New Paltz
STATE UNIVERSITY OF NEW YORK

Division of Engineering Programs

EGC220 Digital Logic Fundamentals

Test 1

For full credit, you need to show your work.
Closed Book and Notes

First Name: Key **Last Name:** _____

- Your submission must be in a single PDF file
- Make sure you submit before the deadline of 3:15 PM. I will not accept late submission by email.
- You must adhere to the honor code. Any evidence of misconduct will be dealt with strictly per syllabus.

5 PT.

1) Convert $(30.25)_{10}$ to base 2 and 16.

16 8 4 2 1 . .5 .25

0 0 0 1 1 1 1 0 . 0 1 0 0

1 E 4

11110.01

1E.4

15 PT.

2) Perform the following operations in the indicated base.

a.

$$\begin{array}{r} {\scriptstyle 1} \\ (2.3)_6 \\ +(15.2)_6 \\ \hline (21.5)_6 \end{array}$$

$(21.5)_6$

b.

$$\begin{array}{r} {\scriptstyle +6} \\ 2\,3{\scriptstyle +6} \\ (34.3)_6 \\ -(25.5)_6 \\ \hline (4.4)_6 \end{array}$$

$(4.4)_6$

c.

$$\begin{array}{r} (4.3)_6 \\ \times(13.2)_6 \\ \hline 1\ 3\ 0 \\ 2\ 1\ 3 \\ 4\ 3 \\ \hline 1\ 1\ 0.0\ 0 \end{array}$$

$6 \div 6 = 1 \quad R = 0$

$9 \div 6 = 1 \quad R = 3$

$13 \div 6 = 2 \quad R = 1$

$7 \div 6 = 1 \quad R = 1$

$(110)_6$

5 PT.

3) Perform $(57)_{10} - (74)_{10}$ operations in binary, assuming signed 2's complement notation.

S 64 32 16 8 4 2 1

0 0 1 1 1 0 0 1 57

0 1 0 0 1 0 1 0 74

1 0 1 1 0 1 1 0 −74

0 0 1 1 1 0 0 1

1 0 1 1 0 1 1 0

1 1 1 0 1 1 1 1 ✓

$- \quad 0\ 0\ 0\ 1\ 0\ 0\ 0\ 1 = -17$ ✓

1110 1111

10 PT.

4) What does the following binary numbers represent in
   a. Unsigned domain
   b. Signed magnitude
   c. Signed 2's complement

	Unsigned	Signed magnitude	Signed 2's complement
00111101	61	+61	+61
11010110	214	−86	−42

64 32 16 8 4 2 1

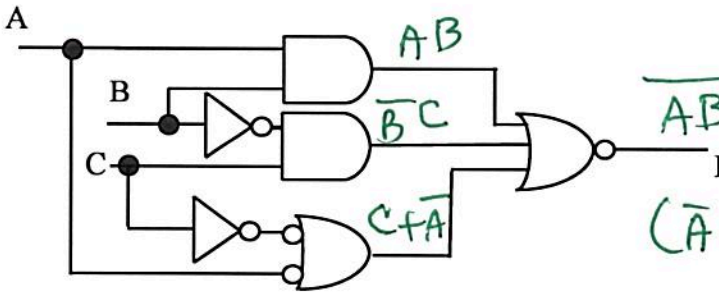
64 32 16 8 4 2 1

128 64 32 16 8 4 2 1

− 0 0 1 0 1 0 1 0

10 PT.

5) Find the Boolean equation for the following circuit. You do not need to simplify the function. However, there should not be a bar over more than one term.



