

Michael Corpos

Rel. 1:

Homework #6

01/14/2020

CSE222

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

A B C F

0 0 0 0

0 0 1 0

0 1 0 0

0 1 1 1

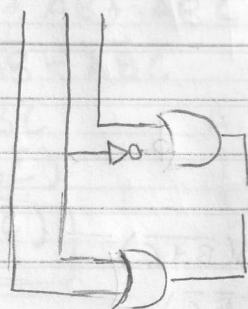
1 0 0 1

1 0 1 1

1 1 0 0

1 1 1 1

A B C



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

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

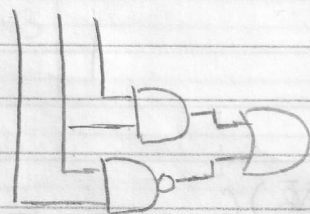
1 0 1 1

1 1 0 0

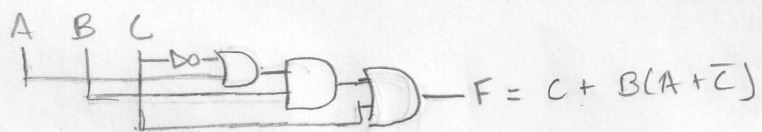
1 1 1 1

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

A B C



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



1c. ABC F $F = C + B(A + \bar{C})$

0000

0011

0101

0111

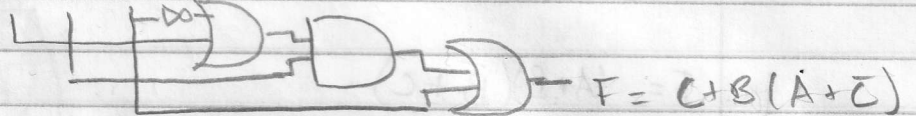
1000

1011

1101

1111

A B C



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

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

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

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

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

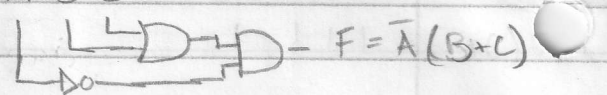
$$= B(\bar{A} + \bar{A}) + \bar{A}C + 0$$

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

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

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

A B C



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

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

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

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

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

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

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

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

B C



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

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

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

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

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

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

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

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

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

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

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

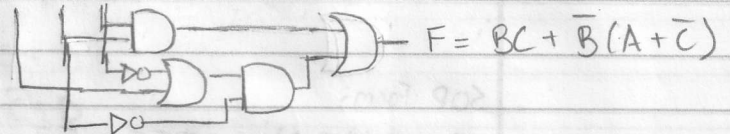
$$= BC + \bar{B}(A + \bar{A}\bar{C})$$

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

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

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

A B C



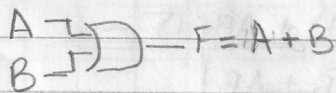
3. $F = AB + (A + B)$

$$= (AB + A) + B \text{ associative } 00 \ 0$$

$$= (A + AB) + B \text{ commutative } 01 \ 1$$

$$= A + B \text{ absorption } 10 \ 1$$

$$11 \ 1$$



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

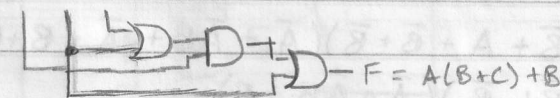
$$= AB + AB + AC + BB + BC$$

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

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

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

A B C



A B C

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

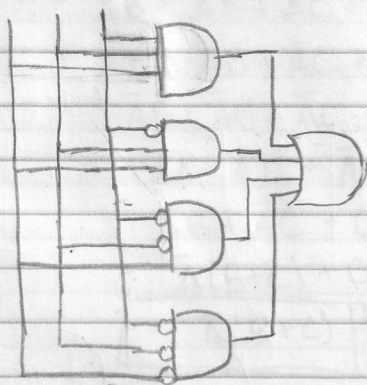
4(1)...

