Assignment 3 - Solution

Problem 1 → use boolean algebra or K-maps

a) $[(A+B)\cdot(C+D)]'$

$= (A+B)' + (C+D)' = \boxed{A'B' + C'D'}$ → SOP

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

$= \boxed{(A'+C')(B'+C')(A'+D')(B'+D')}$ → POS

b) $AB \oplus CD = (AB)'\cdot CD + (AB)(CD)'$

$= (A'+B')CD + AB(C'+D')$

$= \boxed{A'CD + B'CD + ABC' + ABD'}$ → SOP

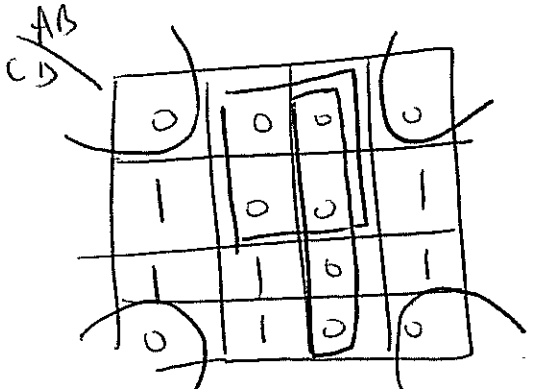
$= \left((AB)'\cdot CD + AB\right)\left((AB)'CD + (CD)'\right)$

$= \left((AB)' + AB\right)(AB + CD)\left((CD)' + CD\right)\left((CD)' + (AB)'\right)$

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

$= \boxed{(A+C)(A+B)(A+D)(B+D)(C'+D'+A'+B')}$ → POS

c) $\left((A'BC)'(B'D)'\right)' = \boxed{A'BC + B'D}$ → SOP



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

→ POS

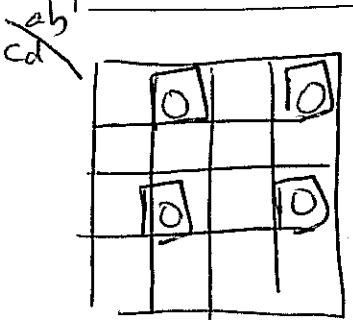
d) $(a \oplus b')' \cdot (c \oplus d')'$ ②

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

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

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

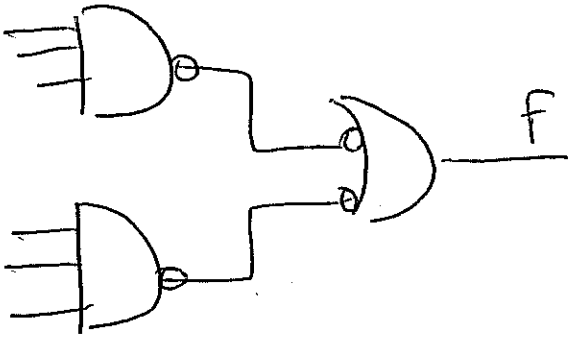
$= \boxed{ab + a'b' + c'd + cd'}$



$= \boxed{(a+b'+c+d)(a'+b+c+d)(a+b'+c'+d')(a'+b+c'+d')}$

Problem 2

a) $xy'z + xyz'$



b)

