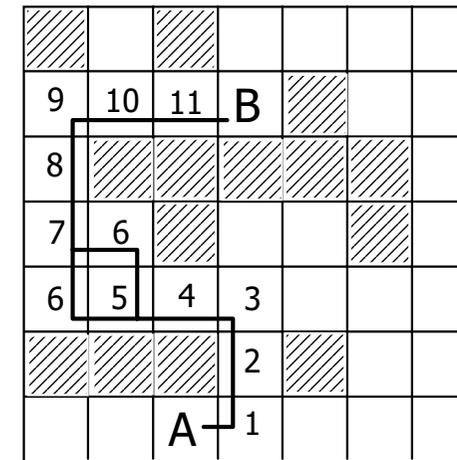
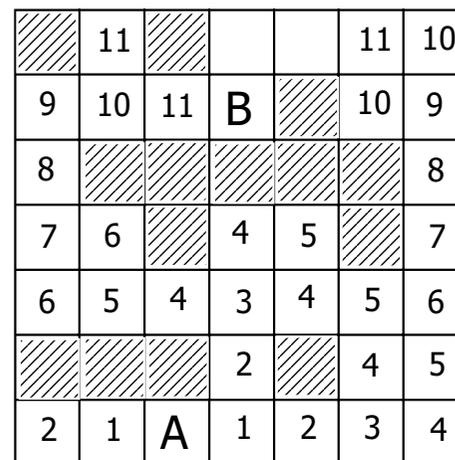
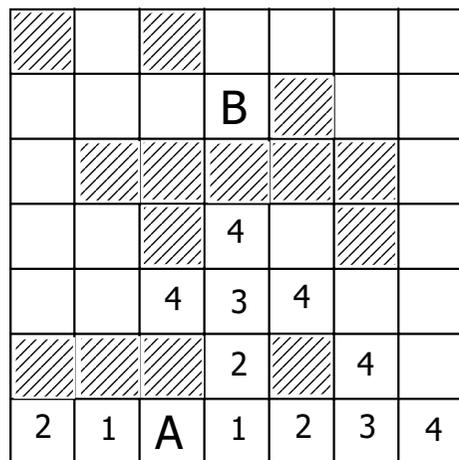
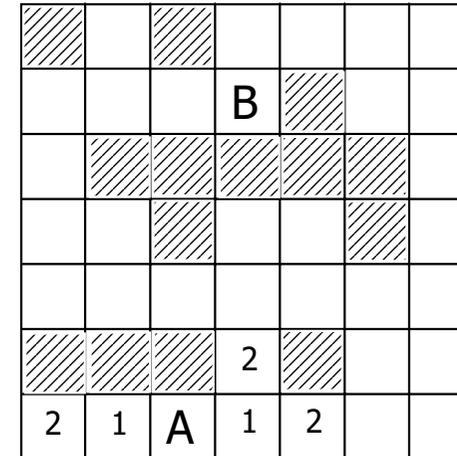
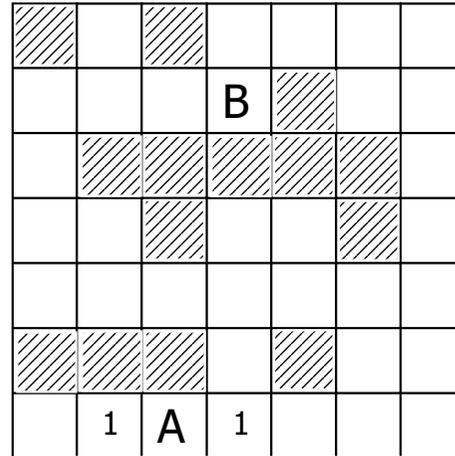
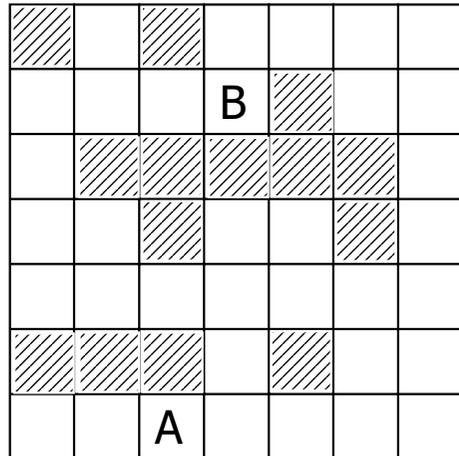
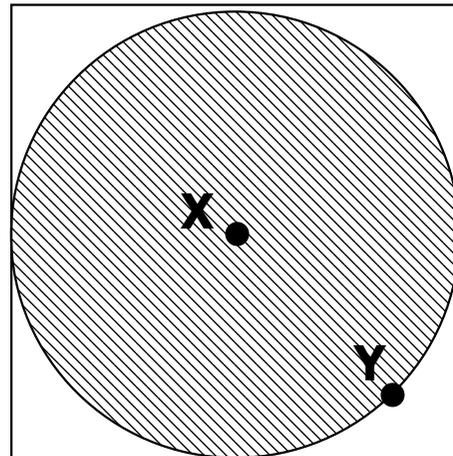
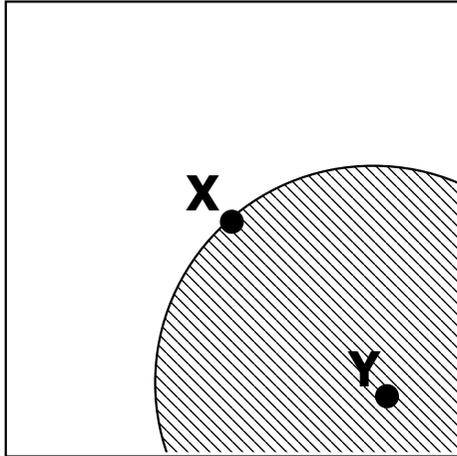