A	B	C	F	min term	max term
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:

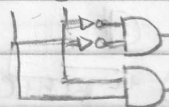
$$Y = F(A, B, C) = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + AB\bar{C} + ABC = \sum(0, 1, 6, 7)$$

A B C



$$\begin{aligned} F &= \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + AB\bar{C} + ABC \\ &= \bar{A}\bar{B}(\bar{C} + C) + AB(\bar{C} + C) \\ &= \bar{A}\bar{B}(1) + AB(1) \\ &= \bar{A}\bar{B} + AB \end{aligned}$$

A B

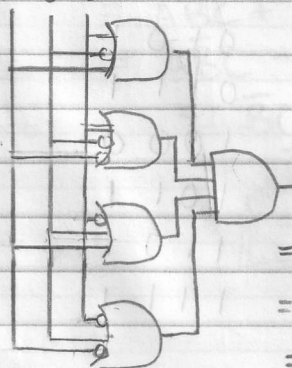


$$F = \bar{A}\bar{B} + AB$$

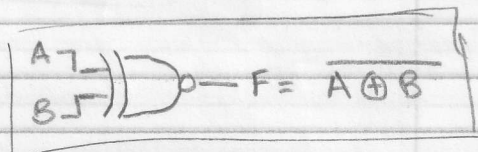
POS Form:

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

A B C



$$\begin{aligned} F &= (A + \bar{B} + C)(A + \bar{B} + \bar{C})(\bar{A} + B + C)(\bar{A} + B + \bar{C}) \\ &= (A + \bar{A}\bar{B} + A + \bar{B} + \bar{B})(\bar{A} + \bar{A}B + \bar{A} + B + B) \\ &= (A + \bar{A}\bar{B} + \bar{B})(\bar{A} + \bar{A}B + B) \\ &= (A + \bar{B})(\bar{A} + B) \\ &= AB + \bar{A}\bar{B} \\ &= A \oplus B \end{aligned}$$

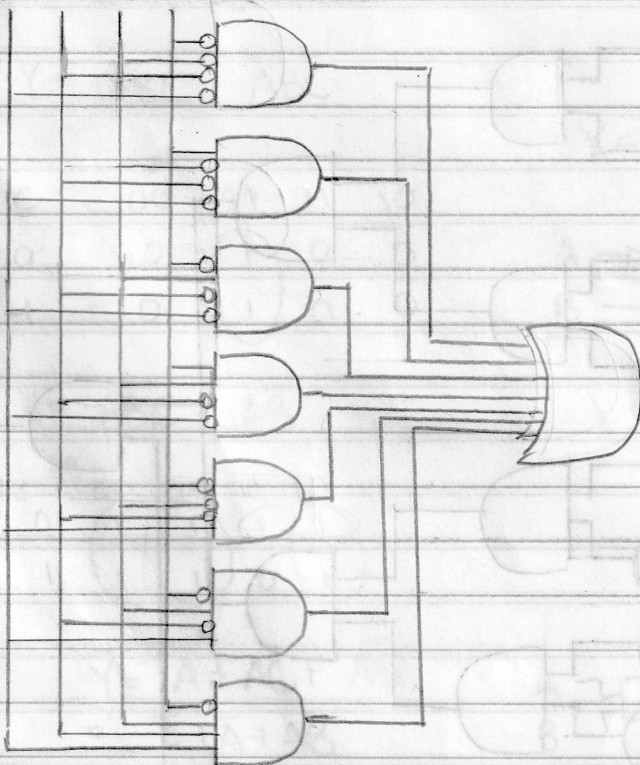


4(2)

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

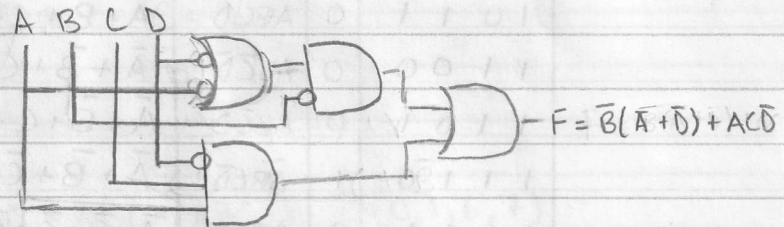
SOP Form: $V = F(A,B,C,D) = \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}C\bar{D} + \bar{A}\bar{B}CD + \bar{A}B\bar{C}\bar{D} + \bar{A}B\bar{C}D + \bar{A}BC\bar{D} + \bar{A}BCD$
 $= \sum(0,1,2,3,8,10,14)$

