

NCSU ECE 109 Sections 002, 602, 604, and 605 and UNCA CSCI 255.001

Exam 1 Spring 2008

11 February, 2008

This is a closed book and closed notes exam. It is to be turned in by 5:45 pm. Calculators, PDA's, cell phones, and any other electronic or communication devices may not be used during this exam.

Please read and sign the following statement:

I have neither given nor received unauthorized assistance on this test.

Name: _____

If you want partial credit for imperfect answers, explain the reason for your answer!

Problem 1 (12 points) Adding

Add the following pairs of seven-bit two's complement numbers **and indicate which additions result in an overflow.**

$\begin{array}{r} 1010111 \\ + 1110100 \end{array}$	$\begin{array}{r} 1011111 \\ + 1011111 \end{array}$
$\begin{array}{r} 0011000 \\ + 0111111 \end{array}$	$\begin{array}{r} 0000111 \\ + 1111001 \end{array}$

Problem 2 (8 points) Two's-complement

Translate the following numbers represented in six-bit two's-complement into their corresponding decimal representation.

100101	001100
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Problem 3 (12 points) Floating point

Express the following three numbers in IEEE floating point notation. I've left some spaces between the major bit fields in the number. None of these answers should involve long calculations.

2 . 5 - - - - -
-2 . 5 - - - - -
0 . 25 - - - - -

Problem 4 (6 points) Ranges

What is the number of different values that can be represented by 7 binary digits?

What is the largest number that be represented in 7-bit twos-complement notation?

What is the smallest number that can be represented in 7-bit twos-complement notation?

Problem 5 (2 points) Extensions

What is the result of extending the following 6-bit two's complement number into an 8-bit two's complement number?

110011 --> _ _ _ _ _

Problem 6 (3 points) Words

Today, the most common use of the word “multiplex” is to describe “a group of two or more motion-picture theaters on the same site or in the same building, esp. a cluster of adjoining theaters” [from dictionary.reference.com]. How is this usage related to the multiplexer we introduced in this course?

Problem 7 (6 points) Sequential logic elements

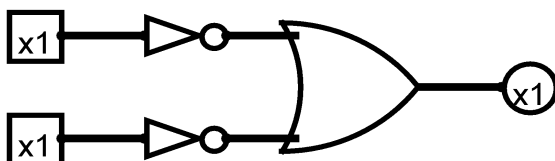
The R-S latch has two binary inputs and one binary output. How does the output of the latch change in response to these four different pairs of bits that can be applied to its inputs? Don't describe the “internals”. Just describe how the output changes.

Problem 8 (13 points) Transistors

In the space below, draw a CMOS implementation of a 3-input AND gate.

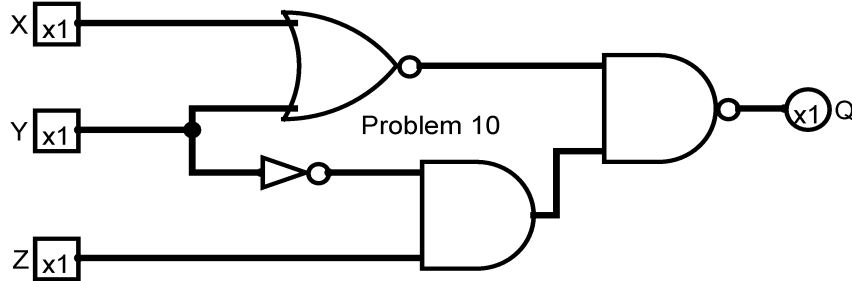
Problem 9 (3 points) deMorgan's Law

How can deMorgan's Law be used to reduce the number of transistors needed to implement the following very simple circuit with two inputs and one output. [The x1 is the size, in bits, of each input and output port. You can ignore it for this problem.]



Problem 10 (13 points) Gates to Truth

Fill in the truth table on the right to represent the gate-level circuit on the left.



X	Y	Z	Q
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

Problem 11 (9 points) Bitwise operations

Perform the following bit-wise logical operations on 8-bit numbers expressed as two hexadecimal digits. Your answer should also be expressed in hexadecimal.

NOT (CD)	-->
AND (07, BB)	-->
OR (07, BB)	-->

Problem 12 (13) Truth to Gates

Draw a circuit, at the gate level, that will implement the following truth table, where A, B, and C are inputs and where Z is the single output.

A	B	C	Z
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0