ROUTING

Somchai Prasitjutrakul

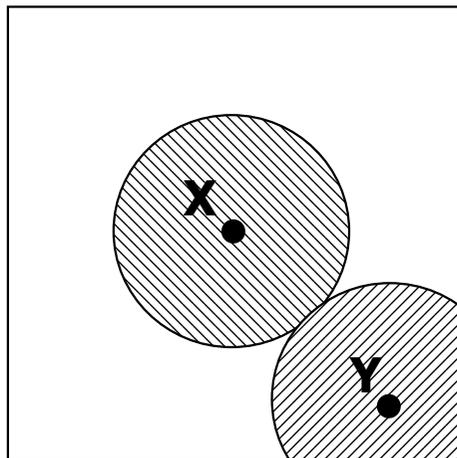
Lee's Algorithm (1961)



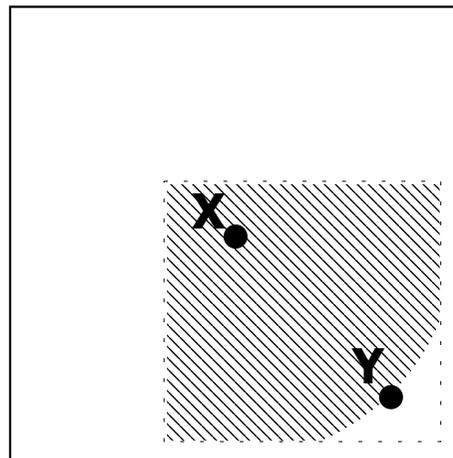
Lee's Algorithm: Speed-Up Techniques



Starting-point selection

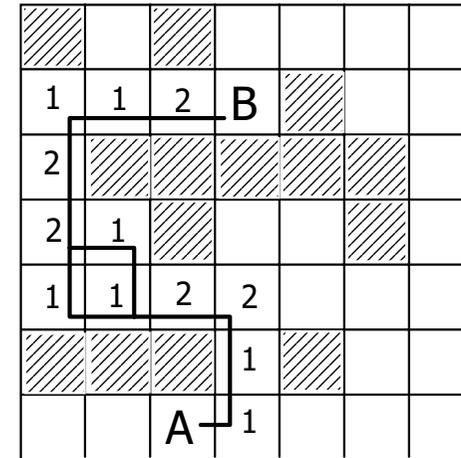
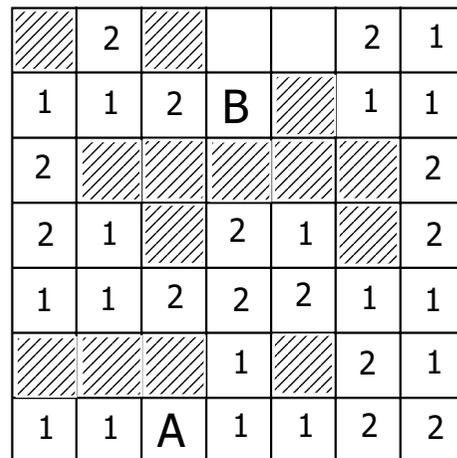
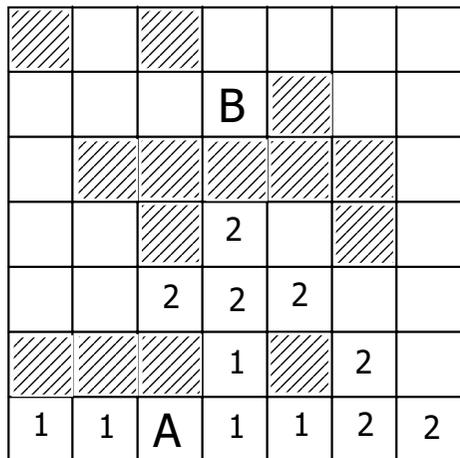