A B C D

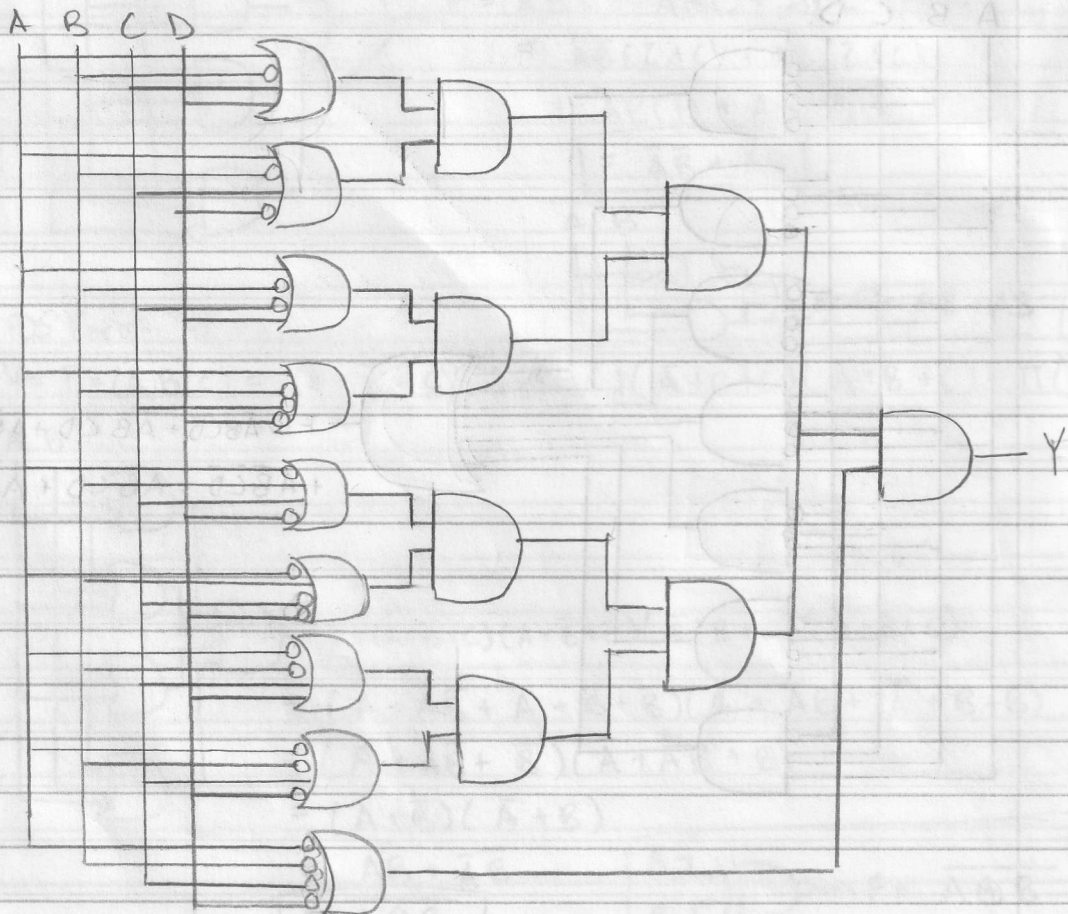


$F = \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}C\bar{D} + \bar{A}\bar{B}CD + \bar{A}B\bar{C}\bar{D} + \bar{A}B\bar{C}D + \bar{A}BC\bar{D} + \bar{A}BCD$

