Solution Set 1

Exercises 11.8, 11.9, 11.13, 11.15, 11.17, 11.19, 11.20, 11.21, 11.22, 11.24.

11.8

(a) $(1+0)1 = 1\cdot 1 = \underline{1}$

(b) $0+(1\bar{1})1 = (1\bar{1})1 = (1\cdot 0)1 = 0\cdot 1 = \underline{0}$

(c) $\overline{(1+0)}(1+1) = \bar{1}(1) = 0\cdot 1 = \underline{0}$

11.9

(a) $F = (X+Y)\bar{X}$

X	Y	$X+Y$	$\bar{X}$	F
0	0	0	1	0
1	0	1	0	0
0	1	1	1	1
1	1	1	0	0

(b) $F = (Y\cdot Z)\bar{X} + X$

X	$\bar{X}$	Y	Z	$Y\cdot Z$	$(Y\cdot Z)\bar{X}$	F
0	1	0	0	0	0	0
0	1	0	1	0	0	0
0	1	1	0	0	0	0
0	1	1	1	1	1	1
1	0	0	0	0	0	1
1	0	0	1	0	0	1
1	0	1	0	0	0	1
1	0	1	1	1	0	1

(11.13)

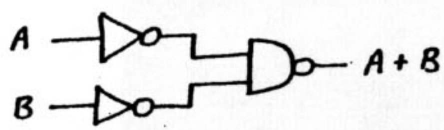
A	B	C	A+B	A+C	(A+B)(A+C)	BC	A+BC
0	0	0	0	0	0	0	0
0	0	1	0	1	0	0	0
0	1	0	1	0	0	0	0
0	1	1	1	1	1	1	1
1	0	0	1	1	1	0	1
1	0	1	1	1	1	0	1
1	1	0	1	1	1	0	1
1	1	1	1	1	1	1	1

COMPARING THE LAST AND THE LAST BUT TWO COLUMNS, WE SHOWED THAT $(A+B)(A+C) = A+BC$ ■

(11.15) BY DE MORGAN'S THM,

$$A+B \equiv \overline{\left(\overline{A+B}\right)} = \overline{\left(\bar{A}\,\bar{B}\right)}$$

HENCE THE FOLLOWING CIRCUIT PERFORMS THE "OR" OPERATION:

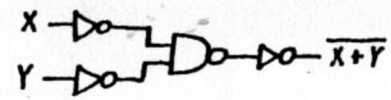


■

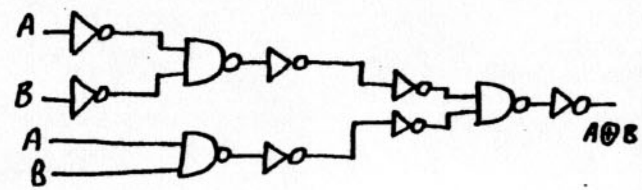
(11.17) FIG 11.12 SHOWS HOW TO MAKE AN XOR OUT OF TWO "NOR'S" AND ONE "AND". FROM DE MORGAN'S THM, $\bar{A}+\bar{B} = \overline{AB}$, OR, IF WE RENAME $\bar{A}=X$, $\bar{B}=Y$,

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

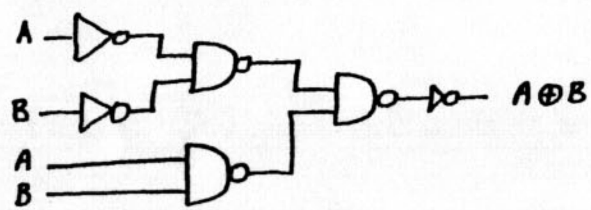
THUS A NOR GATE IS REALIZED BY



THUS FROM FIG 11.12,



(All INPUTS MARKED "A" ARE CONNECTED TOGETHER, ETC.) ELIMINATING THE DOUBLE NEGATIVES, THIS SIMPLIFIES TO

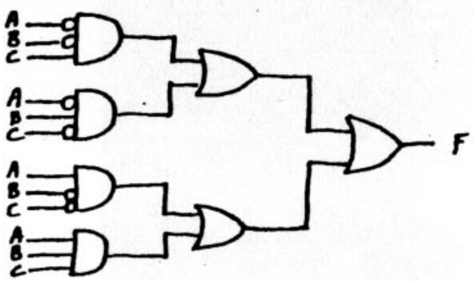


THE INVERTERS CAN BE IN EITHER FORM SHOWN. IN FIG. 9.33. ■

(11.19) THE DESIRED TRUTH TABLE IS

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

TO AVOID A 4-INPUT OR GATE WE REALIZE (USING SUM-OF-PRODUCTS METHOD) AS FOLLOWS:



