EEN 220 LOGIC DESIGN

SUMMER 2002
TEST 1
50 MINUTES

NDU
ECCE DEPARTMENT
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NOTE1: OPEN BOOK, CLOSED NOTES.
NOTE2: SHOW ALL WORK IN ORDER TO RECEIVE FULL CREDIT.

1. 15 Pts. Perform the base conversions and binary operations indicated below.

$(1040.9375)_{10} = (\quad)_{16} = (\quad)_{8} = (\quad)_{2}$

$(1007.1)_8 - (1FF.C)_{16}$. Use two's complement addition.

2. 25 Pts. Which of the following four variable functions are equivalent? Justify your answer.

$F_1 = \sum m(0, 2, 5, 7, 8, 10, 13, 15)$
$F_2 = (A + B)' + CD(A' + B') + ((B'C'D')'(ABC'D)'(ABCD')')'$
$F_3 = ((B + D)(B' + D'))' + ABD + (B' + C' + D')'$
$F_4 = \prod M(4, 5, 6, 9, 10, 12, 15)$
$F_5 = AB' + CD + A'D + A'BC + A'B'C'$
$F_6 = (B' + C + D)(A' + B' + C)(A' + B' + D)(A + B + C' + D)$

3. 20 Pts. Find the minterm and maxterm list forms for the function defined by the logic diagram in Fig.P3.

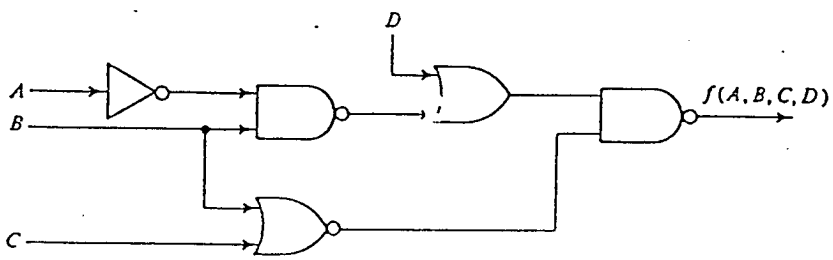

Fig.P3.

4. 20 Pts. $F(A,B,C,D,E) = \prod M(0, 3, 6, 9, 11, 19, 20, 24, 25, 26, 27, 28, 29, 30) \cdot \prod D(1, 2, 12, 13)$

   a. Find two minimum sum-of-products expressions for F.

b. Underline the essential prime implicants in your answer .

5.20 Pts. Design a switching network which has five input variables and one output variable. Four of the input variables represent BCD digits, while the fifth is a control line. While the control line is a logic 0, the output should be logic 1 only if the BCD digit is greater than or equal to 5. While the control line is high, the output should br logic 1 only if the BCD digit is less than or equal to 5.

Solution

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1) $(1040.9375)_{10} = (10000010000.1111)_2 (2020.74)_8 = (410.F)_{16}$