$AB + A'BC' + BC$

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

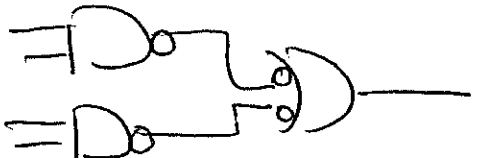
B ——— F

c) $A'B'C' + AB'C' + AB'C$

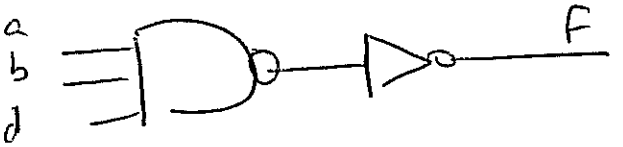
$= B'(A'C' + AC' + AC) = B'(A'C' + A)$

$= B'(C' + A)$

$= B'C' + B'A$



d) $ab(cd + c'd) = abd$

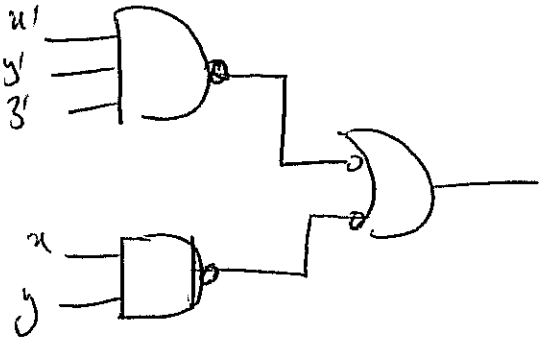


e) $[x(xy)'][y(xy)']$

$= xy(xy)' = xy(x' + y') = 0$

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

$= x'y'z' + xy$



g) $(a+b)'(a'+b')'$

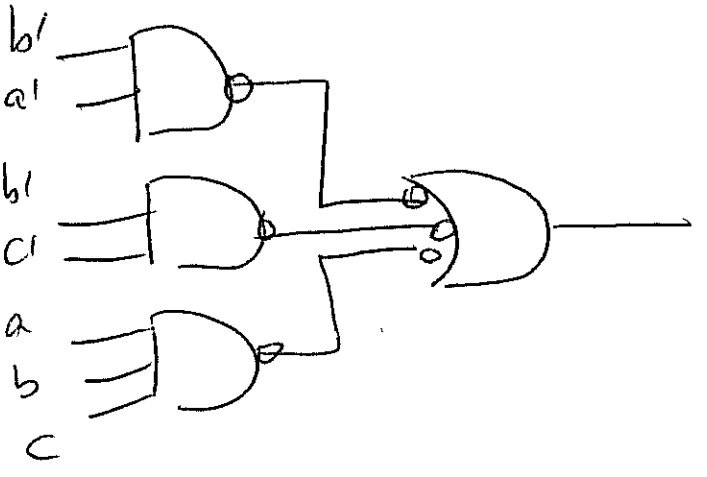
$= a'b'ab = 0$

h) $a'b'c' + a'b'c + ab'c' + abc$

$= a'b' + ab'c' + abc$

$= b'(a' + ac') + abc$

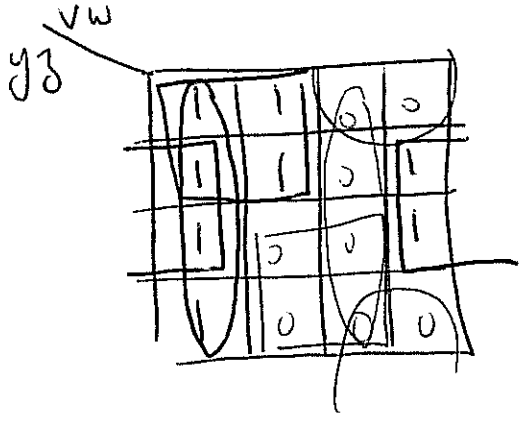
$= b'a' + b'c' + abc$



Problem 3

(b)

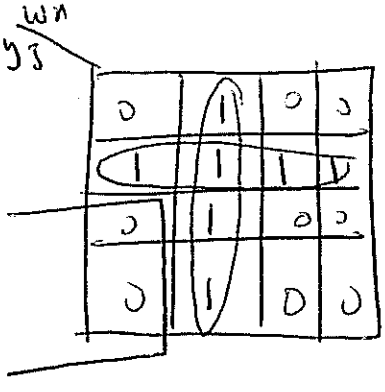
b) $P = v'w' + v'wy' + vw'z$



$P = v'w' + w'z + v'y'$

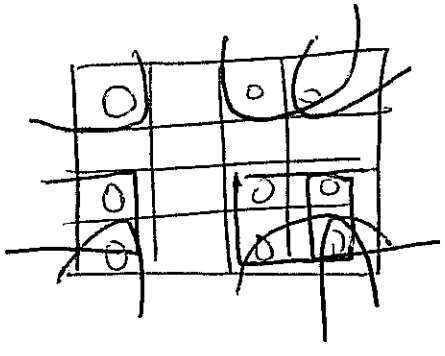
$= (v'+z)(v'+w')(w'+y')$

c) $G = y'z + w'xy' + wxy + xy'z$

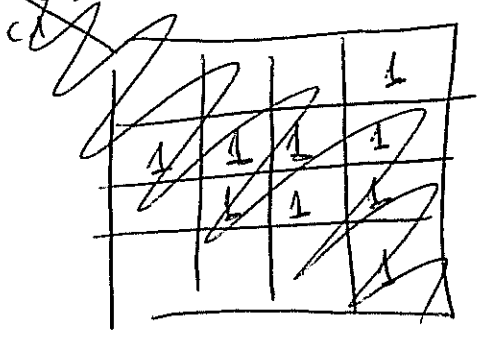


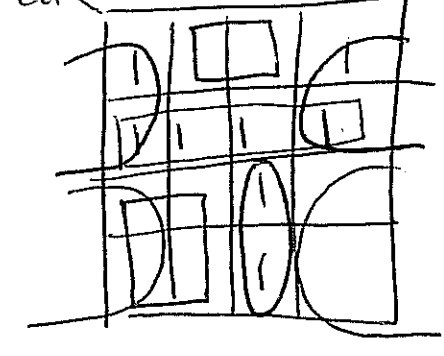
$G = y'z + w'x$

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



d) $R = f(a,b,c,d) = \prod(2,3,4,6,7,10,11,12) = \Sigma(0,1,5,8,9,13,14,15$





$R = abc + b'c' + c'd$

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

Problem 4

a) $S = f(a,b,c,d) = \Sigma(1,5,7,8,9,10,11,13,15)$

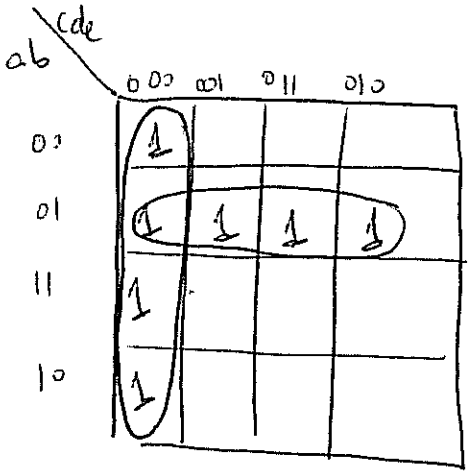
cd \ ab	00	01	11	10
00	0	0	0	1
01	1	1	1	1
11	0	1	1	1
10	0	0	0	1

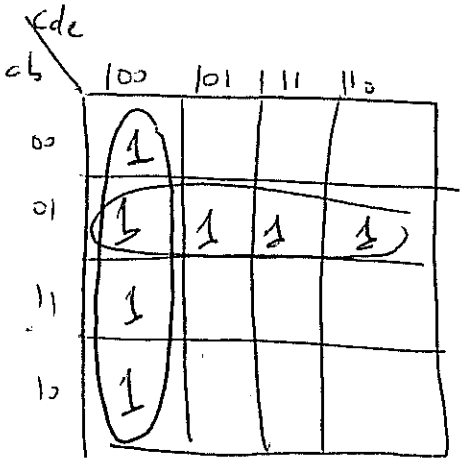
prime implicant: ad.

$S = c'd + bd + ab'$

essential PI

b) $T = f(a,b,c,d,e) = \Sigma(0,4,8,9,10,11,12,13,14,15,16,20,24,28)$





$T = d'e' + a'b$

essential PI