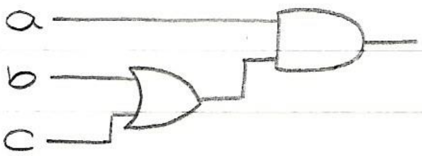
HW2 20191286

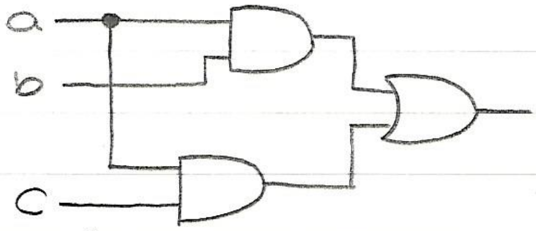
CH2

pg 102. #3-(b) : $a(b+c) = ab+ac$

① $a(b+c)$



② $ab+ac$



pg 103. #8-(e) : $x'y'z' + x'yz' + x'yz + xyz$ (2 terms, 4 literals)

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

↓ P1b, P2b

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

↓ P1a, P8a

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

↓ P5a

$= x'z' + yz$ ▨

cf literals : $x', z', y, z \rightarrow 4$

terms : $x'z', yz \rightarrow 2$

pg 104 #9-(b) : $(x+y+z)(x+y+z')(x+y'+z)(x+y'+z')$ (1 term, 1 literal)

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

↓ P2b

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

↓ P9b

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

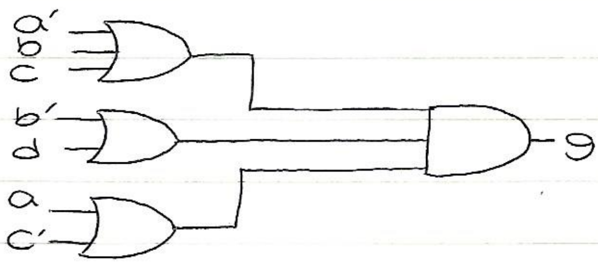
↓ P9b

$= x$ ▨

cf literal : $x \rightarrow 1$

term $x \rightarrow 1$

#11-(b) :



$g = (a'+b+c)(b'+d)(a+c')$

↓ P2a, P1b

$= (a'+(b+c))(a+c')(b'+d)$

↓ P14a

$= (a'c' + a(b+c))(b'+d)$

↓ P8a

$= (a'c' + ab + ac)(b'+d)$

↓ P8a, P5b

$= a'b'c' + a'c'd + abd + ab'c + acd$ ▨

Pg105. #13-(d),(e)

$f(x,y,z) = \Sigma m(1,3,6)$, $g(x,y,z) = \Sigma m(0,2,4,6)$

(d) $f'(x,y,z) = \Pi M(1,3,6) = \Sigma m(0,2,4,5,7)$ $\boxtimes$

(e) $f'(x,y,z) = \Pi M(1,3,6) = M1M3M6$

$= (x+y+z')(x+y'+z')(x'+y'+z)$ $\boxtimes$

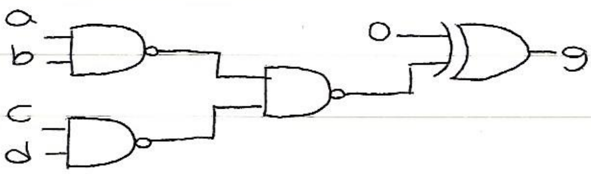
$g'(x,y,z) = \Pi M(0,2,4,6) = M0M2M4M6$

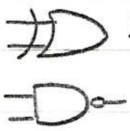
$= (x+y+z)(x+y'+z)(x'+y+z)(x'+y'+z)$ $\boxtimes$

Truth table

x	y	z	Minterms	Maxterms
0	0	0	$m_0 = x'y'z'$	$M_0 = x+y+z$
0	0	1	$m_1 = x'y'z$	$M_1 = x+y+z'$
0	1	0	$m_2 = x'yz'$	$M_2 = x+y'+z$
0	1	1	$m_3 = x'yz$	$M_3 = x+y'+z'$
1	0	0	$m_4 = xy'z'$	$M_4 = x'+y+z$
1	0	1	$m_5 = xy'z$	$M_5 = x'+y+z'$
1	1	0	$m_6 = xyz'$	$M_6 = x'+y'+z$
1	1	1	$m_7 = xyz$	$M_7 = x'+y'+z'$

