Digital Logic
MID EXAM
Spring 2013

POWER UNIT
ELECTRICAL ENGINEERING

Problem 1 (3pts)

A. (1.5 points)Represent the binary nuber $(1011\ 0110)_2$ in BCD.Answer: $(10000010)_{BCD}$

$(10110110)_2 = 2 + 4 + 16 + 32 + 128 =$

$54 + 128 = (182)_{10} = 0001\ 1000\ 0010$

1.5

B. (1.5 points) Convert the decimal number $(76.63)_{10}$ to binary with a maximum of 4 fraction bits.Answer: $(1001100.1010)_2$

76 → 0
38 → 0
9 → 1
9 → 1
4 → 0
2 → 0
1 → 1

76 → 0
38 → 0
19 → 1
9 → 1
4 → 0
2 → 0
1 → 1

0.63 * 2 → 1.26
0.26 * 2 → 0.52
0.52 * 2 → 1.04
0.04 * 2 → 0.08

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Problem 2(2 pts)

Simplify the following expression using Boolean algebra identities

$$\overline{\overline{(A.\overline{B}.\overline{C}.D).(\overline{B}+C)}}$$

$$\overline{\overline{(A+B+C+\overline{D}).(B\overline{C})}}$$

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

$= \overline{A} + B + (C + \overline{D}) + (B.\overline{C})$ ②

$= \overline{A} + B + C + \overline{D} + B.\overline{C}$

$= \overline{A} + C + \overline{D} + B(1 + \overline{C})$

$= \overline{A} + B + C + \overline{D}$ ②

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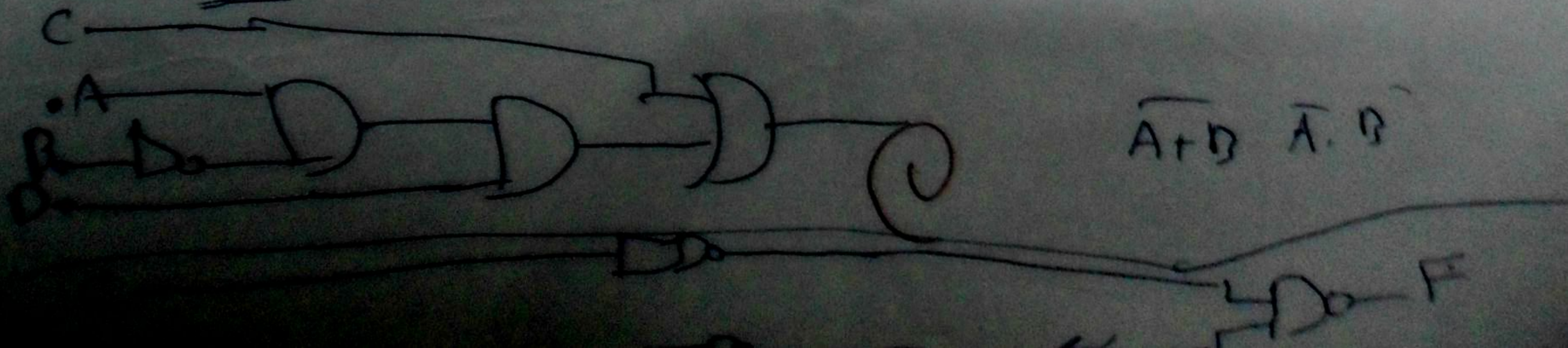
Problem 3 (2pts)

