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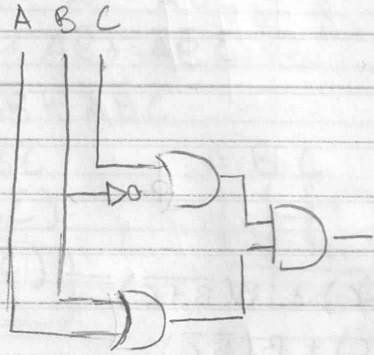
04/14/2020
CSE222

Homework #6

1a. $F = (A+B)(\overline{B}+C)$

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

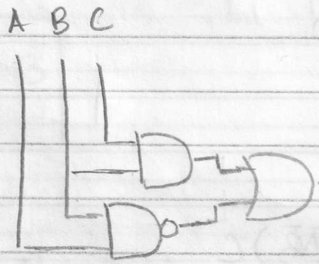


$F = (A+B)(\overline{B}+C)$

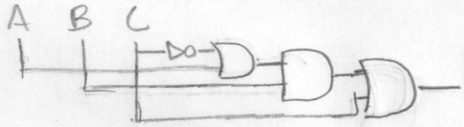
1b.

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

$F = \overline{AB} + BC$



$F = \overline{AB} + BC$

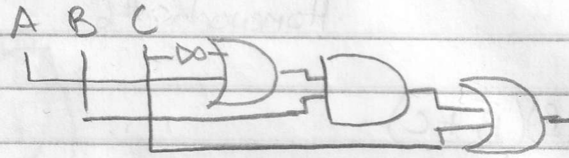


$F = C + B(A+\overline{C})$

1c.

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

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



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

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

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

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

$= \overline{A}B + \overline{A}B + \overline{A}C + 0 \cdot \overline{C}$

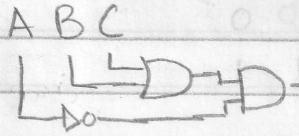
$= \overline{A}B + \overline{A}B + \overline{A}C + 0$

$= B(\overline{A}+\overline{A}) + \overline{A}C + 0$

$= \overline{A}B + \overline{A}C + 0$

$= \overline{A}(B+C) + 0$

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



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

2b. $F = (A\overline{B}(C+BD) + \overline{A}\overline{B})C$

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

$= A\overline{B}CC + A\overline{B}CBD + \overline{A}\overline{B}C$

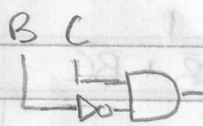
$= A\overline{B}C + ACD \cdot 0 + \overline{A}\overline{B}C$

$= A\overline{B}C + 0 + \overline{A}\overline{B}C$

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

$= \overline{B}C(1)$

$\boxed{= \overline{B}C}$



$F = \overline{B}C$

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$$X\bar{Y} + Y = X + Y$$

2c. $F = \bar{A}BC + A\bar{B}\bar{C} + \bar{A}\bar{B}\bar{C} + A\bar{B}C + ABC$

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

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

$= \bar{A}BC + A\bar{B}(1) + \bar{A}\bar{B}\bar{C} + ABC$

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

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

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

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

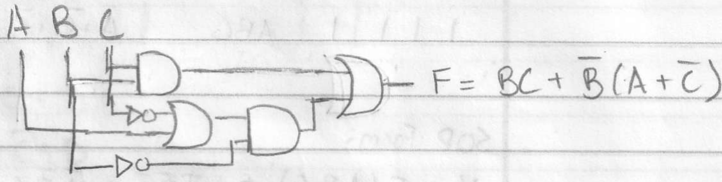
$= BC + A\bar{B} + \bar{A}\bar{B}\bar{C}$

