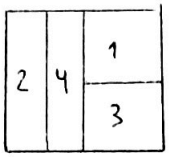
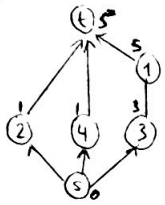
1 Floorplanning

a) $\alpha = 24V13HV$

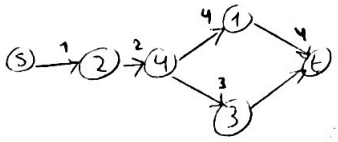


b) **No rotations.**

VCG:

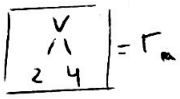


HCG:



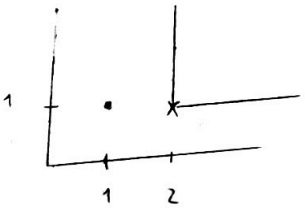
Best Bounding Box: $(5,4)$

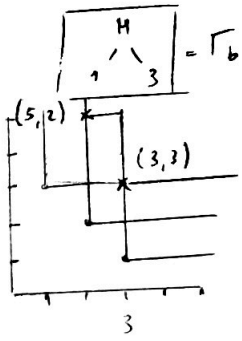
Rotations:



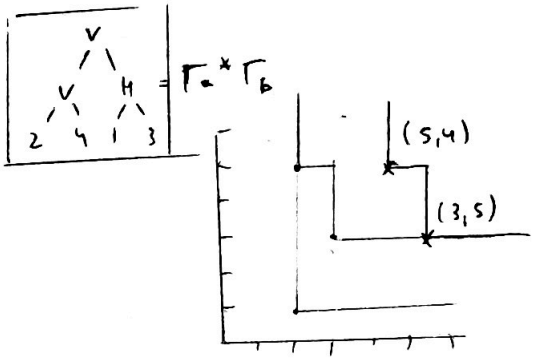
$= \Gamma_a$

Using shape curves (you could've also used constraint graphs)





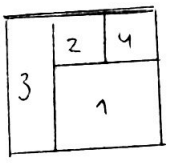
$= \Gamma_b$



$= \Gamma_a * \Gamma_b$

the best bounding box is $(3,5)$

c) It is easy to see that the optimal floorplan is:



to achieve this floorplan you need to apply $M3(3,H)$ and check the balloting property

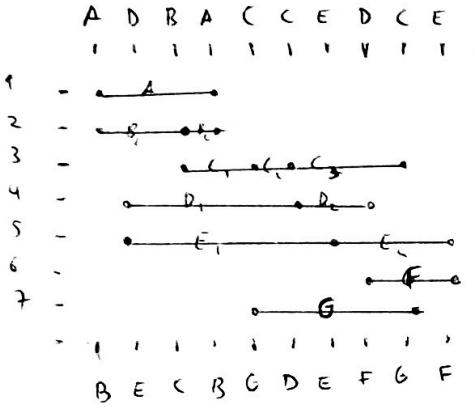
$\alpha \xrightarrow{M3} \alpha' = 24V1H3V$

2 Channel Routing

a) Zone representation

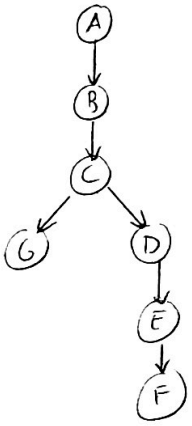
$S(J) = \{A, B, C, D, E\}$

$S(L) = \{F, G\}$

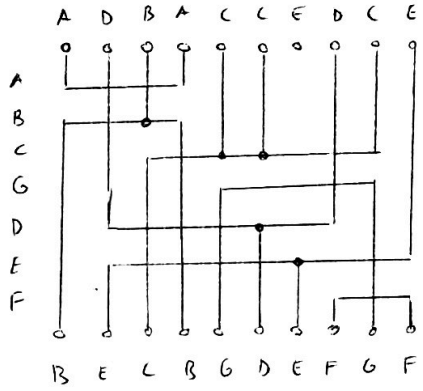


J	L
A	F
B	G
C	
D	
E	

b)



c)



d)

e)