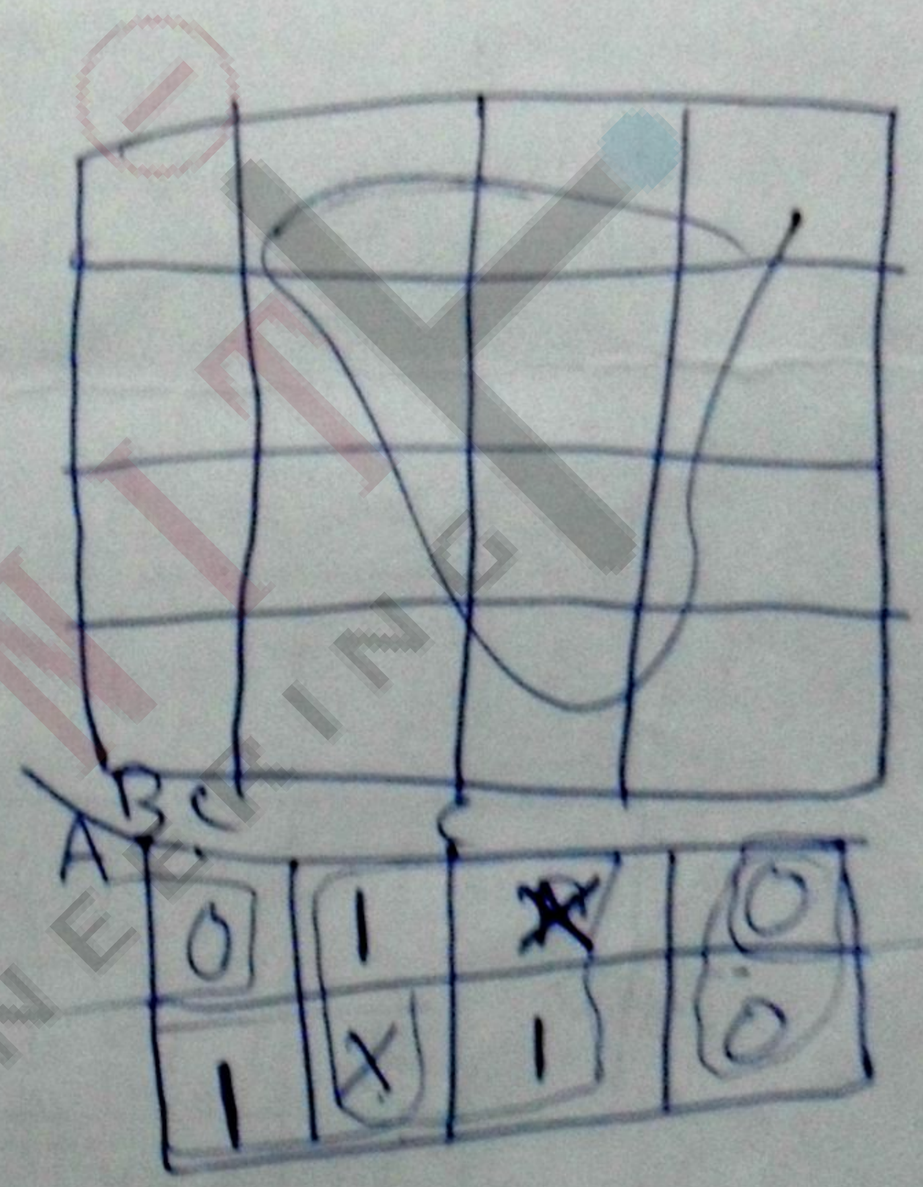
Draw the NAND implementation of the equation: $F = C + A\overline{B}D$



Problem 4(5 points)

Consider the following truth table

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



Answer the following questions:

A. (1 point) Write F as a sum of minterms

Answer:
F= $\Sigma m(1, 4, 7) + \Sigma d(3, 5)$

B. (1 point) Write F as a product of maxterms

Answer:
F= $\Pi M(0, 2, 6) + \Sigma d(3, 5)$

C. (2 points) Write F in a simplified SOP format

Answer:
F= $C + A\bar{B}$

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D. (1 point) Write F in a simplified POS format