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

$\boxed{= BC + \bar{B}(A + \bar{C})}$

$AC + BC + \bar{B}\bar{C}$

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



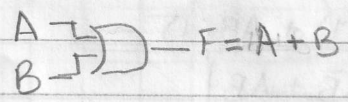
3. $F = AB + (A + B)$

$= (AB + A) + B$ associative

$= (A + AB) + B$ commonitive

$\boxed{= A + B}$ absorption

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



$F = AB + A(B+C) + B(B+C)$

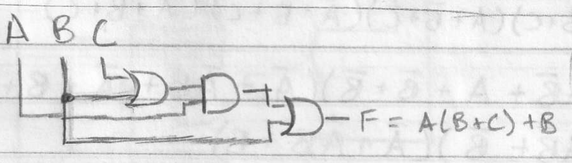
$= AB + AB + AC + BB + BC$

$= A(B + B + C) + B + BC$

$= A(B+C) + B + BC$

$\boxed{= A(B+C) + B}$

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

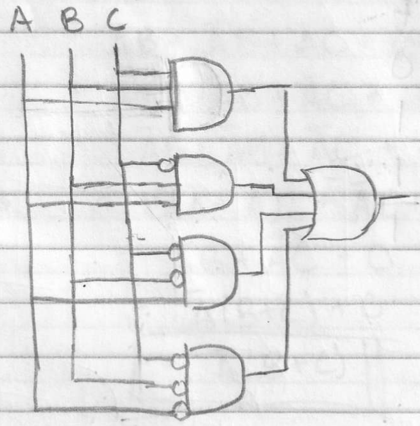


4(1)...

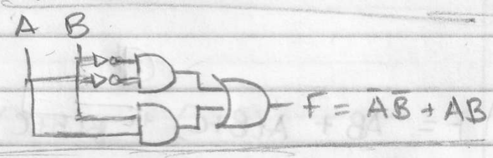
A	B	C	F	minterm	maxterm
0	0	0	1	$\bar{A}\bar{B}\bar{C}$	$A+B+C$
0	0	1	1	$\bar{A}\bar{B}C$	$A+B+\bar{C}$
0	1	0	0	$\bar{A}B\bar{C}$	$A+\bar{B}+C$
0	1	1	0	$\bar{A}BC$	$A+\bar{B}+\bar{C}$
1	0	0	0	$A\bar{B}\bar{C}$	$\bar{A}+B+C$
1	0	1	0	$A\bar{B}C$	$\bar{A}+B+\bar{C}$
1	1	0	1	$AB\bar{C}$	$\bar{A}+\bar{B}+C$
1	1	1	1	ABC	$\bar{A}+\bar{B}+\bar{C}$

SOP Form:

$Y = F(A,B,C) = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + AB\bar{C} + ABC = \Sigma(0,1,6,7)$

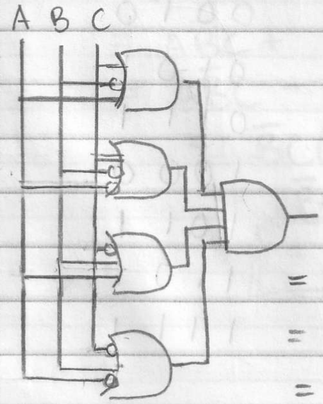


$$F = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + AB\bar{C} + ABC$$
$$= \bar{A}\bar{B}(\bar{C}+C) + AB(\bar{C}+C)$$
$$= \bar{A}\bar{B}(1) + AB(1)$$
$$\boxed{= \bar{A}\bar{B} + AB}$$

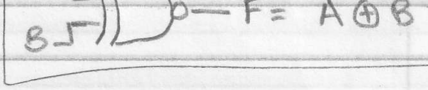


POS Form:

$Y = F = (A,B,C) = (A+\bar{B}+C)(A+\bar{B}+\bar{C})(\bar{A}+B+C)(\bar{A}+B+\bar{C}) = \Pi(2,3,4,5)$



