



ECE 238L Computer Logic Design  
Quiz 2 Take Home - September 25, 2014  
**Total Number of Points = 150**

ON-LINE STUDENTS ONLY:

- Email the Quiz to me by 10:45am, September 30th of this year, [rjordan@ece.unm.edu](mailto:rjordan@ece.unm.edu)
- The ONLY file format accepted is PDF!!!!!!! Follow the instructions in the syllabus!!!!!!!

IN CLASS STUDENTS ONLY:

- Hand in the Quiz in-class to me by 10:45am, September 30th of this year

**Please sign the following agreement: I acknowledge that if I do not follow instructions I will not receive any credit.**

**NAME:** \_\_\_\_\_

Yes calculators, smart and dumb phones, tablets, laptops, and consultants.

**Signature:** \_\_\_\_\_

**READ, READ, READ!!!!!!!!!!!!!!!!!!!!!!**

**If you do not follow instructions you will not receive ANY credit!!!!!!**

**All problems must be submitted in numerical-sequential order, that is, 1 , 2 , 3 ... to last. Please do not jump all over the map. If they are not in order I will not grade your “work”.**

**Paint/draw your work; please make your writing legible; show step-by-step your solution in an orderly manner; all work must be shown.**

**SHOW YOUR WORK AND CHECK YOUR WORK!!!!**

**Write your name on every page!!!!!!**

1. [10 points] Convert to base hex, octal, decimal and binary the Mayan (base 20) number HJGE.I8E (do all the arithmetic in decimal).

2. [10 points] Find the NUMBER first and then find the other representations.

NUMBER	1's complement	2's complement	MAGNITUDE	SIGN
_____	_____	_____	101011.01	1
_____	_____	10111110.11	_____	_____
BINARY	OCTAL	DECIMAL	HEXADECIMAL	
_____	_____	589.071	_____	
_____	575.73	_____	_____	

3. [10 points] Simplify each of the following expressions to a minimum SOP or POS and sketch the circuit using NAND, NOR, and NOT gates.

a)  $F(a,b,c,d) = \sum m(3,7,9,12,13,14,15)$

b)  $F(a,b,c) = \prod M(0,1,5)$

4. [20 points] From a 4-bit Instruction Register we have the following Truth Table (instruction decoding). a) Express the Boolean functions using minterms and maxterms representations. b) Provide the Boolean functions using Sum of Products (SOP), and Product of Sums (POS). c) Provide the complement of the Boolean functions using Sum of Products (SOP), and Product of Sums (POS). d) Draw the logic circuits for part b using NAND, NOR and NOT gates.

A	B	C	D	F1	F2
0	0	0	0	1	1
0	0	0	1	0	0
0	0	1	0	0	1
0	0	1	1	0	1
0	1	0	0	1	1
0	1	0	1	0	0
0	1	1	0	1	1
0	1	1	1	0	0
1	0	0	0	1	1
1	0	0	1	0	0
1	0	1	0	0	1
1	0	1	1	1	1
1	1	0	0	1	0
1	1	0	1	0	0
1	1	1	0	0	1
1	1	1	1	1	0

5. [30 points] Plot each of the following functions on a KMAP. a) Write the reduced (simplified) functions F in Sum of Products (SOP) form, and draw the circuit using NAND gates only. b) Write the reduced (simplified) complement functions F' in Product of Sums (POS) form, and draw the circuit using NOR gates only.  
 1)  $F(A,B,C,D) = \Sigma m(0,2,3,4,7,13,15) + \Sigma d(5,6,12,14)$   
 2)  $F(A,B,C,D) = \Pi M(0,3,5,11,12,13) \Pi M d(2,6,8,9,10,15)$
6. [10 points] a) Design a logic circuit to implement the function  $F(A,B,C) = \Sigma m(0,2,4,6)$  with a 3-to-8 Decoder with active high outputs. Use a gate with the minimum fan-in. b) Design a logic circuit to implement the function  $F(A,B,C) = \Sigma m(1,3,5,7)$  with a 3-to-8 Decoder with active low outputs. Use a gate with the minimum fan-in.
7. [10 points] a) Using a MUX design for the XNOR function. b) Using a MUX design the function  $F(A,B,C) = \Sigma m(0,2,3,5,7)$ . The MUX has an active low strobe input.
8. [10 points] Draw the function  $F(A,B,C) = \Sigma m(0,1,2,3,6)$  in a KMAP. a) Write the equation for the minimum Boolean function first. Now, eliminate all logic hazards that can result from the 1s and b) write the equation for the logic-hazard free function.
9. [10 points] a) Is an SR-NOR latch set or reset dominant? B) Is an SR-NAND latch set or reset dominant? In each case EXPLAIN what the terms mean.
10. [30 points] For the SR-NOR and SR-NAND latches derive: a) Characteristic tables, b) Characteristic equations, c) Present State/Next State tables. The sequence to follow is:  $t=0$  SR=10,  $t=1$  SR=00,  $t=2$  SR=01,  $t=3$  SR=11