$\overline{AB+\bar{B}C+(\bar{A}+C)}$

$(\bar{A}+\bar{B})(B+\bar{C})(A\bar{C})$

$(\bar{A}+\bar{B})(B+\bar{C})(A\bar{C})$

10 PT.

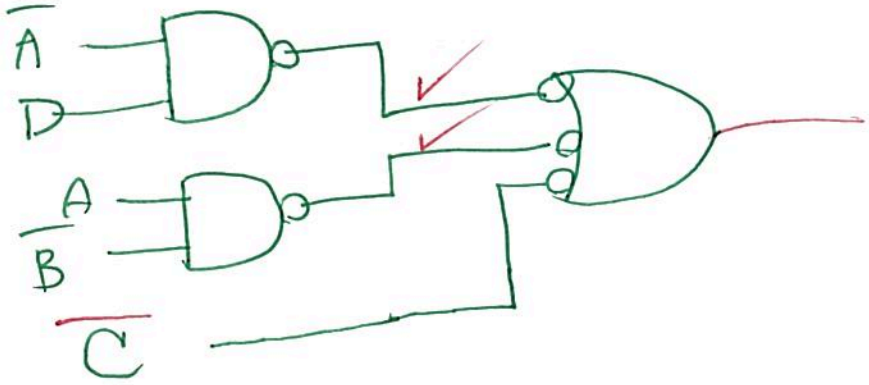
6) By means of truth table prove or disprove that $A+\bar{B}C=(A+\bar{B})(A+\bar{C})$ not the same

A	B	C	$\bar{B}C$	$A+\bar{B}C$	$A+\bar{B}$	$A+\bar{C}$	$(A+\bar{B})(A+\bar{C})$
0	0	0	0	0	1	1	1
0	0	1	1	0	1	0	0
0	1	0	0	0	0	1	0
0	1	1	0	0	0	0	0
1	0	0	0	1	1	1	1
1	0	1	1	1	1	1	1
1	1	0	0	1	1	1	1
1	1	1	0	1	1	1	1

10 PT.

7) Implement the following function using all NAND gates.

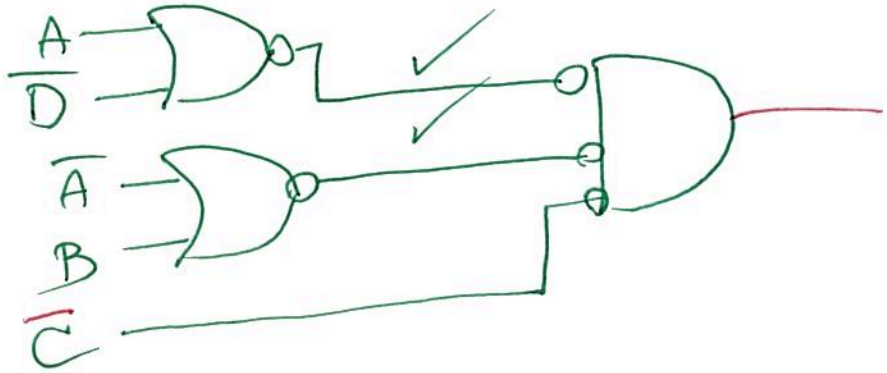
$F = C + \overline{A}\,D + A\,\overline{B},$



10 PT.

8) Implement the following function using all NOR gates

$F = C\,(A + \overline{D})\,(\overline{A} + B),$



10 PT.

9) For the following function $F(A, B, C) = \bar{A}\,\bar{B} + B\,C + \bar{A}\,B\,\bar{C}$

a. Make a truth table

b. Using Boolean algebra simplify the function.

$BC(\bar{A}+A) = BC$

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

$F = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + \bar{A}B\bar{C} + \bar{A}BC + ABC$

$\bar{A}\bar{B}(\bar{C}+C)$ $\qquad$ $\bar{A}B(\bar{C}+C)$

$\bar{A}\bar{B}$ $\qquad$ $\bar{A}B$

$\bar{A}(\bar{B}+B)$

$\bar{A}$

$F = \bar{A} + BC$

15 PT.

9) For Boolean expression $F(A, B, C, D) = \prod M(7, 8, 12, 13, 15) + d(0, 2, 5, 10, 14)$, determine

a. Sum of Min terms.

b. Minimum sum of products.

c. Minimum products of sums.

a. $F = \Sigma m(1,3,4,6,9,11) + d(0,2,5,10,14)$

b. $F = \bar{A}\,\bar{D} + \bar{B}\,D$

c. $\bar{F} = BD + A\bar{D}$

$F = (\bar{B}+\bar{D})(\bar{A}+D)$