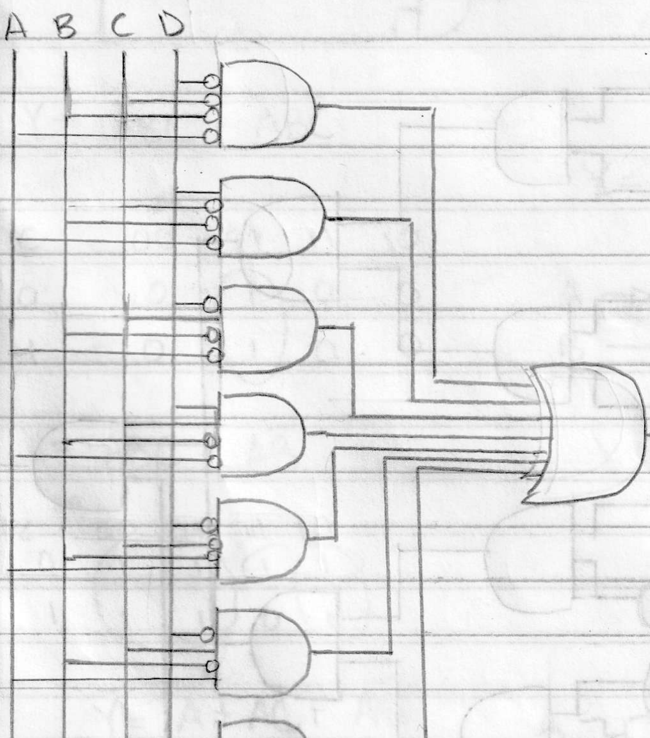
$$F = (A+\bar{B}+C)(A+\bar{B}+\bar{C})(\bar{A}+B+C)(\bar{A}+B+\bar{C})$$
$$= (A + A\bar{B} + A + \bar{B} + \bar{B})(\bar{A} + \bar{A}B + \bar{A} + B + B)$$
$$= (A + A\bar{B} + \bar{B})(\bar{A} + \bar{A}B + B)$$
$$= (A+\bar{B})(\bar{A}+B)$$
$$= AB + \bar{A}\bar{B}$$
$$\boxed{= \overline{A \oplus B}}$$



4(2)

A	B	C	D	F	minterm	maxterm
0	0	0	0	1	$\bar{A}\bar{B}\bar{C}\bar{D}$	$A+B+C+D$
0	0	0	1	1	$\bar{A}\bar{B}\bar{C}D$	$A+B+C+\bar{D}$
0	0	1	0	1	$\bar{A}\bar{B}C\bar{D}$	$A+B+\bar{C}+D$
0	0	1	1	1	$\bar{A}\bar{B}CD$	$A+B+\bar{C}+\bar{D}$
0	1	0	0	0	$\bar{A}B\bar{C}\bar{D}$	$A+\bar{B}+C+D$
0	1	0	1	0	$\bar{A}B\bar{C}D$	$A+\bar{B}+C+\bar{D}$
0	1	1	0	0	$\bar{A}BC\bar{D}$	$A+\bar{B}+\bar{C}+D$
0	1	1	1	0	$\bar{A}BCD$	$A+\bar{B}+\bar{C}+\bar{D}$
1	0	0	0	1	$A\bar{B}\bar{C}\bar{D}$	$\bar{A}+B+C+D$
1	0	0	1	0	$A\bar{B}\bar{C}D$	$\bar{A}+B+C+\bar{D}$
1	0	1	0	1	$A\bar{B}C\bar{D}$	$\bar{A}+B+\bar{C}+D$
1	0	1	1	0	$A\bar{B}CD$	$\bar{A}+B+\bar{C}+\bar{D}$
1	1	0	0	0	$AB\bar{C}\bar{D}$	$\bar{A}+\bar{B}+C+D$
1	1	0	1	0	$AB\bar{C}D$	$\bar{A}+\bar{B}+C+\bar{D}$
1	1	1	0	1	$ABC\bar{D}$	$\bar{A}+\bar{B}+\bar{C}+D$
1	1	1	1	0	$ABCD$	$\bar{A}+\bar{B}+\bar{C}+\bar{D}$

SOP Form: $Y = F(A,B,C,D) = \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}C\bar{D} + \bar{A}\bar{B}CD + A\bar{B}\bar{C}\bar{D}$
$+ A\bar{B}C\bar{D} + ABC\bar{D} = \Sigma(0,1,2,3,8,10,14)$



