邏輯設計 HW3_solution

備註 1:第四題(b)答案可以是一階
備註 2:第六題 10%
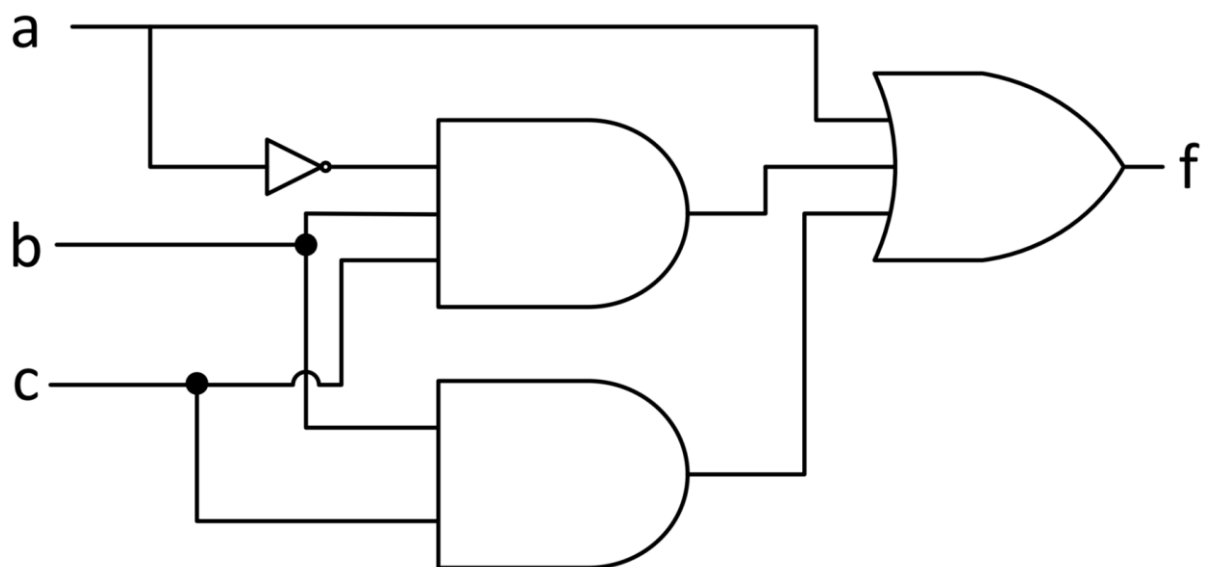
1. 18%

(a)

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

— original
— fixed

$$F = a + a'bc$$
$$= a + a'bc + bc$$

(b)