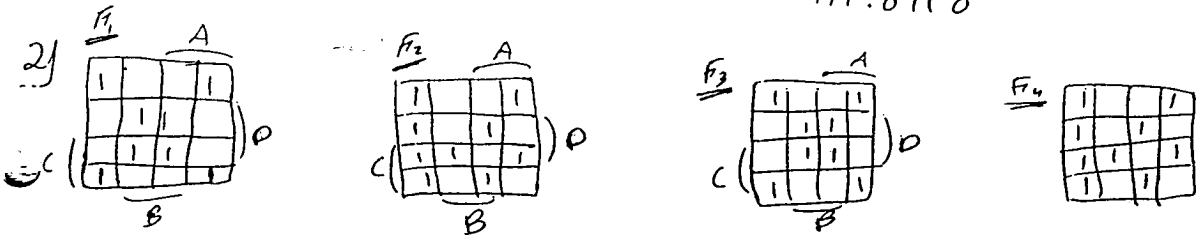
$(1007.1)_8 - (1FF.C)_{16} =$

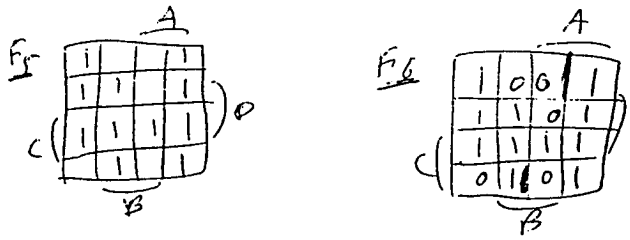
$1\,000\,000\,111.0010$

$-\quad 0\,111\,111\,111.1100$

0	$1\,000\,000\,111.0010$
1	$1\,000\,000\,000.0100$
	$1\,0\,000\,0000\,111.0110$

2)



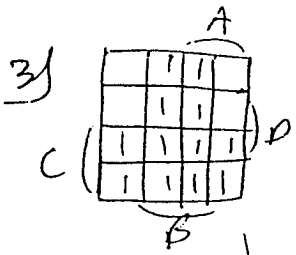


$f_5 = f_6$

$F_1 = F_3$

$F_2 = F_4$

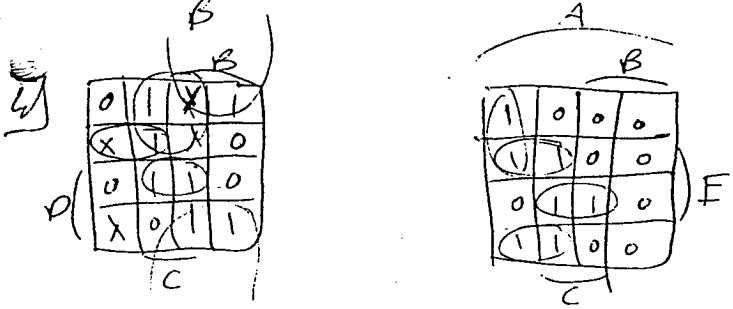
3)



$\Sigma m (2,3,4,5,6,7,10,11,12,13,14,15)$

$\Pi M (0,1,8,9)$

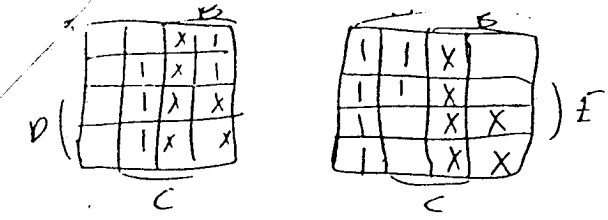
4)



$\underline{A'CD'}$ $\underline{A'BE'}$ $\underline{CDE}$ $\underline{B'D'E}$ essentials

$A'CD' + A'BE' + CDE + AB'C'D' + \underline{B'D'E} + AB'DE'$

$A'CD' + A'BE' + CDE + AB'C'E' + \underline{B'D'E} + AB'CD$



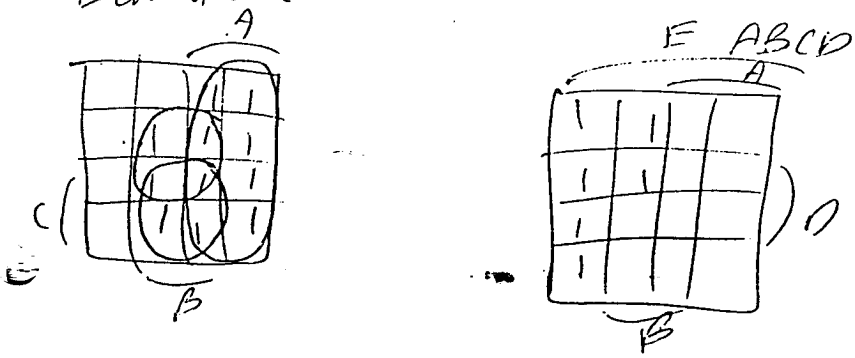
with X:

$$F(A,B,C,D,E) = A'B + AB'C' + A'CE + A'CD + ACD'$$

no X:

$$AB'C' + AB'D' + A'BC'D' + A'B'CD + A'B'CE$$

Essential line



$$AE' + A'B'E + A'C'E + BDE' + BCE'$$