$$\begin{aligned}
 F &= \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}C\bar{D} + \bar{A}\bar{B}CD + A\bar{B}\bar{C}\bar{D} + A\bar{B}\bar{C}D + A\bar{B}C\bar{D} \\
 &= \bar{A}\bar{B}\bar{C}(\bar{D}+D) + \bar{A}\bar{B}C(\bar{D}+D) + A\bar{B}\bar{C}\bar{D} + A\bar{B}C\bar{D} + A\bar{B}CD \\
 &= \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + A\bar{B}(\bar{C}\bar{D} + C\bar{D}) + A\bar{B}CD \\
 &= \bar{A}\bar{B} + A\bar{B}\bar{D} + A\bar{B}C\bar{D} = \bar{A}\bar{B} + \bar{D}(A\bar{B} + A\bar{B}C) = \bar{A}\bar{B} + \bar{D}(A(\bar{B} + BC)) \\
 &= \bar{A}\bar{B} + \bar{D}(A(\bar{B} + C)) \\
 &= \bar{A}\bar{B} + \bar{D}(A\bar{B} + AC) = \bar{A}\bar{B} + A\bar{B}\bar{D} + AC\bar{D} \\
 &= \bar{B}(\bar{A} + A\bar{D}) + AC\bar{D} \quad \leftarrow 1 \\
 &= \boxed{\bar{B}(\bar{A} + \bar{D}) + AC\bar{D}}
 \end{aligned}$$



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



Simplify POS Form:

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

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

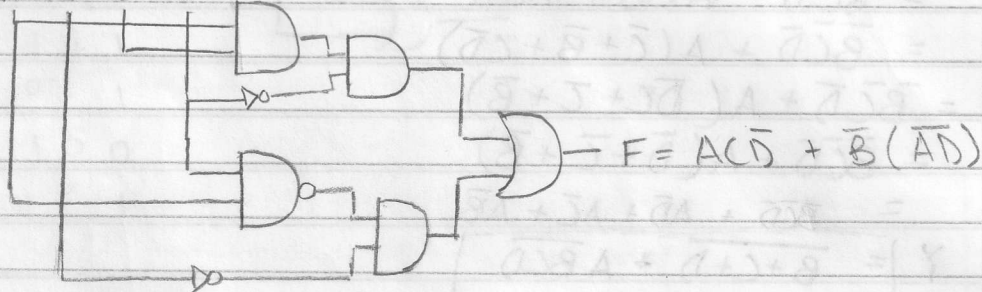
$$= AC\bar{D} + \bar{B}\bar{D} + \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}$$

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

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

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

A B C D



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

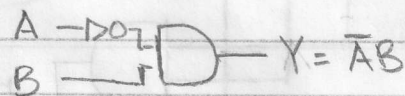
AB

C 00 01 11 10

0 0 1 0 0

1 0 1 0 0

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



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

AB

C 00 01 11 10

0 1 1 1 1

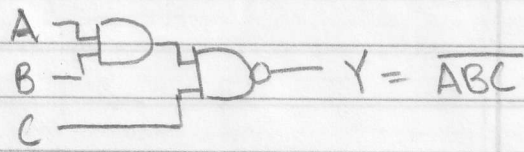
1 1 1 0 1

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

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

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

$$= \overline{ABC}$$



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

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

$$\begin{aligned}
 Y &= \overline{B}\overline{C}\overline{D} + A\overline{C} + A\overline{B} + A\overline{C}\overline{D} \\
 &= \overline{B}\overline{C}\overline{D} + A(\overline{C} + \overline{B}) + A\overline{C}\overline{D} \\
 &= \overline{B}\overline{C}\overline{D} + A\overline{C}\overline{B} + A\overline{C}\overline{D} \\
 &= \overline{B}\overline{C}\overline{D} + A(\overline{C} + \overline{B} + \overline{C}\overline{D}) \\
 &= \overline{B}\overline{C}\overline{D} + A(\overline{D} + \overline{C} + \overline{B}) \\
 &= \overline{B}\overline{C}\overline{D} + A\overline{D} + A\overline{C} + A\overline{B} \\
 Y &= \overline{B+C+D} + A\overline{BCD}
 \end{aligned}$$

A B C D