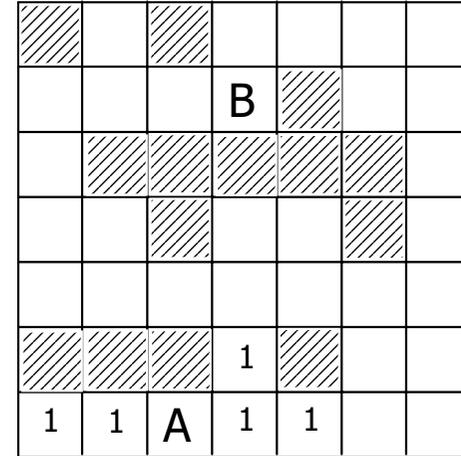
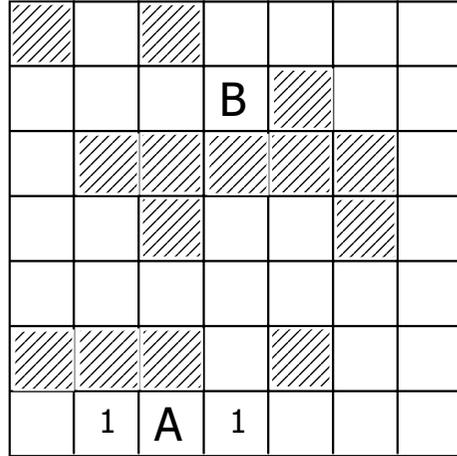
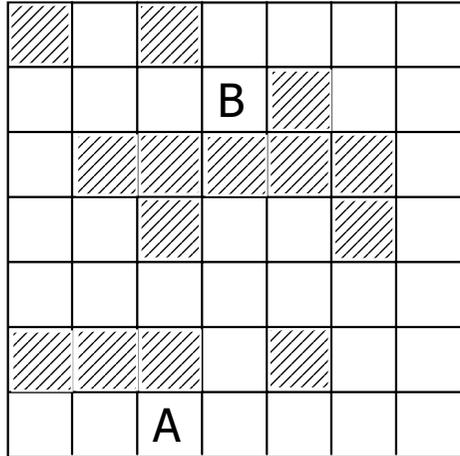


Double fan-out



Framing

Lee's Algorithm : 1-1-2-2



Lee's Algorithm with Weights

1	2	2	1	2	2	2	1	2	1
2	3	2		3	3	3		2	2
2	3	2						2	2
2	3	3	2	2	2	2		2	2
2	3	3	3	3	3	2		2	2
2	3	3	3	3	3	3	2	3	2
1	2	2	2	2	2	2	2	2	3