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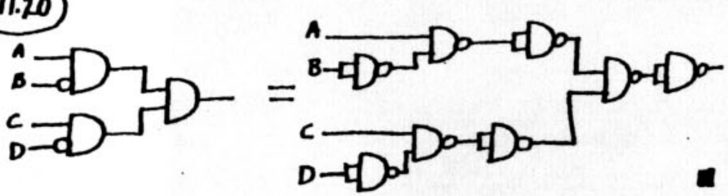
(11.20)



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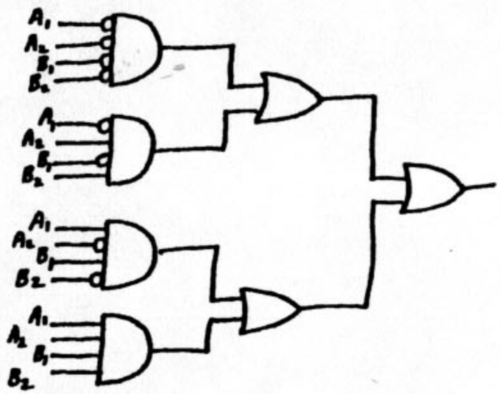
(11.21) THE ONLY SETS OF INPUTS FOR WHICH THE OUTPUT SHOULD BE 1 ARE

$A_1 A_2$	$B_1 B_2$
0 0	0 0
0 1	0 1
1 0	1 0
1 1	1 1

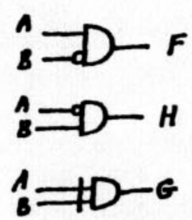
THUS WE OBTAIN FROM SUM-OF-PRODUCTS



FOR THE INVERTERS USE FIG 11.33 (a or b).
FOR THE OR GATES SEE PROBLEM 11.15. ■

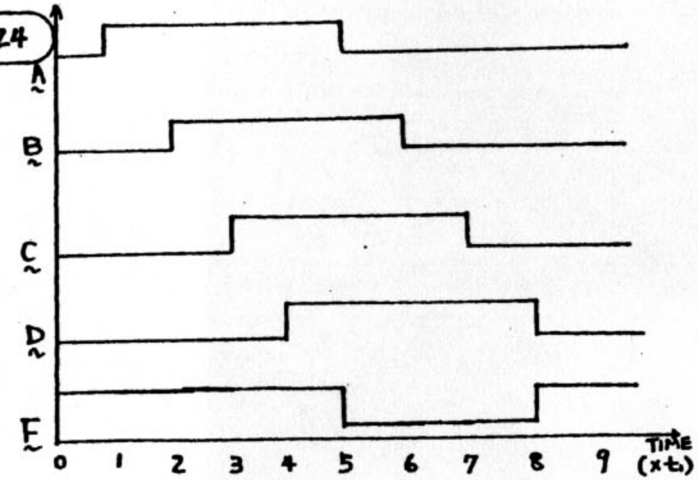
(11.22)

A B	F	G	H
0 0	0	1	0
0 1	0	0	1
1 0	1	0	0
1 1	0	1	0



■

11.24



(1)

A	B	C	D	$\overline{AB}$	C+D	$F=\overline{\overline{AB}(C+D)}$
0	0	0	0	1	0	1
0	0	0	1	1	1	0
0	0	1	0	1	1	0
0	0	1	1	1	1	0
0	1	0	0	1	0	1
0	1	0	1	1	1	0
0	1	1	0	1	1	0
0	1	1	1	1	1	0
1	0	0	0	1	0	1
1	0	0	1	1	1	0
1	0	1	0	1	1	0
1	0	1	1	1	1	0
1	1	0	0	0	0	1
1	1	0	1	0	1	1
1	1	1	0	0	1	1
1	1	1	1	0	1	1