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

Answer:
F= $(\bar{B}+C).(A+C)$

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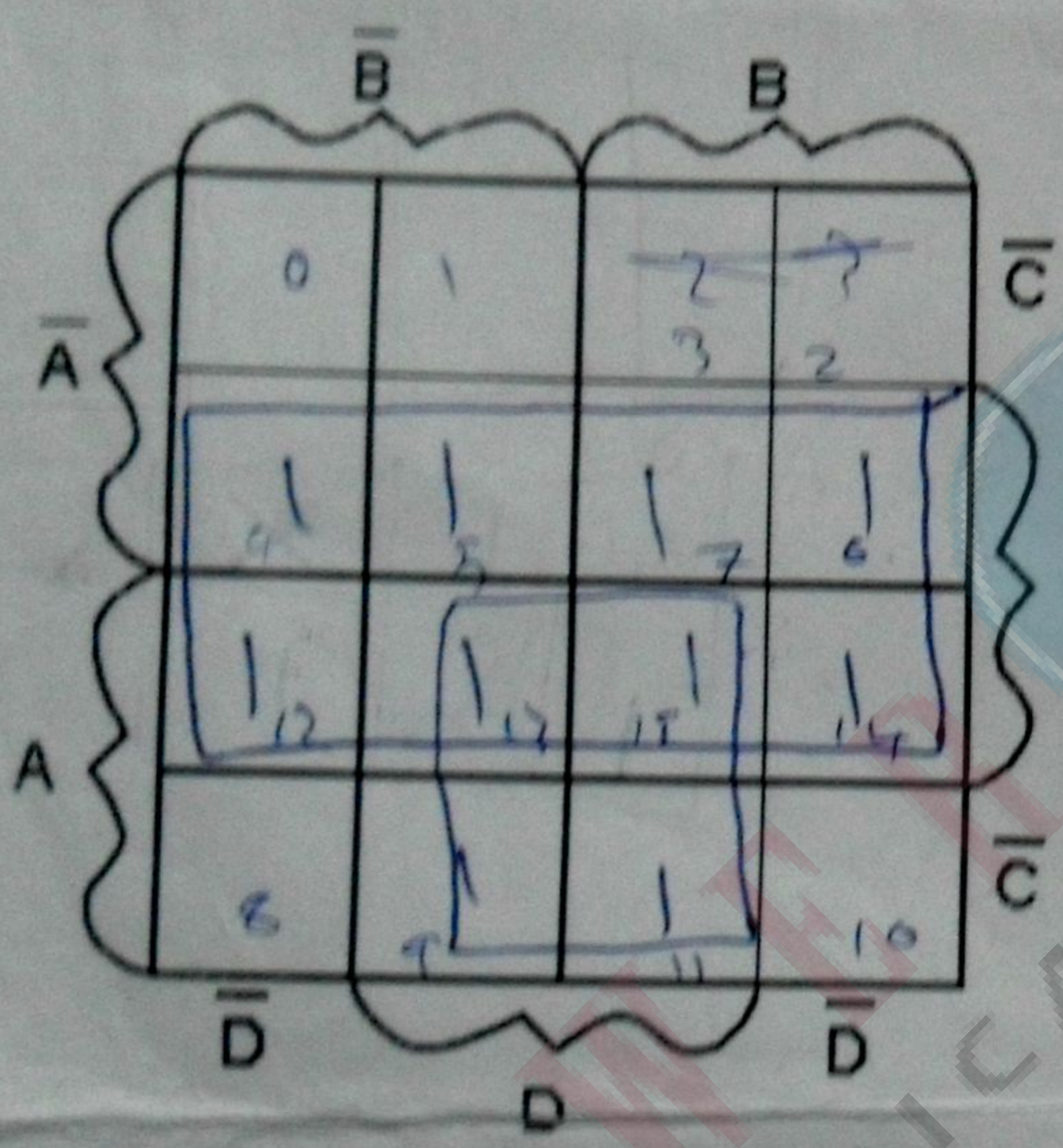
Problem 5(5pts)
Consider the following function.

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

A. (4 points) Derive a simplified ***sum of products*** expression using a Karnaugh Map. List the prime implicants, indicating which ones are essential.



prime implicants	essential? yes	no
C	☑	☐
AD	☑	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐

Simplified sum of products: C + AD

3. (1 point) Write the function as summation of minterms:

Answer: $F(A,C,B,D) = \sum m\,(4,5,6,7,9,11,12,13,14,15)$

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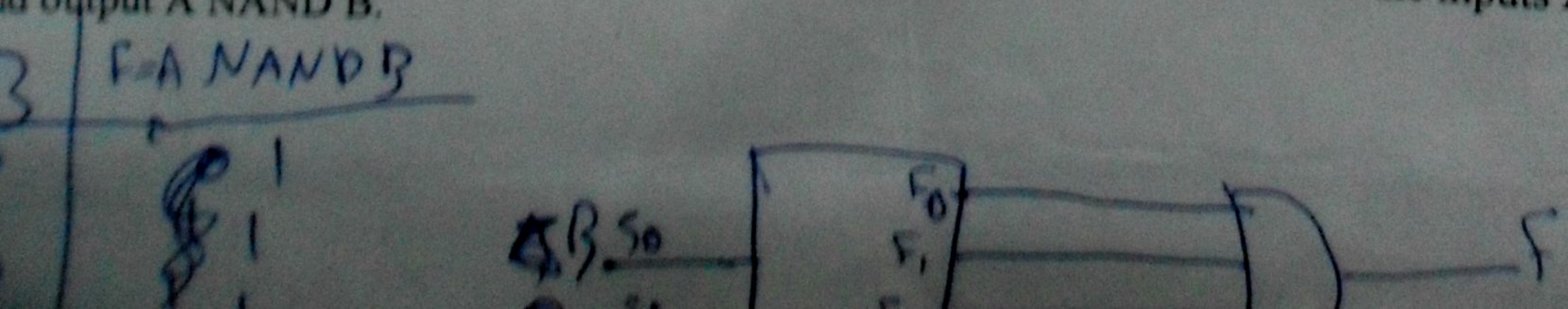
Problem 6(4pts)
Implement a 2-input NAND using a 2-to-4 decoder and a single OR gate. Label the inputs A and B, and output A NAND B.



0907231 Digital Logic
7 Problems, 5 Pages

Midterm Exam
75 Minutes

Spring 2013
March30; 5 PM

Problem 7 (4pts)

Using a multiplixer, design a circuit that will take in a 3-bit number and produce a value of 1 if there is an even number of 1's in the input and a 0 if there is an odd number of 1's.

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