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

— original
— fixed

$$F = ab + a'bc$$
$$= ab + a'bc + bc$$
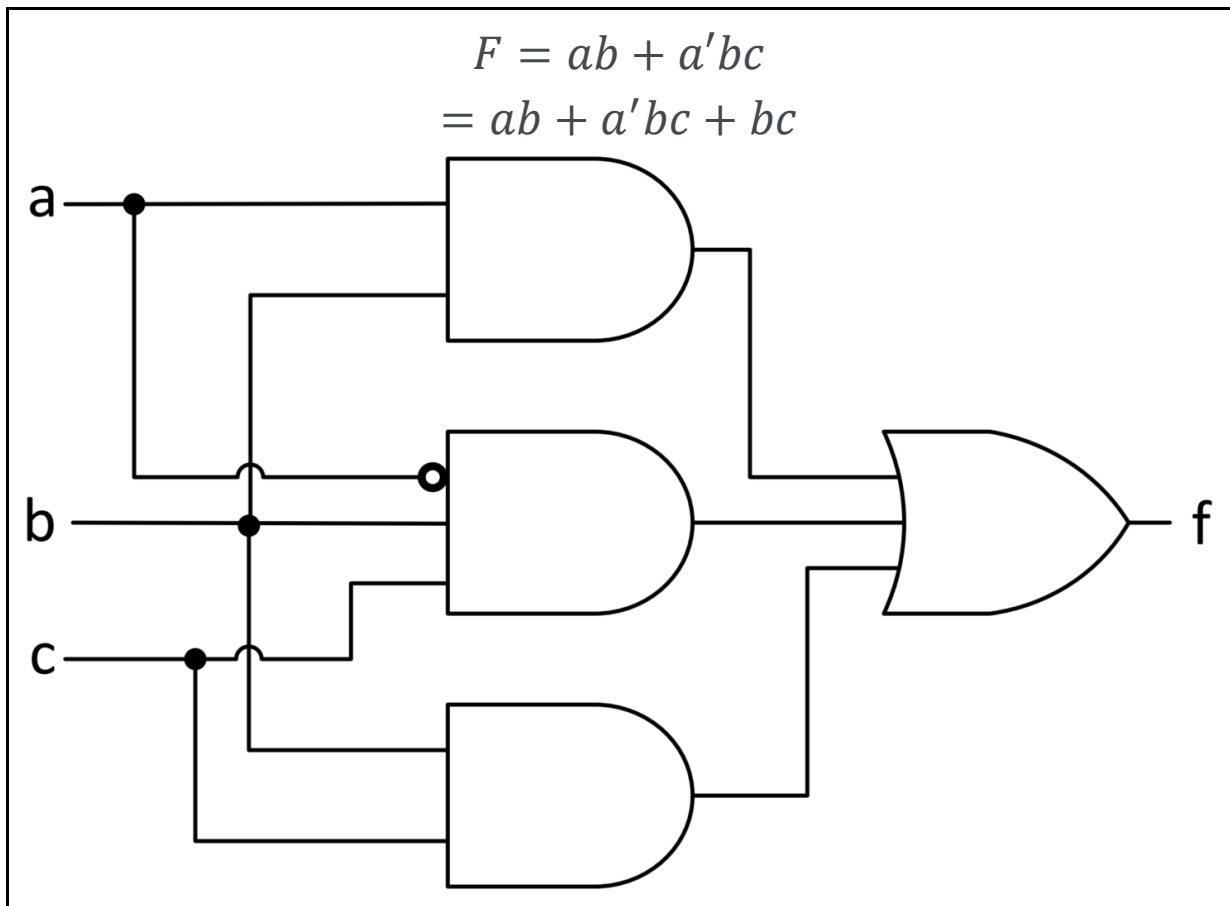
2. 18%

最高有效位元(Most Significant Bit，MSB)

最低有效位元(Least Significant Bit，LSB)

當二進位輸入為 0、1、2 時，輸出比輸入大 3(011)

當二進位輸入為 3、4、5、6、7，輸出比輸入小 2(010)

000→**011**

001→**100**

010→**101**

011→**001**

100→**010**

101→**011**

110→**100**

111→**101**

(a)Truth table

xyz	A	B	C
000	0	1	1
001	1	0	0
010	1	0	1
011	0	0	1
100	0	1	0
101	0	1	1
110	1	0	0
111	1	0	1

