Name _____ GT#_____

ECE 2030h, Intro. To Computer Eng., Final Exam

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RULES.

i This quiz is closed book.

ii. Non-programmable calculators may be used.

iii Answer all questions and show all work to receive full credit.

iv All questions have the same weight. (10 Points). All sub-questions within a question are weighted equally.

v Please do not ask the proctors any questions during the exam about exam questions. Part of the test is understanding the question as written, without supplemental information. If you feel additional data is needed to solve the problem, make (and state) an assumption and then work the problem.

Question 1 – Minterm and Maxterm Indices

For the truth tables below, show the minterm sum of products, and the maxterm product of sums:

A	B	C	F
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

sum of products _____

product of sums _____

Name _____

Question 2 – Karnaugh Map For the Karnaugh map below, circle the Prime Implicants and label the Essential Prime Implicants with "EPI".

AB \ CD	00	01	11	10
00	0	1	1	0
01	1	0	1	1
11	1	0	0	1
01	0	1	0	0

Write the reduced logic expression: _____

minterm indices (decimal) _____

Question 3 – Mixed Logic. Design a logic circuit for the logic function

X = (AB' + A'B) + (C'D)'

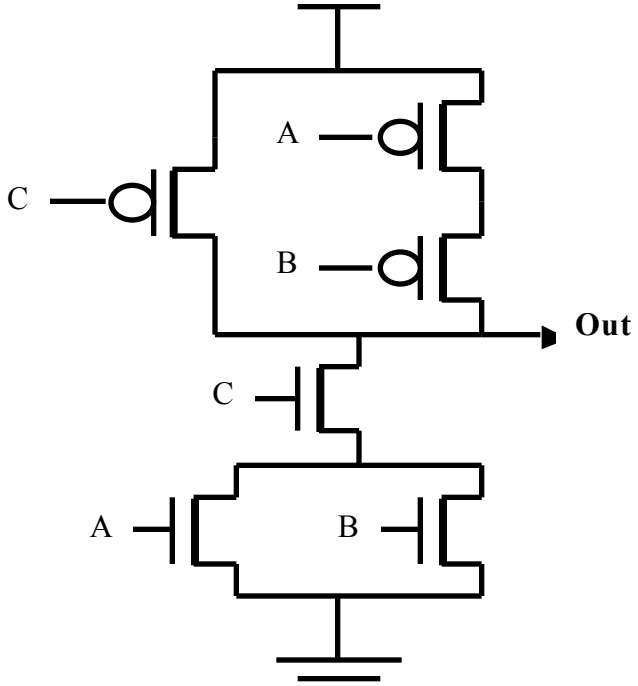
. using the mixed logic technique. Assume only signals A, B, C, and D are available. A' = NOT A..

Step 1.

Step 2.

Name _____

Question 4 – CMOS Logic Gates. For the following switch level circuit, complete the truth table computed. If a floating or shorted output is detected, indicate that in the truth table. If no floats or shorts are detected, write the Boolean expression computed by the circuit.



A	B	C	Out
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

Write the Boolean expression for this function, Out = _____

Question 5. Write the missing unsigned integer numbers in binary, hex, and decimal representations.

Decimal	Hex	Binary
314		
	F6	
		10010101

Question 6 – Binary Arithmetic in Two's Complement Notation

Do the arithmetic below in two's compliment binary arithmetic (8-bit integers, -128 to +127).

+31 _____

-63 _____

= -32 _____

Question 7. Our MIPS architecture has only "Branch on Equal" (BEQ $X, $Y) and "Branch on Not Equal" (BNE $X, $Y) commands. Show how to use the "Set on Less Than" (SLT $1, $X, $Y) and BEQ or BNE to make as two-command equivalent of the following (note: $0 always = 0):

BLT $2, $3

BGT $2, $3

BLE $2, $3

BGE $2, $3

Show how to make a branch comand that always jumps ahead to the label xxx.