	(5)								
(5)	A	(5)							
	(6)								
							B		

(6)	5	(7)							
5	A	5							
(7)	6	(7)							
	(9)								
							B		

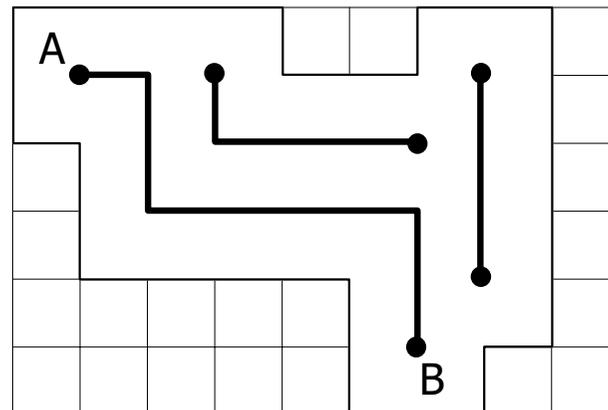
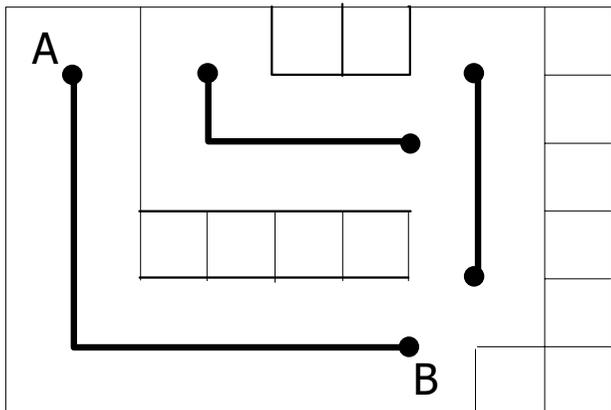
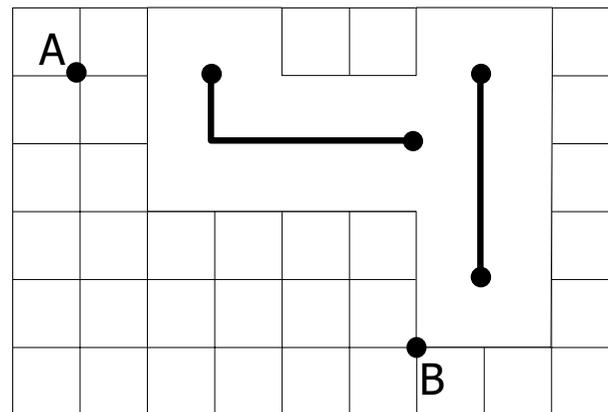
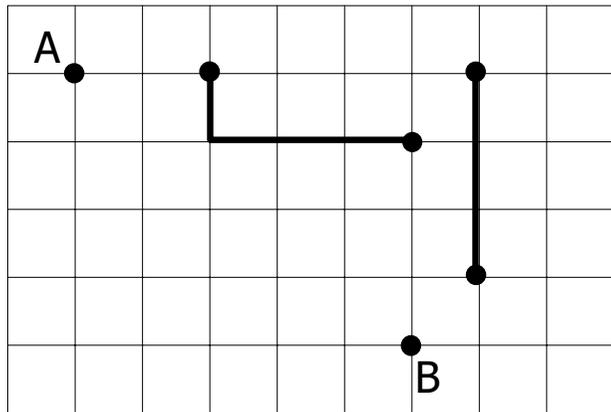
6	5	7	8	10	12	(14)			
5	A	5		11	(13)				
7	6	7							
9	9	10	12	14	(16)				
11	12	13	15	(17)					
13	15	16	(18)				B		
(14)	17	(18)							

Lee's Algorithm with Weights

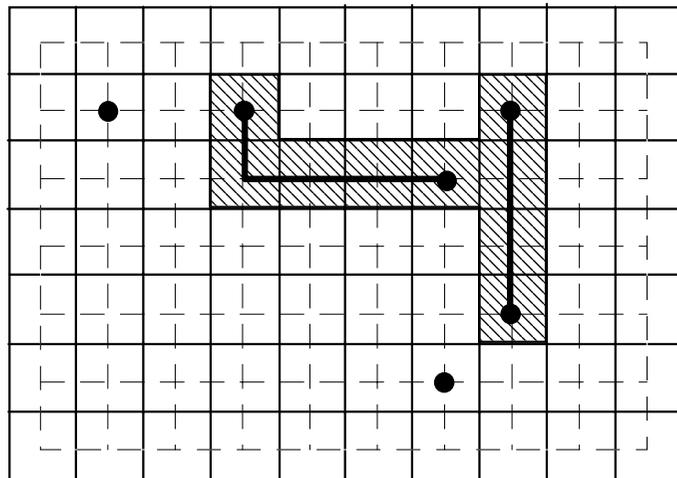
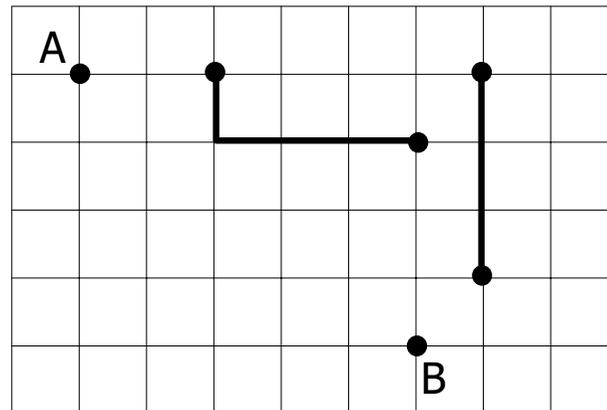
6	5	7	8	10	12	14	15	17	(18)
5	A	5		11	13	14		(19)	
7	6	7							
9	9	10	12	14	16	17			
11	12	13	15	17	19	19			
13	15	16	18	20	22	22			
14	16	18	21	22	(24)				

6	5	7	8	10	12	14	15	17	18
5	A	5		11	13	14		19	20
7	6	7						21	22
9	9	10	12	14	16	17		23	(24)
11	12	13	15	17	19	19		(25)	
13	15	16	18	20	22	22			
14	16	18	21	22	24				