Pg106 #17-(f)



cf  XOR $F = x \oplus y$

NAND $F = (xy)'$

$g = 0 \oplus ((ab)'(cd)')'$ ↙ $X \oplus 0 = X$ (theorems for Exclusive-OR)

$= ((ab)'(cd)')'$ ↙ P11b (DeMorgan)

$= ((ab)')' + ((cd)')'$ ↙ P7a

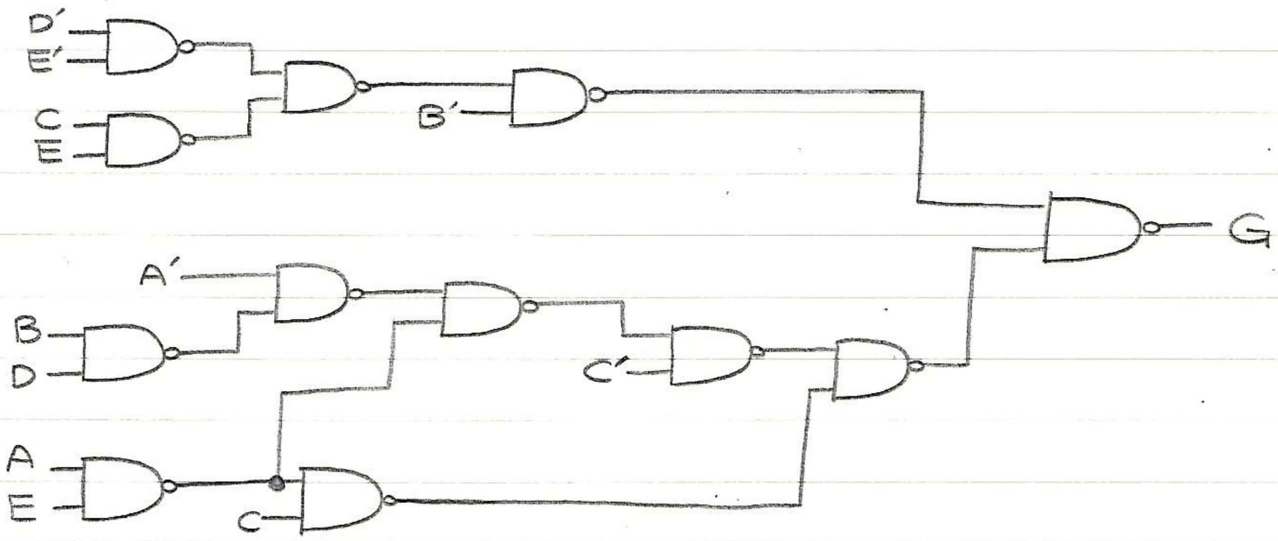
$= ab + cd$

Pg108 #25-(e) ; $G = B'D'E' + A'BC'D + ACE + AC'E' + B'CE$ (12 gates, one of which is shared)

$G = B'(D'E' + CE) + C'(A'BD + AE') + ACE$ ↙ P8a

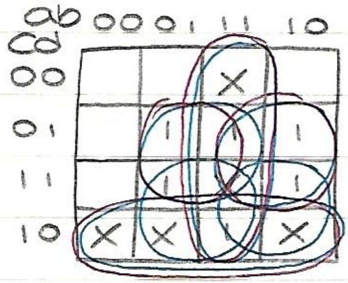
$= B'(D'E' + CE) + C'(A + BD)(A' + E') + CAE$ ↙ P14a, P1b

$= B'(D'E' + CE) + (C' + AE)[C + (A + BD)(A' + E')]$ ↙ P14a, P1b



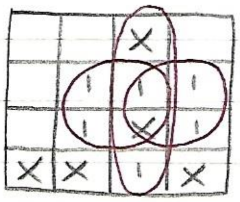
CH3

Pg 178 #4-(d): $f(a,b,c,d) = \Sigma m(5,7,9,11,13,14) + \Sigma d(2,6,10,12,15)$ (4 solutions)

