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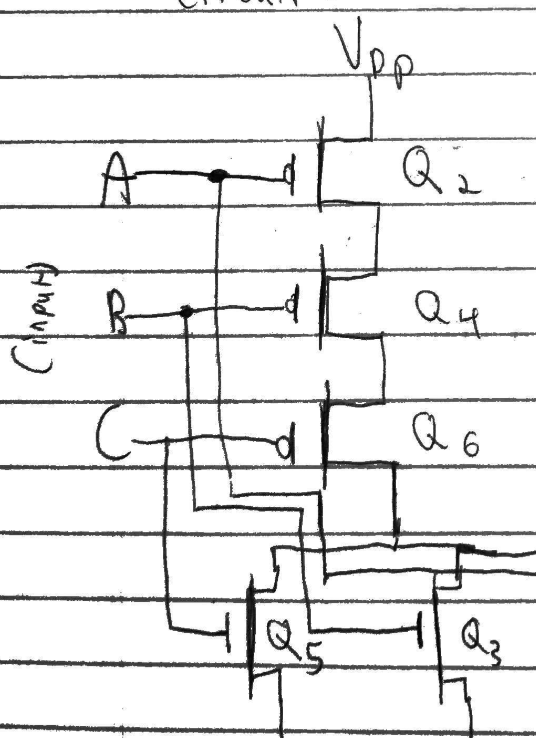
Colo HW#2

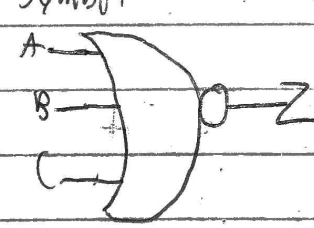
(1) 3.5: False. A NAND produces the opposite of an AND gate. In order an OR gate to become its dual, the inputs and outputs must be inverted. Because only the inputs are inverted this statement is false.

(2) 3.13:

Circuit:



Symbol



ignore this

Function table:

A	B	C	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6

→

function Table:

A	B	C	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Z
L	L	L	L	H	L	H	L	H	H
L	L	H	L	H	L	H	H	L	L
L	H	L	L	H	H	L	L	H	L
L	H	H	L	H	H	L	H	L	L
H	L	L	H	L	L	H	L	H	L
H	L	H	H	L	L	H	H	L	L
H	H	L	H	L	H	L	L	H	L
H	H	H	H	L	H	L	H	L	L

(3) 4.5: De Morgan's theorem holds so something is wrong in the boolean logic. If the expression is $(W \cdot X + Y \cdot Z)$ then the counter from De Morgan's theorem is $(\overline{W} + \overline{X} \cdot \overline{Y} + \overline{Z})$. The question seemed to group the terms as $\overline{W} + (\overline{X} \cdot \overline{Y}) + \overline{Z}$ which would give a 1. However the proper group is $(\overline{W} + \overline{X}) \cdot (\overline{Y} + \overline{Z})$ according to De Morgan's theorem. This expression will give a 0.

(4) 4.6 A: $F = W \cdot X \cdot Y \cdot Z \cdot (W \cdot X \cdot Y \cdot Z' + W \cdot X' \cdot Y \cdot Z + W' \cdot X \cdot Y \cdot Z$
$+ W \cdot X \cdot Y' \cdot Z)$

$F = W \cdot X \cdot Y \cdot (W \cdot X \cdot Y \cdot 0 + W \cdot X' \cdot Y \cdot Z + W' \cdot X \cdot Y \cdot Z + W \cdot X \cdot Y' \cdot Z)$

$F = W \cdot X \cdot (0 + W \cdot X' \cdot Y \cdot Z + W' \cdot \cancel{X} \cdot Y \cdot Z + W \cdot X \cdot 0 \cdot Z)$

$F = W \cdot (W \cdot 0 \cdot Y \cdot Z + W' \cdot X \cdot Y \cdot Z + 0)$

$F = 0 + 0 \cdot X \cdot Y \cdot Z$

$\boxed{F = 0}$

B: $F = A \cdot B + A \cdot B \cdot C' \cdot D + A \cdot B \cdot D \cdot E' + A' \cdot B \cdot C' \cdot E +$
$A' \cdot B' \cdot C' \cdot E$

$F = B \cdot (A + A \cdot C' \cdot D + A \cdot D \cdot E' + A' \cdot C' \cdot E) + (A' \cdot B' \cdot C' \cdot E)$

$F = B \cdot (A \cdot (1 + C' \cdot D + D \cdot E') + A' \cdot C' \cdot E) + (A' \cdot B' \cdot C' \cdot E)$

$F = B \cdot (A \cdot (1) + A' \cdot C' \cdot E) + (A' \cdot B' \cdot C' \cdot E)$

$\boxed{F = B \cdot (A + A' \cdot C' \cdot E) + (A' \cdot B' \cdot C' \cdot E)}$

(5)