Routing to Preserve Grid Segments

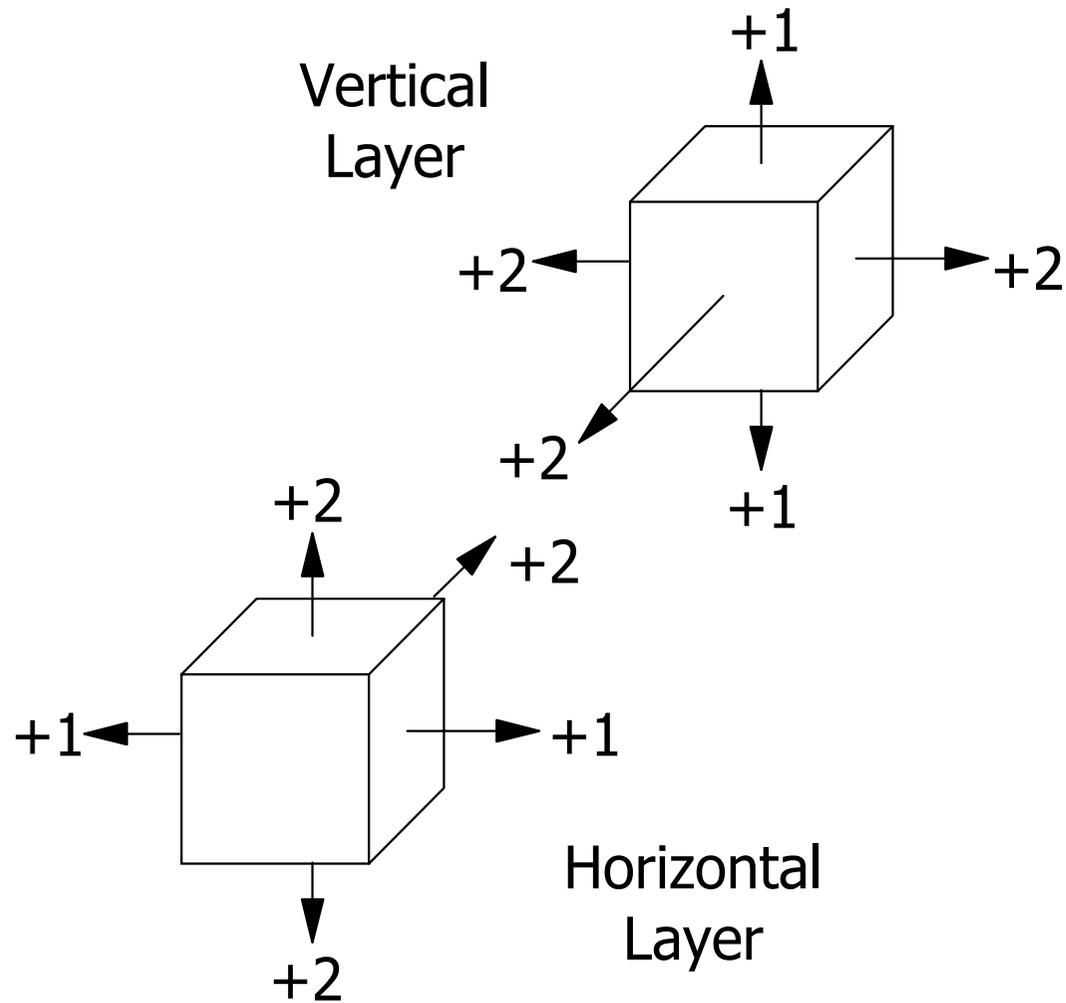


Routing to Preserve Grid Segments

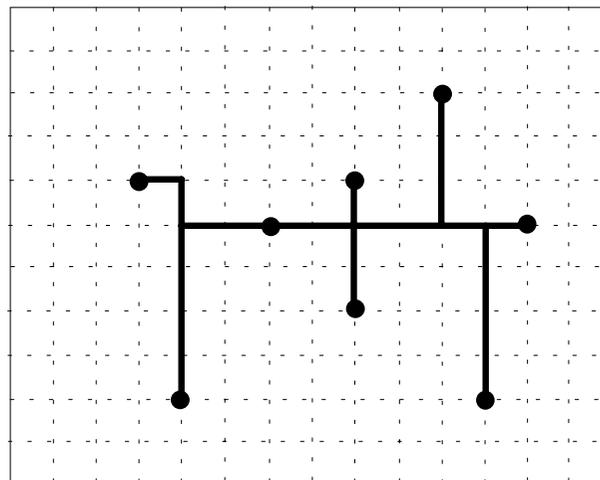
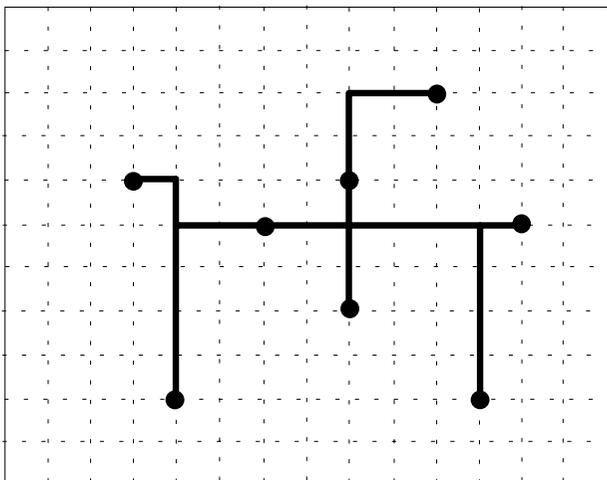
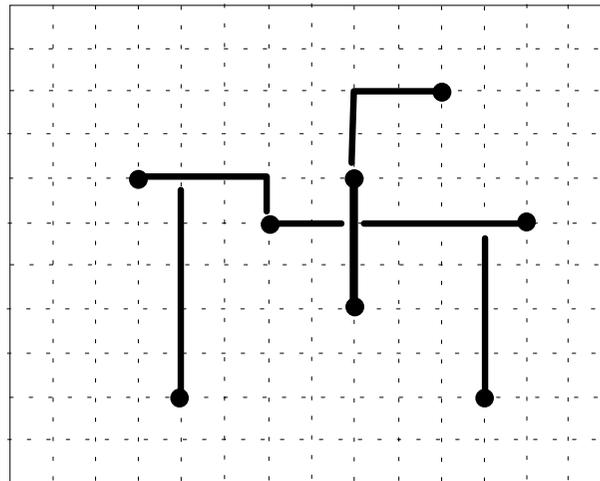
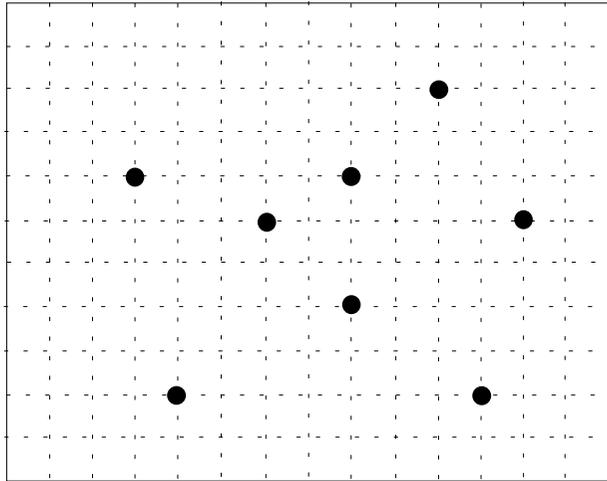