B_____

ADD $4, $3, $5

xxx: ADDI $4, $4, 56

Question 8. Branch and Jump Ranges

a. What is the range of a BNE or BEQ instruction? _____ to _____

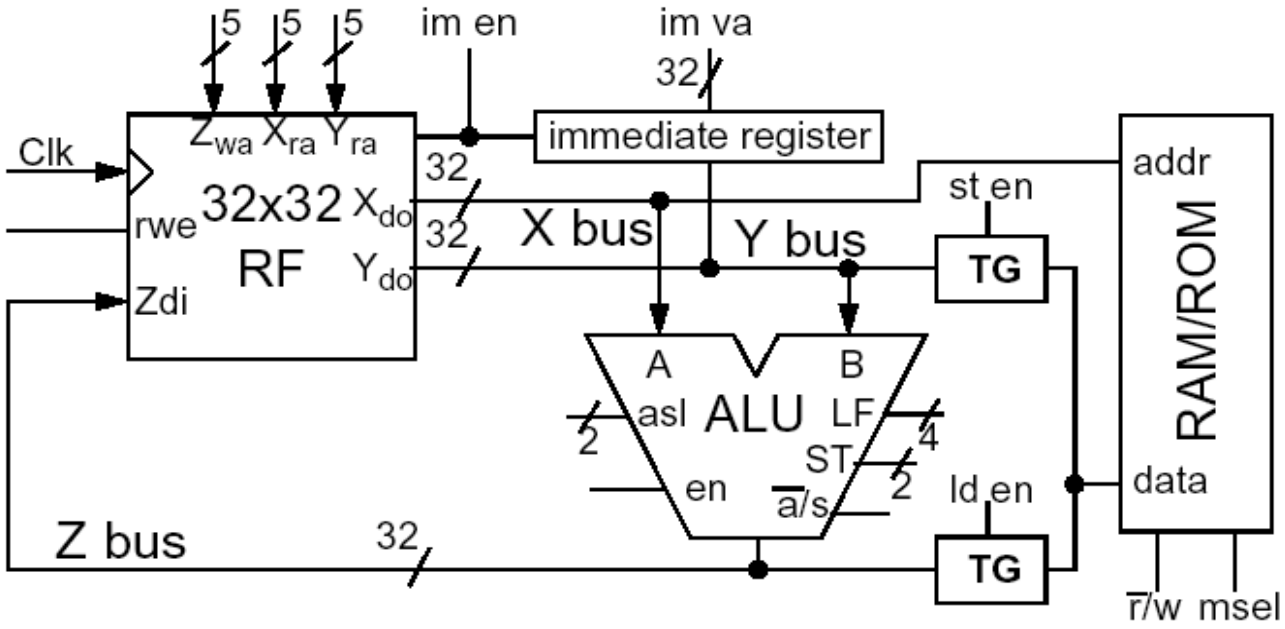
b. What is the range of a "j" jump instruction? _____to _____

c. What is the range of a "jr" jump instruction? _____to _____

note: you can use G to mean 2^30, (~ 1 billion), M to mean 2^20 (~ 1 million), K to mean 2^10 (1024)

Name _____

Question 9 – CPU Control Lines



Show how the control lines are set to achieve the operations below. Assume msel = 1;

asl: 0=AU, 1=LU, 2=SU, 3 = invalid; ST: 0=arithmetic, 1=logical, 2=rotate, 3 = invalid;
LF: 0=AND, 1=OR, 2=XOR, 3 = invalid; a'/s: 0=add, 1= subtract rwe: 1=write, 0= do not write

Add $5 to the value in $2 and put the result into memory (address=$9) M[9] = $5 + $2
(note: loading or storing data requires a separate CPU clock cycle)

Mem r'/w	X	Y	Z	rwe	asl	a'/s	en	ld en	st en	im en	im va (Immediate Value)

Question 10. When is a "jal" jump used? What value is put into register $ra? Why?