4.7 F:

A	B	C	D	E	Z
0	0	0	0	0	1
0	0	0	0	1	1
0	0	0	1	0	1
0	0	0	1	1	1
0	0	1	0	0	1
0	0	1	0	1	1
0	0	1	1	0	1
0	0	1	1	1	1
0	1	0	0	0	1
0	1	0	0	1	1
0	1	0	1	0	1
0	1	0	1	1	1
0	1	1	0	0	0
0	1	1	0	1	0
0	1	1	1	0	0
0	1	1	1	1	1
1	0	0	0	0	0
1	0	0	0	1	0
1	0	0	1	0	0
1	0	0	1	1	0
1	0	1	0	0	0
1	0	1	0	1	0
1	0	1	1	0	1

→ continued

A	B	C	D	E	Z
1	0	1	1	1	1
1	1	0	0	0	0
1	1	0	0	1	0
1	1	0	1	0	0
1	1	0	1	1	0
1	1	1	0	0	0
1	1	1	0	1	0
1	1	1	1	0	0
1	1	1	1	1	0

4.7 H:

A	B	C	D	Z
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	0

$F = (((A + B')' + C)' + D)'$

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

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

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

4.7 I:

A	B	C	D	Z
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

4.10 C: $F = \Sigma_{ABCD}(1,2,5,6)$

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

D: $F = \prod_{M,N,P}(0,1,3,6,7)$

$F = (M+N+P)(M+N+\bar{P})(M+\bar{N}+\bar{P})(\bar{M}+\bar{N}+P)(\bar{M}+\bar{N}+$

(6) 4.10 C: $F=\Sigma_{A,B,C,D}(1,2,5,6)$

$F=\Sigma_{A,B,C,D}(1,2,5,6)$

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

$F=\Pi_{A,B,C,D}(0,3,4,7,8,9,10,11,12,13,14,15)$

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

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

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

D: $F=\Pi_{MNP}(0,1,3,6,7)$

$=(M+N+P)(M+N+\bar{P})(M+\bar{N}+\bar{P})(\bar{M}+\bar{N}+P)\cdot$

$(\bar{M}+\bar{N}+\bar{P})$

$F=\Sigma_{MNP}(2,4,5)$

$\boxed{=\bar{M}N\bar{P}+M\bar{N}\bar{P}+M\bar{N}P}$

F: $F=x'+Y\cdot Z'+Y\cdot Z'$

$=x'+Y\cdot Z'$

$=x'(y+y')(z+z')+yz'(x+x')$

$=x'yz+x'y'z'+x'yz'+x'y'z+xyz'+x'yz'$

$=x'yz+x'y'z'+x'yz'+x'y'z+xyz'$ Answer

$=\Sigma_{xyz}(0,1,2,3,6)$

$F=\Pi_{xyz}(4,5,7)$

$=(\bar{x}+Y+Z)(\bar{x}+Y+\bar{Z})(\bar{x}+\bar{Y}+\bar{Z})$ Answer

HW #2 Re-Submission

4.7 F:

→ continued

A	B	C	D	E	Z
0	0	0	0	0	1
0	0	0	0	1	1
0	0	0	1	0	1
0	0	0	1	1	1
0	0	1	0	0	1
0	0	1	0	1	1
0	0	1	1	0	1
0	0	1	1	1	1
0	1	0	0	0	1
0	1	0	0	1	1
0	1	0	1	0	1
0	1	0	1	1	1
0	1	1	0	0	0
0	1	1	0	1	0
0	1	1	1	0	1
0	1	1	1	1	0
1	0	0	0	0	0
1	0	0	0	1	0
1	0	0	1	0	0
1	0	0	1	1	0
1	0	1	0	0	0
1	0	1	0	1	0
1	0	1	1	0	1

A	B	C	D	E	Z
1	0	1	1	1	1
1	1	0	0	0	0
1	1	0	0	1	0
1	1	0	1	0	0
1	1	0	1	1	0
1	1	1	0	0	0
1	1	1	0	1	0
1	1	1	1	0	0
1	1	1	1	1	0

Represent as SoP

$\Sigma(0,1,2,3,4,5,6,7,8,9,10,11,14,22,23)$

4.7 H:

A	B	C	D	Z
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	0

Represent as SoP

$\boxed{\Sigma(2,4,6,10,14)}$

4.7 I:

Represent as SoP

A	B	C	D	Z
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

$$\boxed{\Sigma(2,3,4,5,6,7,8,13,15)}$$

4.6 B: $F = A\cdot B + A\cdot B\cdot C'\cdot D + A\cdot B\cdot D\cdot E' + A'\cdot B\cdot C'\cdot E + A'\cdot B'\cdot C'\cdot E$

$F = A\cdot B(1 + 1\cdot C'\cdot D + 1\cdot D\cdot E' + A'\cdot B\cdot C'\cdot E$ pull out the $A\cdot B$
$+ A'\cdot B'\cdot C'\cdot E)$

$F = A\cdot B + A'\cdot \cancel{B}\cdot C'\cdot E + A'\cdot \cancel{B'}\cdot C'\cdot E$ simplify and re-distribute

$$\boxed{F = A\cdot B + A'\cdot C'\cdot E}$$