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

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

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

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

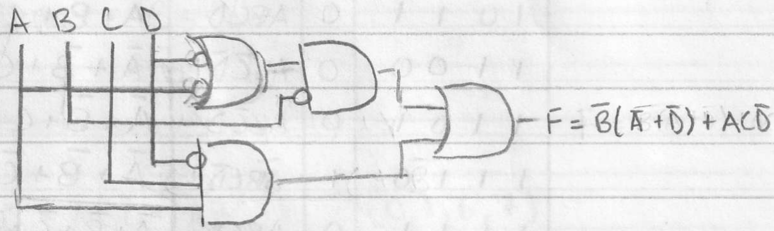
$= \bar{A}\bar{B} + A\bar{B}\bar{D} + ABC\bar{D} = \bar{A}\bar{B} + \bar{D}(A\bar{B} + ABC) = \bar{A}\bar{B} + \bar{D}(A(\bar{B} + BC))$

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

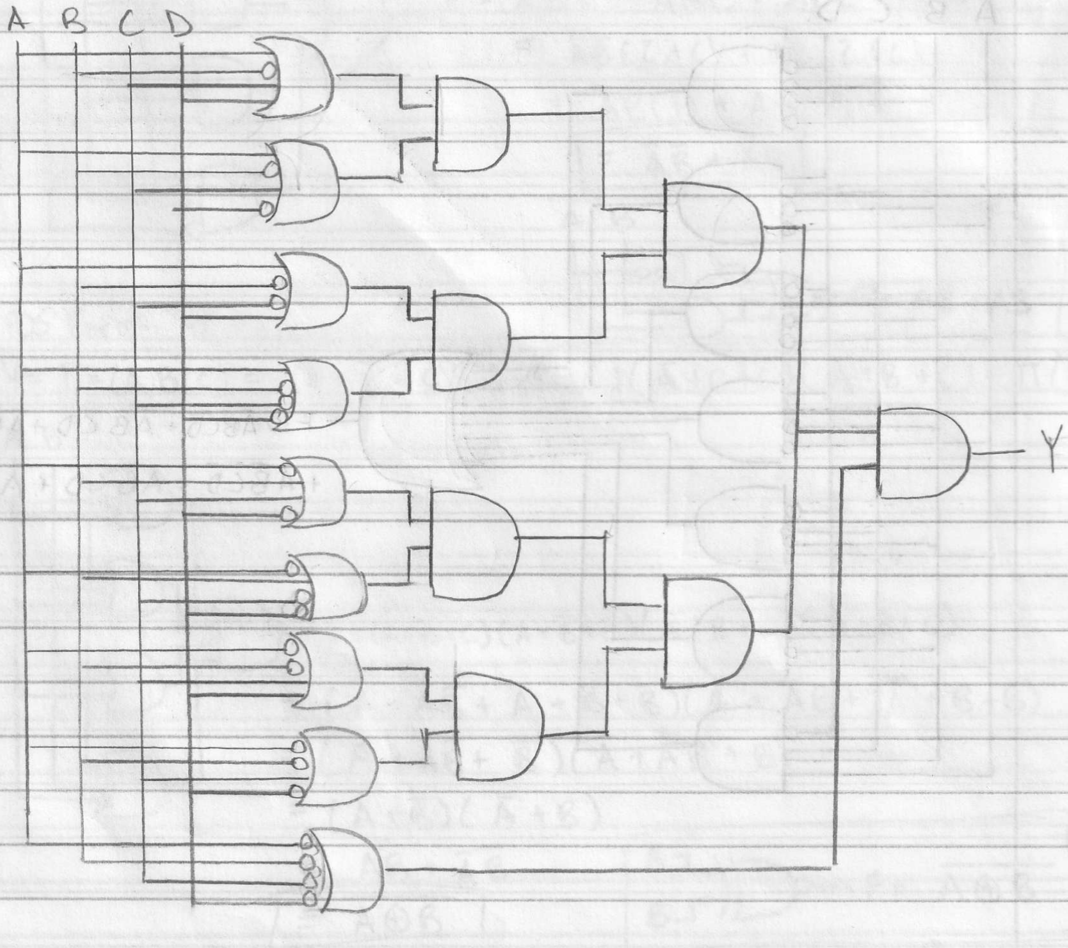
$= \bar{A}\bar{B} + \bar{D}(A\bar{B} + AC) = \bar{A}\bar{B} + A\bar{B}\bar{D} + AC\bar{D}$