3 Unate Covering

a) and b) can be solved at the same time

	A	B	C	D	E	F
1				1	1	
2			1	1		1
3		1	1		1	
4		1			1	1
5	1		1			
6		1		1		1
7	1			1		

No essentials
No column dominance
No row dominance

take D

Do not take D

	A	B	C	E	F
3		1	1	1	
4		1		1	1
5	1		1		

No essentials
B, E dominate F } Delete column F and A
C dominates A }

	B	C	E
3	1	1	1
4	1		1
5		1	

C is essential => take C

	B	E
4	1	1

to cover minterm 4 you must take implicant B or E

- Now all minterms are covered and the minimal cover is {D, C, B} and {D, C, E}

	A	B	C	E	F
1				1	
2			1		1
3		1	1	1	
4		1		1	1
5	1		1		
6		1			1
7	1				

E is essential => take E

	A	B	C	F
2			1	1
5	1		1	
6		1		1
7	1			

A is essential => take A

	B	C	F
2		1	1
6	1		1

F dominates B } Delete column B and C
F dominates C }

	F
2	1
6	1

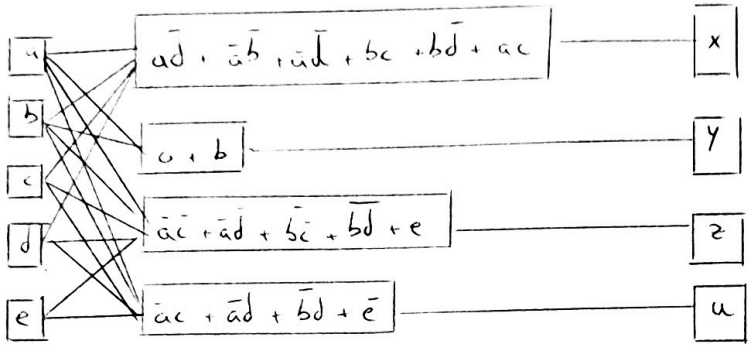
F is essential => take F

- Now all minterms are covered and the minimal cover is {E, A, F}

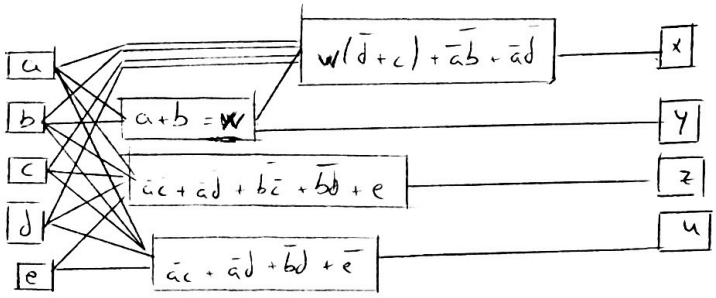
1. {D, C, B}, {D, C, E}
2. {E, A, F}

4 Multi-level logic synthesis

a)



b) $f_x / f_y = \dfrac{a\bar{d} + \bar{a}\bar{b} + \bar{a}\bar{d} + bc + b\bar{d} + ac}{a + b} = (a+b)(\bar{d}+c) + \bar{a}\bar{b} + \bar{a}\bar{d}$



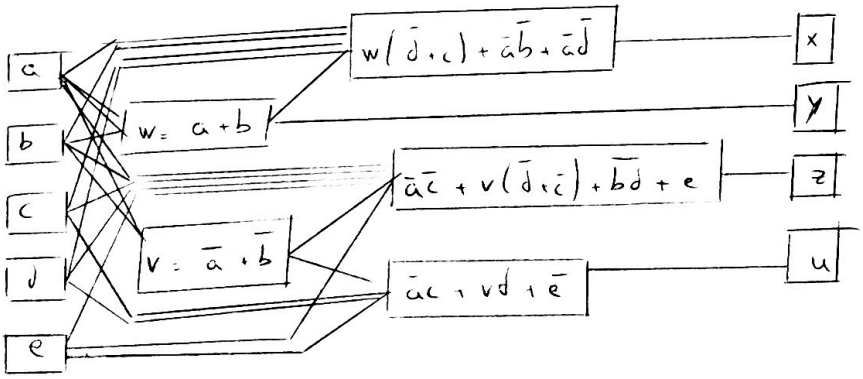
c) $K(z) = \{(\bar{c}+\bar{d}),\ (\bar{a}+\bar{b}),\ \bar{a},\ \bar{c},\ z\}$

$coK(z) = \{\bar{a},\ \bar{c},\ \bar{d},\ \bar{b},\ 1\}$

$K(u) = \{(c+d),\ \bar{a},\ (\bar{a}+\bar{b}),\ u\}$

$coK(u) = \{\bar{a},\ c,\ d,\ \bar{b},\ 1\}$

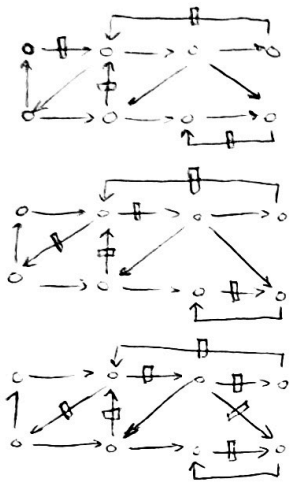
d) Multi-cube = $\bar{a} + \bar{b}$



5 Returning

a) $P_{min} = 5$ corresponding to the path (h, c, f, g, h).

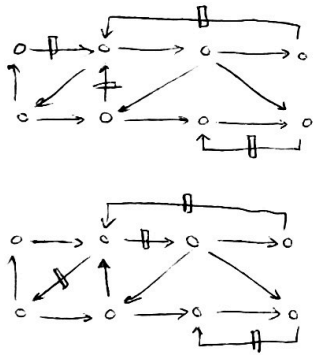
b)



the minimum period (P_{min}) is

$P_{min} = 3$ corresponding to path (e, a, b)

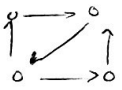
c)



the minimum number of registers (R_{min}) is

$R_{min} = 3$.

Proof. there are four loops, and each loop has to be broken by placing a register.

And  loops share a edge so you can break both loops with a single register. the rest of the loops do not share any edge □