(b)**K-Map** 每次只能框2^{n}格子，每框2^{n}則少**n**個變數，可重覆框，不具唯一性

A

yz \ x	00	01	11	10
0		1		1
1			1	1

$A = yz' + xy + x'y'z$

B

yz \ x	00	01	11	10
0	1			
1	1	1		

$B = y'z' + xy'$

C

yz \ x	00	01	11	10
0	1		1	1
1		1	1	

$C = yz + xz + x'z'$

(c) logic diagram.
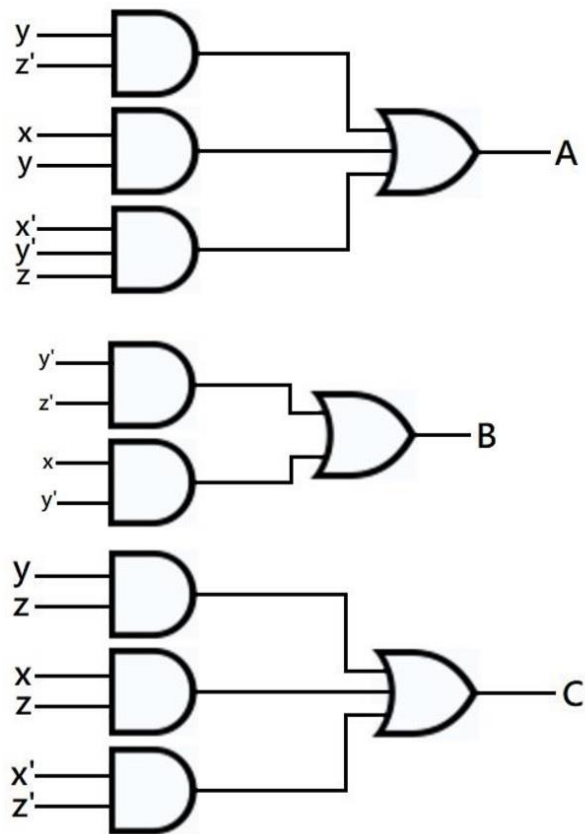
3.18%

Truth table

e_0	e_1	e_2	e_3	b_0	b_1	b_2	b_3
0	0	1	1	0	0	0	0
0	1	0	0	0	0	0	1
0	1	0	1	0	0	1	0
0	1	1	0	0	0	1	1
0	1	1	1	0	1	0	0
1	0	0	0	0	1	0	1
1	0	0	1	0	1	1	0
1	0	1	0	0	1	1	1
1	0	1	1	1	0	0	0
1	1	0	0	1	0	0	1

e_0e_1 \ e_2e_3	00	01	11	10
00	X	X	0	X
01	0	0	0	0
11	1	X	X	X
10	0	0	1	0

$$b_0 = e_0 e_1 + e_0 e_2 e_3$$

e_0e_1 \ e_2e_3	00	01	11	10
00	X	X	0	X
01	0	0	1	0
11	0	X	X	X
10	1	1	0	1

$$b_1 = e_1' e_2' + e_1 e_3 e_3 + e_1' e_3'$$

e_0e_1 \\ e_2e_3	00	01	11	10
00	X	X	0	X
01	0	1	0	1
11	0	X	X	X
10	0	1	0	1

$$b_2 = e_2{'}e_3 + e_2e_3{'}$$

e_0e_1 \\ e_2e_3	00	01	11	10
00	X	X	0	X
01	1	0	0	1
11	1	X	X	X
10	1	0	0	1

$$b_3 = e_3{'}$$

4.18%

(A)(B)各九分,畫簡一分,四種架構各兩分

(a)xy'z+xy'z'+xyz'=xy'(z+z')+xyz'=xy'+xyz'

Nand Nand

x
y'

x
y
z'
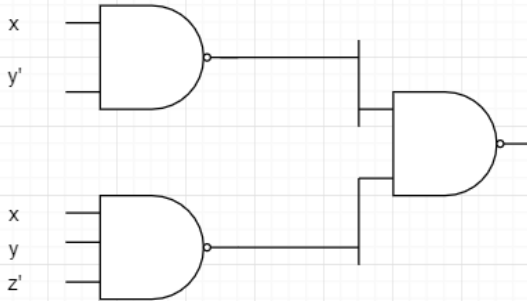
NAND -NAND :((XY')' (XYZ')')'

NOR NOR

Z'
Y'

X'

(X' + (Y' + Z')')'

AOI

Y
Z
X'

(X'+YZ)'

OAI ver

X'
Y
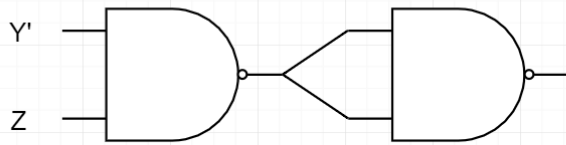
X'
Y'
Z
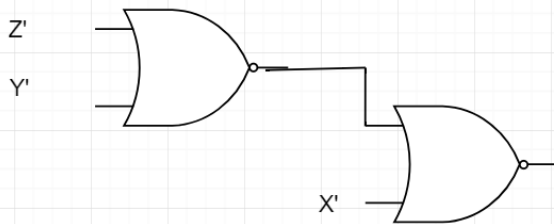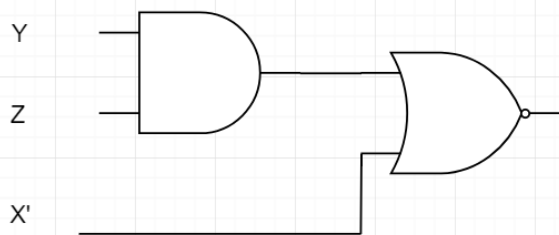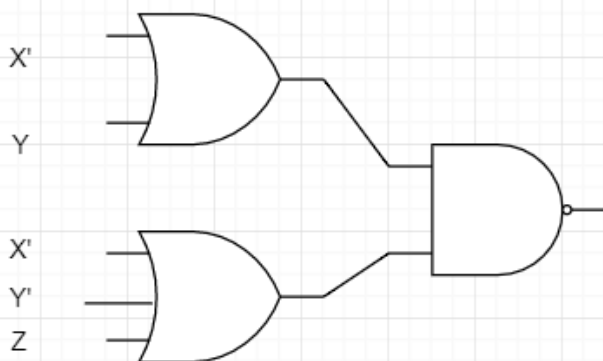
OAI:((X' + Y) . (X' + Y' + Z))'

