UNC Charlotte – Spring 2005 - Exam 1 – February 15, 2005

Name: _____ Student MOSAIC ID: _____

Question	1-4	5	6	7	8	9	10	11	Total
Score	/25	/15	/20	/15	/15	/20	/20	/20	/150

Short Answers

1) (10 points) Convert -265_{10} to hexadecimal (16 bits two's complement notation) by hand. Show your work below.

Solution:

265= 0000000100001001 in binary
=0x109 (3 points)
Taking Two's complement:
1111111011110110
+ 1

1111111011110111= 0xFEF7 (7 points)

Answer: **0xFEF7**

2) (3 points) Translate the following ASCII codes into strings of characters by interpreting each group of eight bits as an ASCII character: 0x74696B3721

Answer: **tik7! (.5 for trying, .5 for each correct character)**

3) (2 points) Sign extend the 6-bit 2's complement binary number 111000 to a 8-bit 2's complement binary number. Then express this number in hexadecimal.

Answer: **0xF8 (all or none)**

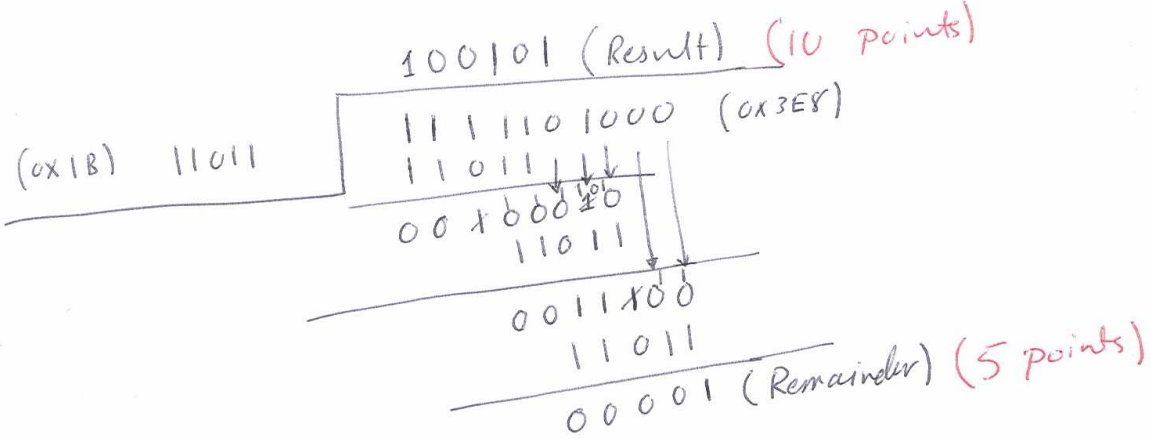
4) (10 points) What is the range of numbers which can be represented by 9 bits if we are representing two's complement integers? (express as the formula and as decimal numbers)

Formula: **2^{n-1} to $2^{n-1}-1$ (5 points or none)**

Decimal: **-256 to 255 (5 points or none)**

5) (15 points) Perform the operation x3E8 divided by x1B. Show your result in binary (hint: Perform the division in binary). Show your work below.

Answer: 100101 , R = 1



*Must show work for full credit

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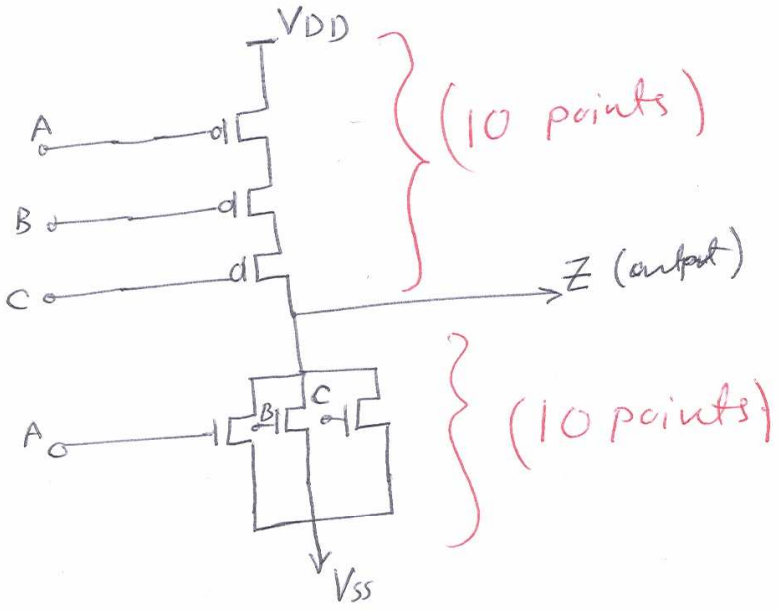
Long Answer

6) (20 points) Draw a Transistor-Level Schematic Diagram of a three-input NOR Gate, similar to what was done in the homework assignment (similar to Figure 3-16a in the book).