1	2	2	1	2	2	2	1	2	1
2	3	2		3	3	3		2	2
2	3	2						2	2
2	3	3	2	2	2	2		2	2
2	3	3	3	3	3	2		2	2
2	3	3	3	3	3	3	2	3	2
1	2	2	2	2	2	2	2	2	3

Routing on a Two-Layer Board



Layout of Complete Nets

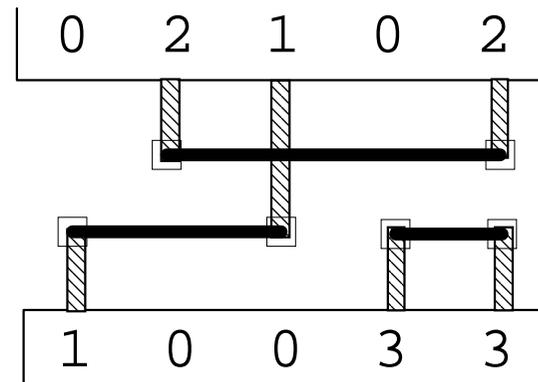
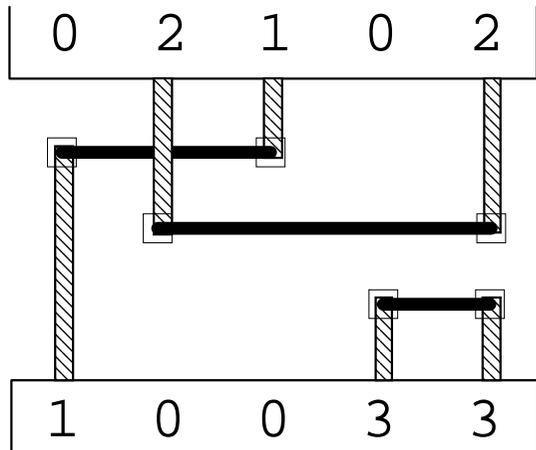