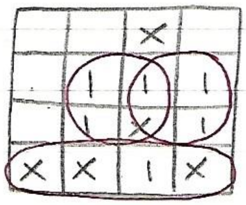


PI lists: ab, cd', bd, ad, bc, ac

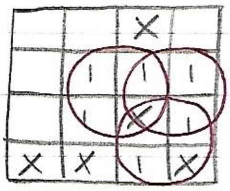
EPI lists: ab, cd', bd, ad

① 

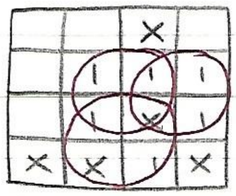
$f_1(a,b,c,d) = ab + bd + ad$

② 

$f_2(a,b,c,d) = cd' + bd + ad$

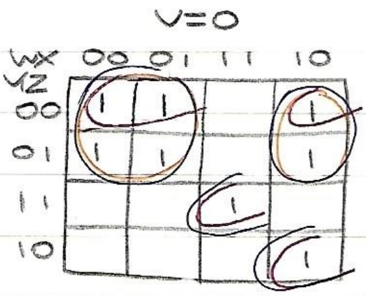
③ 

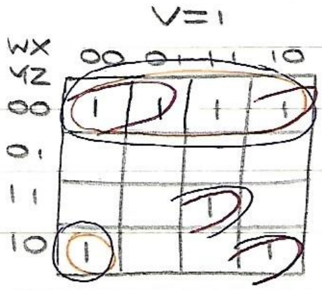
$f_3(a,b,c,d) = bd + ad + ac$

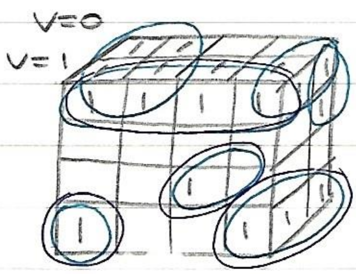
④ 

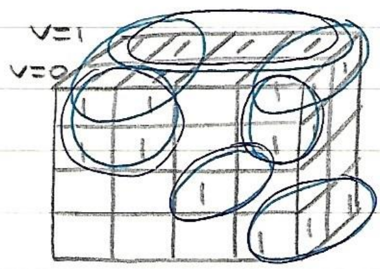
$f_4(a,b,c,d) = bd + ad + bc$

Pg 179. #6-(d): $G(v,w,x,y,z) = \Sigma m(0,1,4,5,8,9,10,15,16,18,19,20,24,26,28,31)$









PI lists: $v'w'y', v'wx'y', vw'x'yz', vy'z', w'y'z', wx'y'z', wxyz, wx'yz'$

EPI lists: $v'w'y', v'wx'y', vy'z', vw'x'yz', wxyz, wx'yz'$

Since we can cover all minterms by using these six essential prime implicants, we don't have to choose any non-essential prime implicants.

$\Rightarrow G(v,w,x,y,z) = v'w'y' + v'wx'y' + vy'z' + vw'x'yz' + wxyz + wx'yz'$. ▨

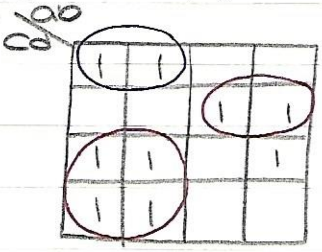
pg 180. #7-(g)

$f(a,b,c,d) = \Sigma m(0,2,3,4,6,7,9,11,13)$

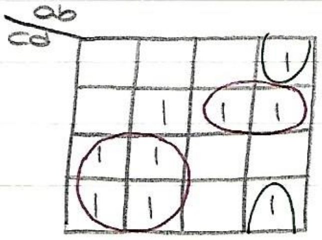
$g(a,b,c,d) = \Sigma m(2,3,5,6,7,8,9,10,13)$

$h(a,b,c,d) = \Sigma m(0,4,8,9,10,13,15)$ (2 solutions for f and g, 10 gates, 32 inputs)