(b)(y'z + xw)(xw ' +y'z) =
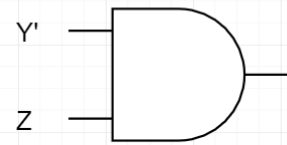(y'z+x)(y'z+w)(y'z+x)(y'z+w')=(y'z+x)(y'z+ww')=(y'z+x)(y'z)=y'z(1+x)=y'z

NAND NAND   OR   1   LEVEL
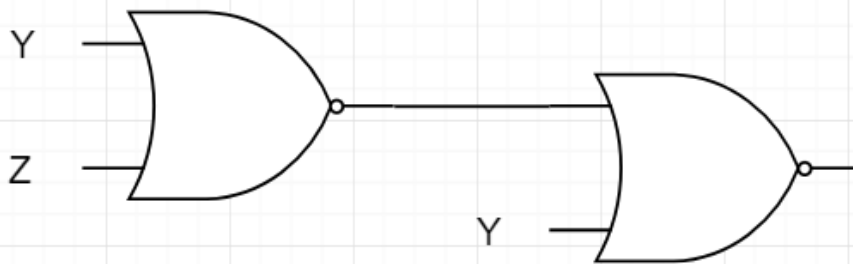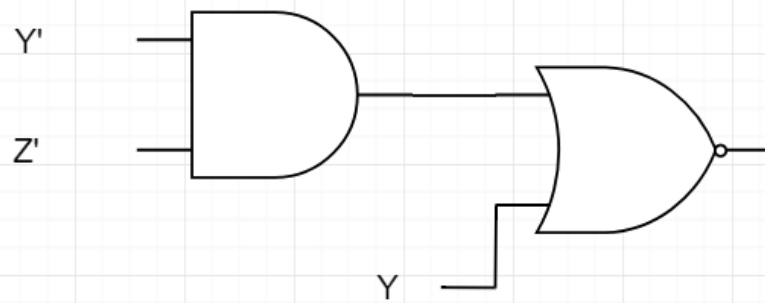
Y'

Z

((Y'Z)' & (Y'Z)')'

Y'

Z

Y'Z

NOR NOR

Y

Z

Y

(Y + (Y + Z)')'

AOI

Y'

Z'

Y

$(Y + Y'Z')'$

OAI

Y

Z'
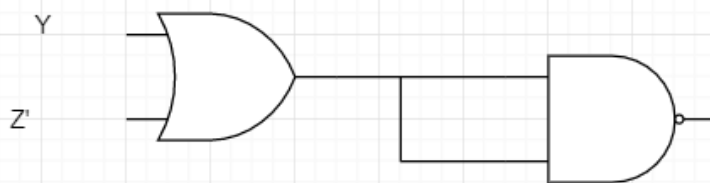
$(Y+ Z')'$

5.18%

(a)

Truth Table			
Input		Output	
a	b	s	co
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

(b)
Use K-map to find SOP.

K-map for CO **K-map for** S

co = ab
s = a'b + ab'

(c)
Prime implicant of co : ab
Essential prime implicant of co : ab
Prime implicant of s : a'b, ab'
Essential prime implicant of s : a'b, ab'