Channel Routing

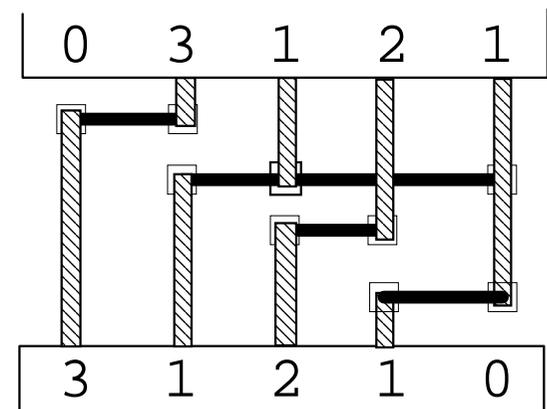
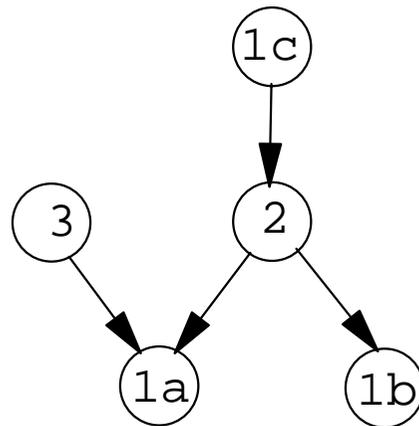
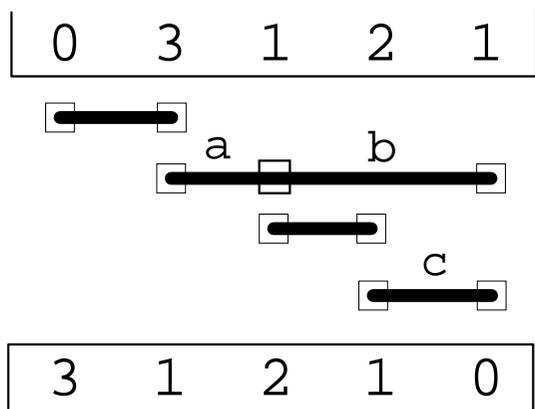
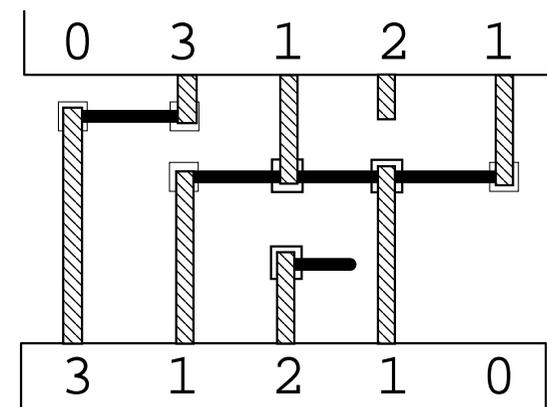
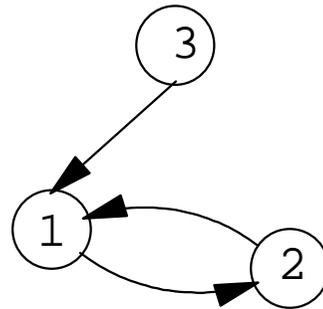
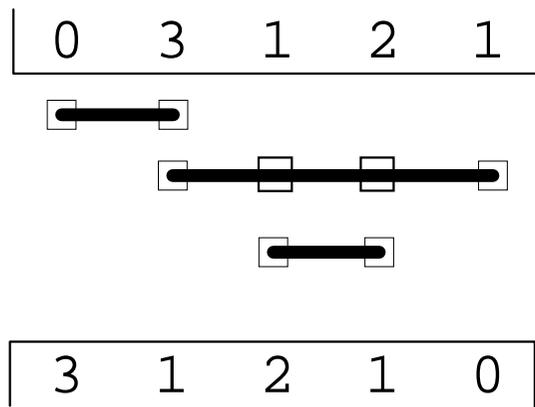
0 2 1 0 2