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

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



POS Form: $Y = F(A,B,C,D) = (A+\bar{B}+C+D)(A+\bar{B}+C+\bar{D})(A+\bar{B}+\bar{C}+D)(A+\bar{B}+\bar{C}+\bar{D})$
$(\bar{A}+B+C+\bar{D})(\bar{A}+B+\bar{C}+\bar{D})(\bar{A}+\bar{B}+C+D)(\bar{A}+\bar{B}+C+\bar{D})(\bar{A}+\bar{B}+\bar{C}+\bar{D})$
$= \Pi(4,5,6,7,9,11,12,13,15)$



Simplyfy POS Form:

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

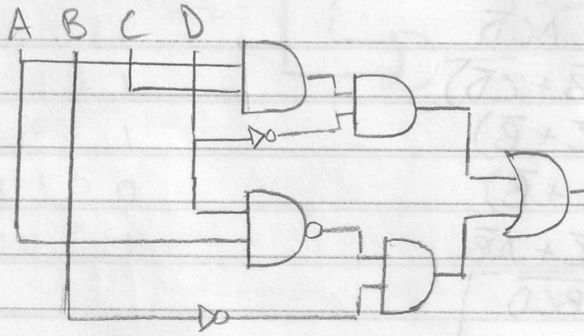
$= ABC\bar{D} + \bar{A}\bar{B}\bar{D} + \bar{B}\bar{C}\bar{D} + \bar{B}\bar{D} + A\bar{B}C\bar{D} + AC\bar{D} + \bar{A}\bar{B} + \bar{A}\bar{B} + \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}\bar{D}$

$= AC\bar{D} + \bar{B}\bar{D} + A\bar{B}C\bar{D} + \bar{A}\bar{B}$

$= AC\bar{D} + \bar{B}\bar{D} + \bar{A}\bar{B}$

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

$= \boxed{AC\bar{D} + \bar{B}(\overline{AD})}$

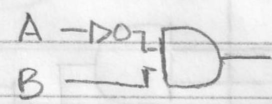


$F = AC\bar{D} + \bar{B}(\overline{AD})$

5a. $Y = \bar{A}BC + \bar{A}B\bar{C}$

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

$Y = \bar{A}B$



$Y = \bar{A}B$

5b. $Y = \overline{ABC} + A\bar{B}$

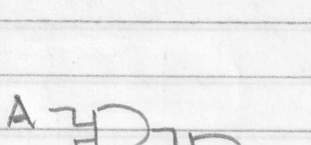
C \ AB	00	01	11	10
0	1	1	1	1
1	1	1	0	1

$Y = \bar{A} + A\bar{C} + A\bar{B}$

$= \bar{C} + \bar{A} + A\bar{B}$

$= \bar{C} + \bar{A} + \bar{B}$

$\boxed{= \overline{ABC}}$



$Y = \overline{ABC}$

5c. $Y = ABC\bar{D} + A\overline{BCD} + \overline{(A+B+C+D)}$

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

$$Y = \bar{B}\bar{C}\bar{D} + A\bar{C} + A\bar{B} + AC\bar{D}$$

$$= \overline{BCD} + A(\bar{C}+\bar{B}) + AC\bar{D}$$

$$= \overline{BCD} + A\overline{CB} + AC\bar{D}$$

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

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

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

$$= \bar{B}\bar{C}\bar{D} + A\bar{D} + A\bar{C} + A\bar{B}$$

$$\boxed{Y = \overline{B+C+D} + A\overline{BCD}}$$