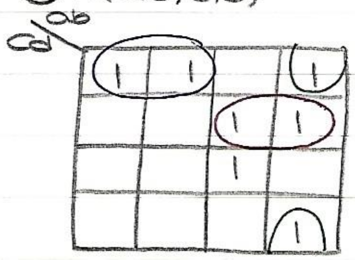
① $f(a,b,c,d)$



② $g(a,b,c,d)$

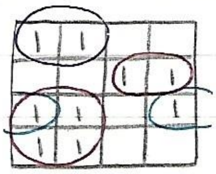


③ $h(a,b,c,d)$



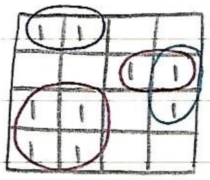
① $f(a,b,c,d)$

(i)



$f_1(a,b,c,d) = a'c'd' + ac'd + b'cd + a'c$

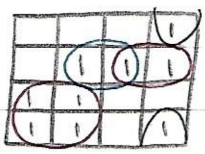
(ii)



$f_2(a,b,c,d) = a'c'd' + ac'd + ab'd + a'c$

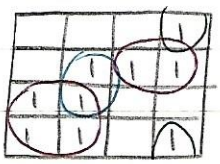
② $g(a,b,c,d)$

(i)



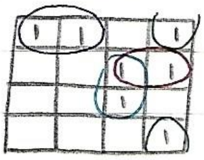
$g_1(a,b,c,d) = ab'd' + bc'd + ac'd + a'c$

(ii)



$g_2(a,b,c,d) = ab'd' + a'bd + ac'd + a'c$

③ $h(a,b,c,d)$



$h(a,b,c,d) = a'c'd' + ab'd' + abd + ac'd$

$f(a,b,c,d) = a'c'd' + ac'd + a'c + b'cd$ (or $ab'd$)

$g(a,b,c,d) = ab'd' + ac'd + a'c + bc'd$ (or $a'bd$)

$h(a,b,c,d) = a'c'd' + ab'd' + ac'd + abd$

⑤

gates: AND → 4+2+1 = 7

OR → 1+1+1 = 3

⇒ 10 ans

inputs: (4×3)+(3×6)+(2×1)

⇒ 32 ans

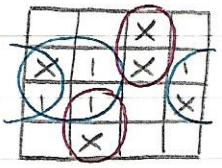
morning glory

pg 182, # Test problem 5

cd \ ab	00	01	11	10
00			X	
01	X	1	X	1
11	1	1		X
10		X		

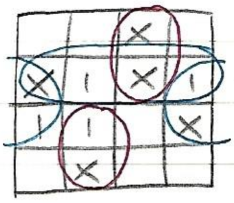
(1) To find SOP expressions,

①



$f_1(a,b,c,d) = abc' + a'bc + b'd + a'd$

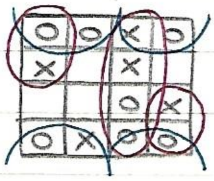
②



$f_2(a,b,c,d) = abc' + a'bc + b'd + c'd$

(2) To find POS expressions,

①

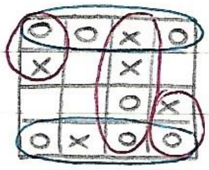


$f_3'(a,b,c,d) = a'b'c' + ab + ab'c + a'd' + ad'$

$\Rightarrow (f_3'(a,b,c,d))' = f_3(a,b,c,d) = (a'b'c' + ab + ab'c + a'd' + ad')'$

$= (a+b+c)(a'+b')(a'+b+c')(a+d)(a'+d)$

②



$f_4'(a,b,c,d) = a'b'c' + ab + ab'c + c'd' + cd'$

$\Rightarrow (f_4'(a,b,c,d))' = f_4(a,b,c,d) = (a'b'c' + ab + ab'c + c'd' + cd')'$

$= (a+b+c)(a'+b')(a'+b+c')(c+d)(c'+d)$

$\therefore$ SOP expressions of f

$f_1(a,b,c,d) = abc' + a'bc + b'd + a'd$

$f_2(a,b,c,d) = abc' + a'bc + b'd + c'd$

$\therefore$ POS expressions of f

$f_3(a,b,c,d) = (a+b+c)(a'+b')(a'+b+c')(a+d)(a'+d)$

$f_4(a,b,c,d) = (a+b+c)(a'+b')(a'+b+c')(c+d)(c'+d)$