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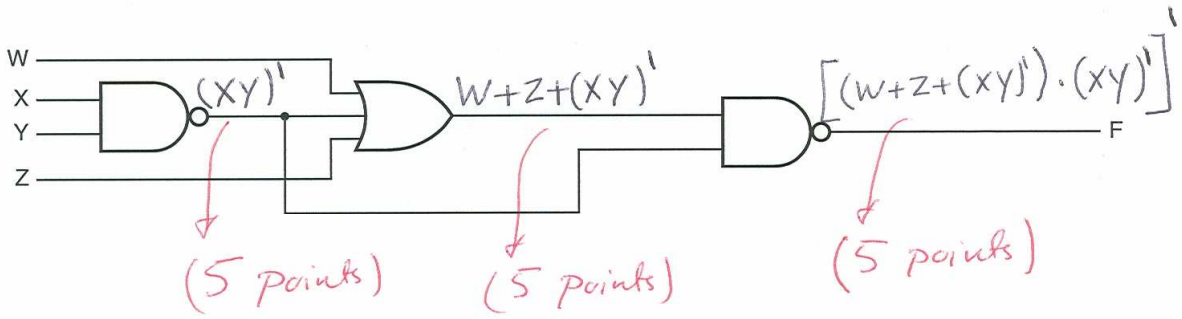
7) (15 pts.) Combinational Circuit Analysis. Write a logic expression for the output F of the circuit below as a function of the circuit inputs (W, X, Y, and Z). Derive the expression directly from the structure of the circuit; do not simplify.



F = [(W+Z+(XY)'.(XY)']'

8) (15 pts.) Complete the Truth Table for the following function: F = ΣA,B,C(1,4,5,7) and give the Canonical Sum representation.

Row	A	B	C	F	Minterm
0	0	0	0	0	
1	0	0	1	1	A'.B'.C
2	0	1	0	0	
3	0	1	1	0	
4	1	0	0	1	A.B'.C'
5	1	0	1	1	A.B'.C
6	1	1	0	0	
7	1	1	1	1	A.BC

1-point for each correct entry. = 12 points.

F = (A'.B'.C) + (A.B'.C') + (A.B'.C) + (A.B.C)

3-points.

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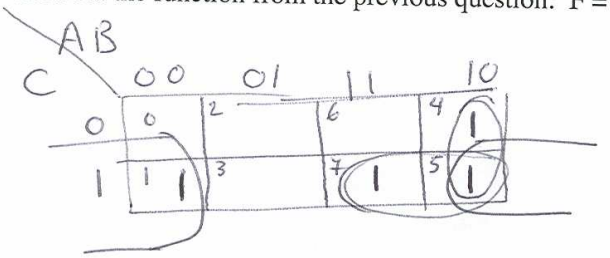
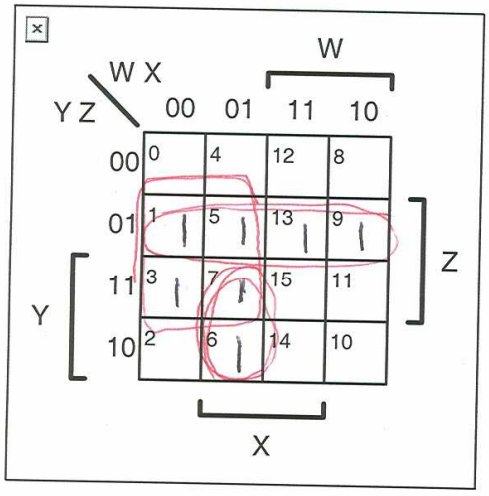
9) (20 pts.) Combinational Circuit Minimization. Using a Karnaugh map, find a minimal sum of products expression for the function from the previous question: $F = \Sigma A,B,C(1,4,5,7)$. Show all of your work.



$F = A \cdot B' + B' \cdot C + A \cdot C$

Points:
2: box for map
2: correct labels
2: correct column & row values
4: correct entries
10: correct F.

10) (20 pts.) Combinational Circuit Minimization. Fill in the Karnaugh map and find a minimal sum of products expression for the function: $F = \Sigma W,X,Y,Z(1,3,5,6,7,9,13)$.



$F = Y'Z + W'Z + W'XY$

Points:
5: correct entries
5: correct "circles"
10: correct F.

11) (20 pts.) Draw the logic diagram (gate-level schematic) for the minimal sum of products expression derived in the question above.

Points: