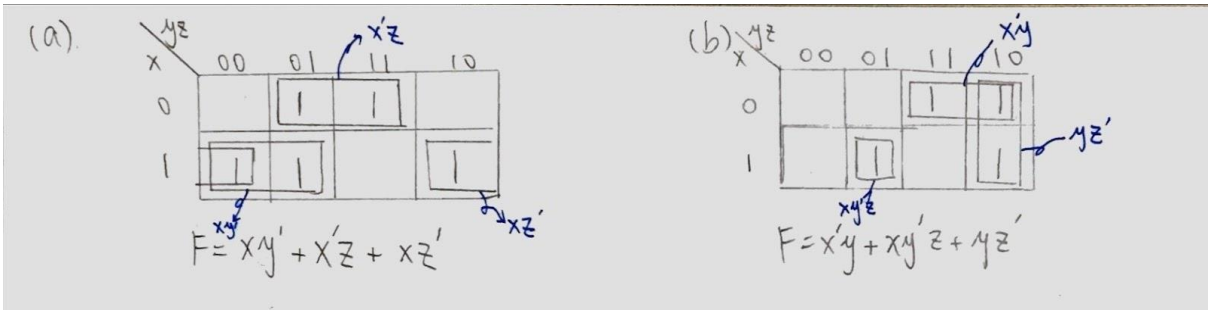
HW3 solution

1. (10%) Simplify the following Boolean functions or expression, using three-variable maps:

(a) F(x, y, z) = S(1, 3, 4, 5, 6)

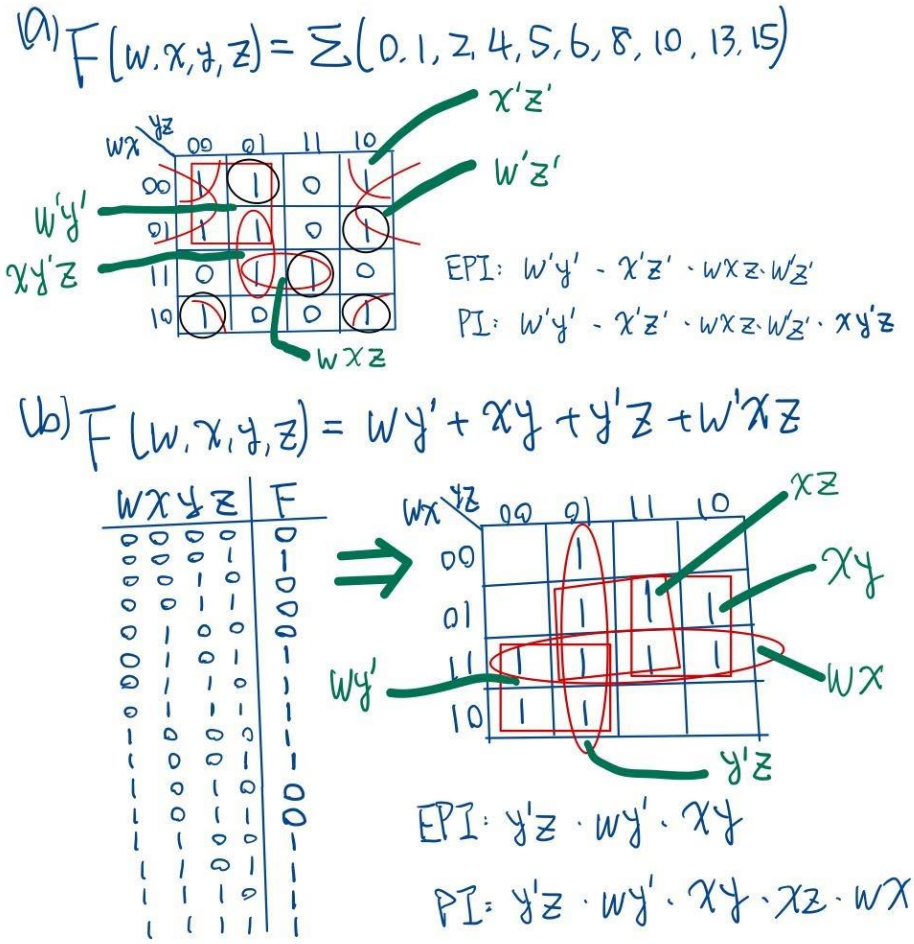
(b) F(x, y, z) = x'y + xy'z + yz'



2. (20%) Simplify the following Boolean functions by first finding the essential prime implicants (Please indicate the essential prime implicants and prime implicants):

(a) F(w, x, y, z) = S(0, 1, 2, 4, 5, 6, 8, 10, 13, 15)

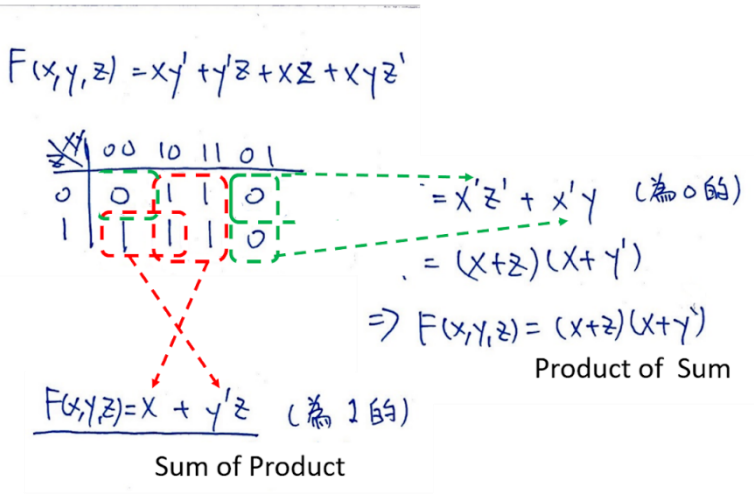
(b) F(w, x, y, z) = wy' + xy + y'z + w'xz



3. (10%) Simplify the following expressions in (a) sum of products and (b) product of sums:

F(x, y, z) = xy' + y'z + xz + xyz'

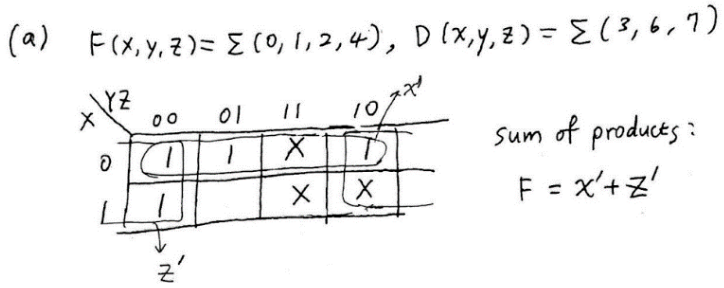
x	y	z	F
0	0	0	**0**
0	0	1	**1**
0	1	0	**0**
0	1	1	**0**
1	0	0	**1**
1	0	1	**1**
1	1	0	**1**
1	1	1	**1**

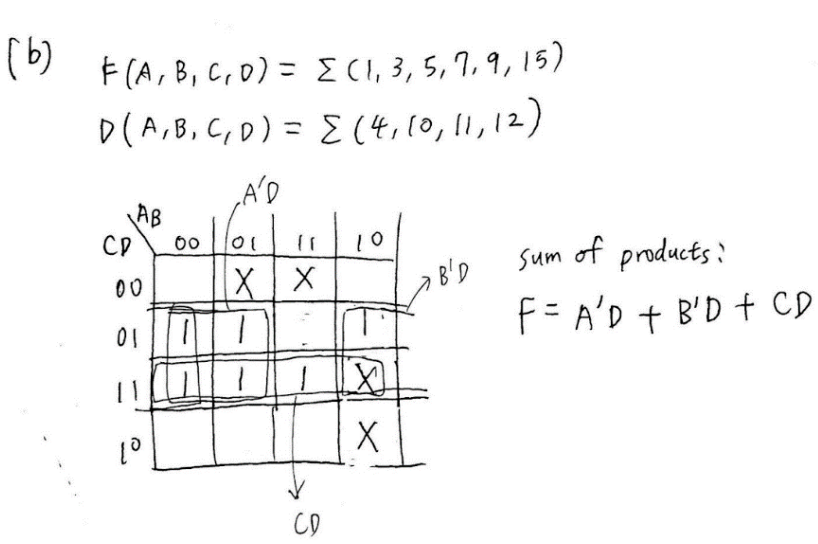


4. (20%) Simplify the following Boolean function F, together with the don't-care conditions d, and then express the simplified function in sum of products:

(a) F(x, y, z) = S(0, 1, 2, 4), D(x, y, z) = S(3, 6, 7)

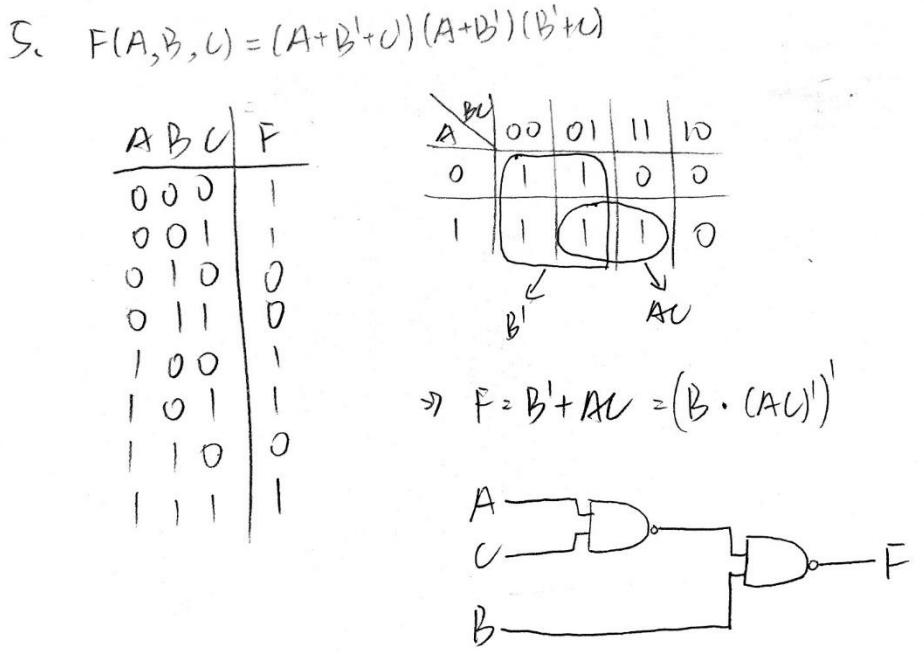
(b) F(A, B, C, D) = S(1, 3, 5, 7, 9, 15), D(A, B, C, D) = S(4, 10, 11, 12)





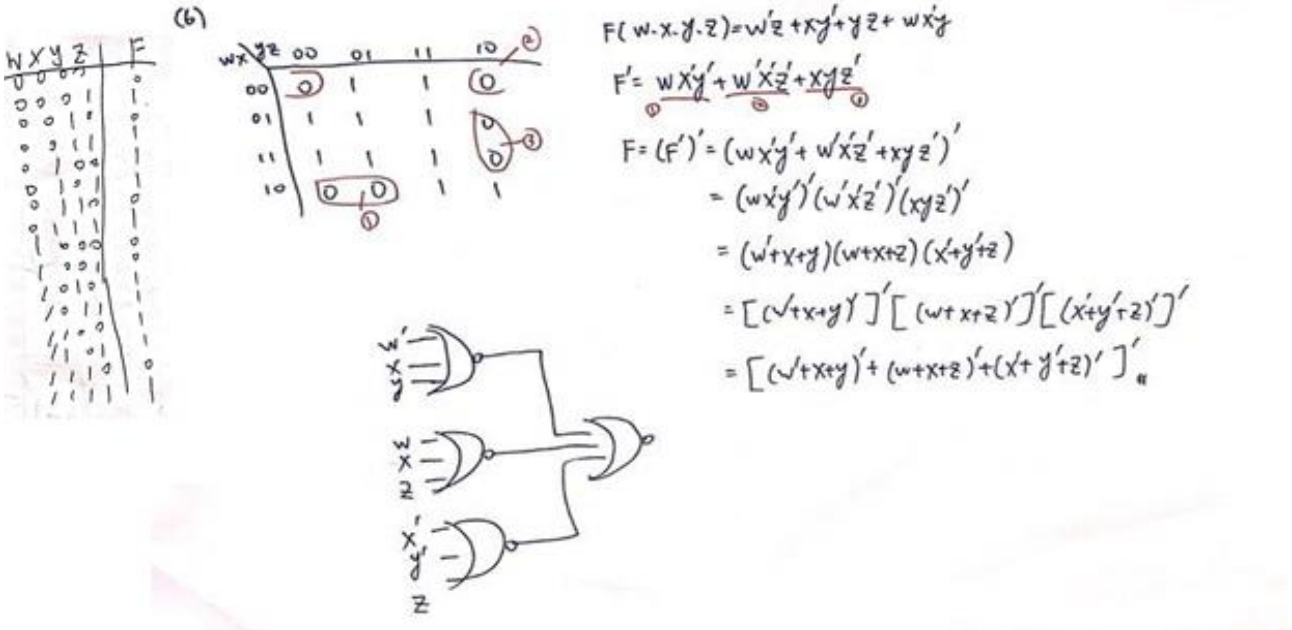
5. (10%) Simplify the following expression, and implement it with two-level NAND gates:

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



6. (10%) Simplify the following expression, and implement it with two-level NOR gates:

$$F(w, x, y, z) = w'z + xy' + yz + wx'y$$



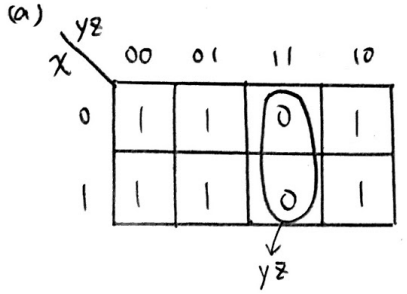
7. (20%) Simplify the following Boolean function F, using the two-level forms (a) AND-OR Inverter, (b) OR-AND-Inverter logic diagrams

$$F(x, y, z) = S(0, 1, 2, 4, 5, 6)$$

7.

$F(x,y,z) = \Sigma(0,1,2,4,5,6)$

(a)



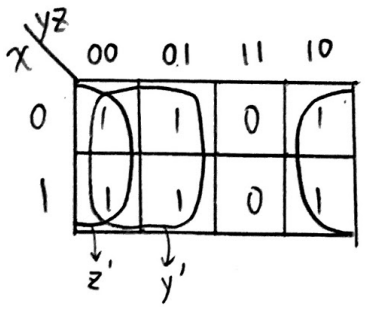
(AOI)

$F' = yz$ (F' in sum of product)

$\Rightarrow F = (yz)'$ #

因退化成 one-level，所以無法呈現 AOI.

(b)



(OAI)

$F = y' + z'$ (F in sum of product)

$\Rightarrow F' = yz$ (F' in product of sum)

$\Rightarrow F = (yz)'$ #

因退化成 one-level，所以無法呈現 OAI.

