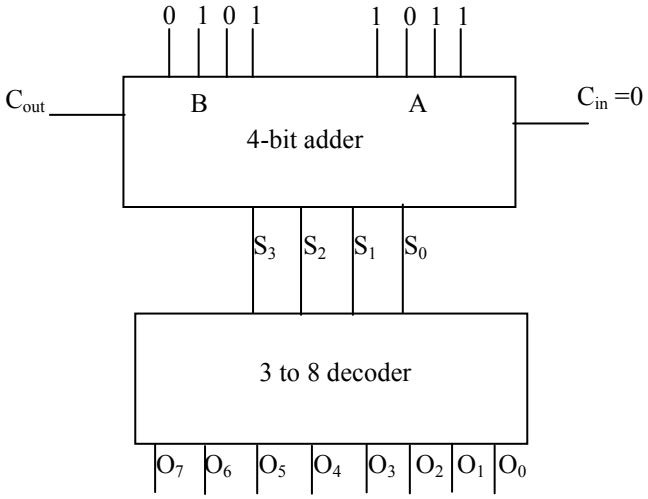
a) The decimal value if the 8 bit number is an unsigned-number

b) The decimal value if the 8 bit number is signed-magnitude

c) The decimal value if the 8 bit number is 2's complement

d) Convert the 8 bit number to a hexadecimal-number

5. Find the values of the outputs ($O_7 ... O_0$) for the circuit given below assuming A=1011 and B=0101 **(5 marks)**



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6. Construct one -bit adder for two bits X and Y to generate a sum bit S and a Carry bit C using 2-to-1 multiplexers. **(5 marks)**

7. Show how the function $f = x_3\ \overline{x_2} + x_1 x_2 + \overline{x_3}\ x_2$ can be realized using the following circuit. Derive and write all values for the circuit inputs. The inputs can be connected to either 1 or 0, or to any logic signal. **(6 marks)**