Channel

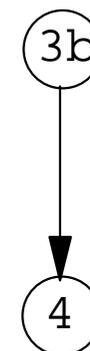
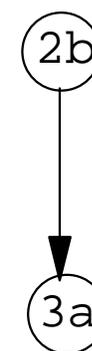
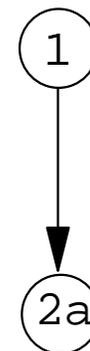
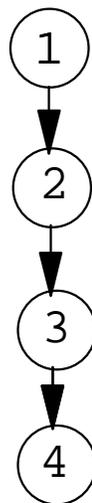
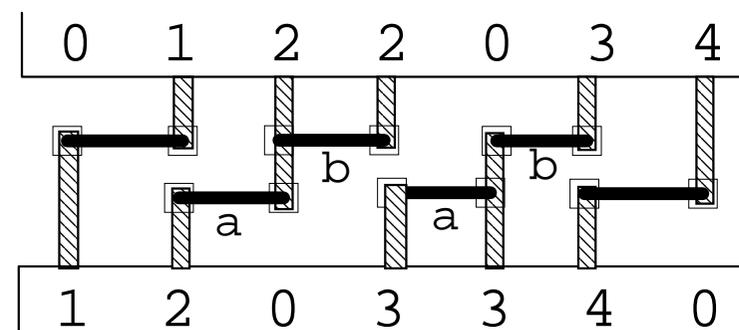
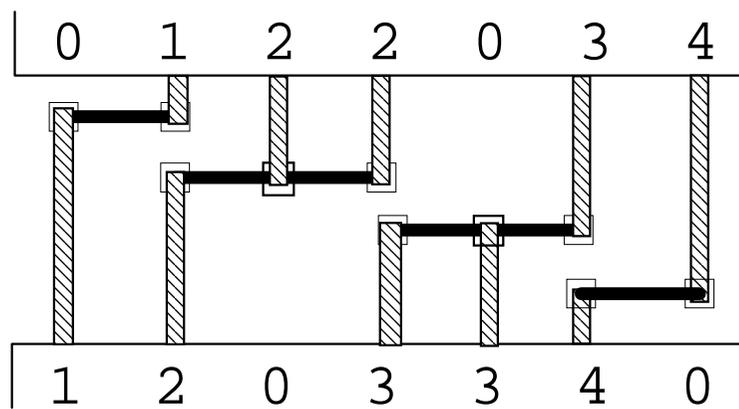
1 0 0 3 3



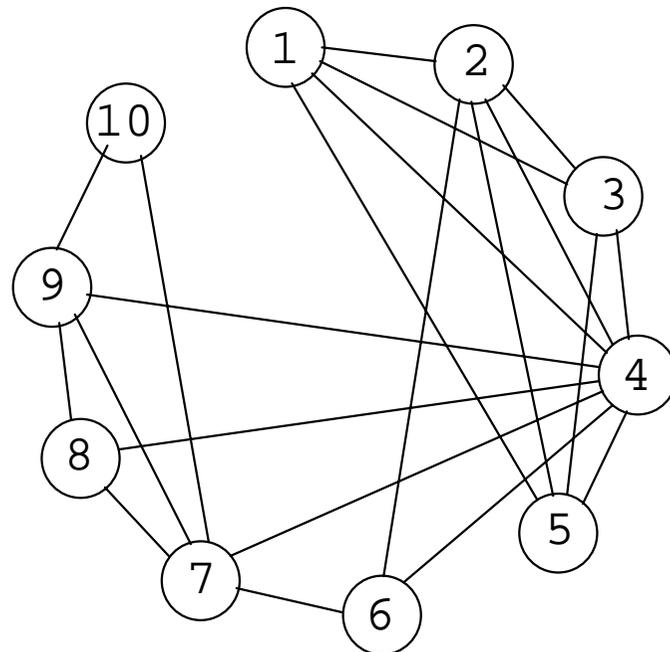
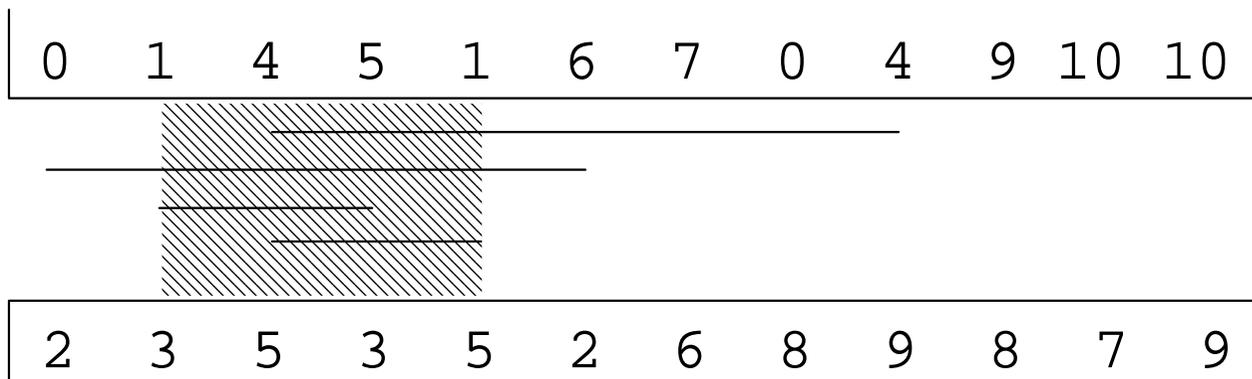
Directed Cycles in VCG



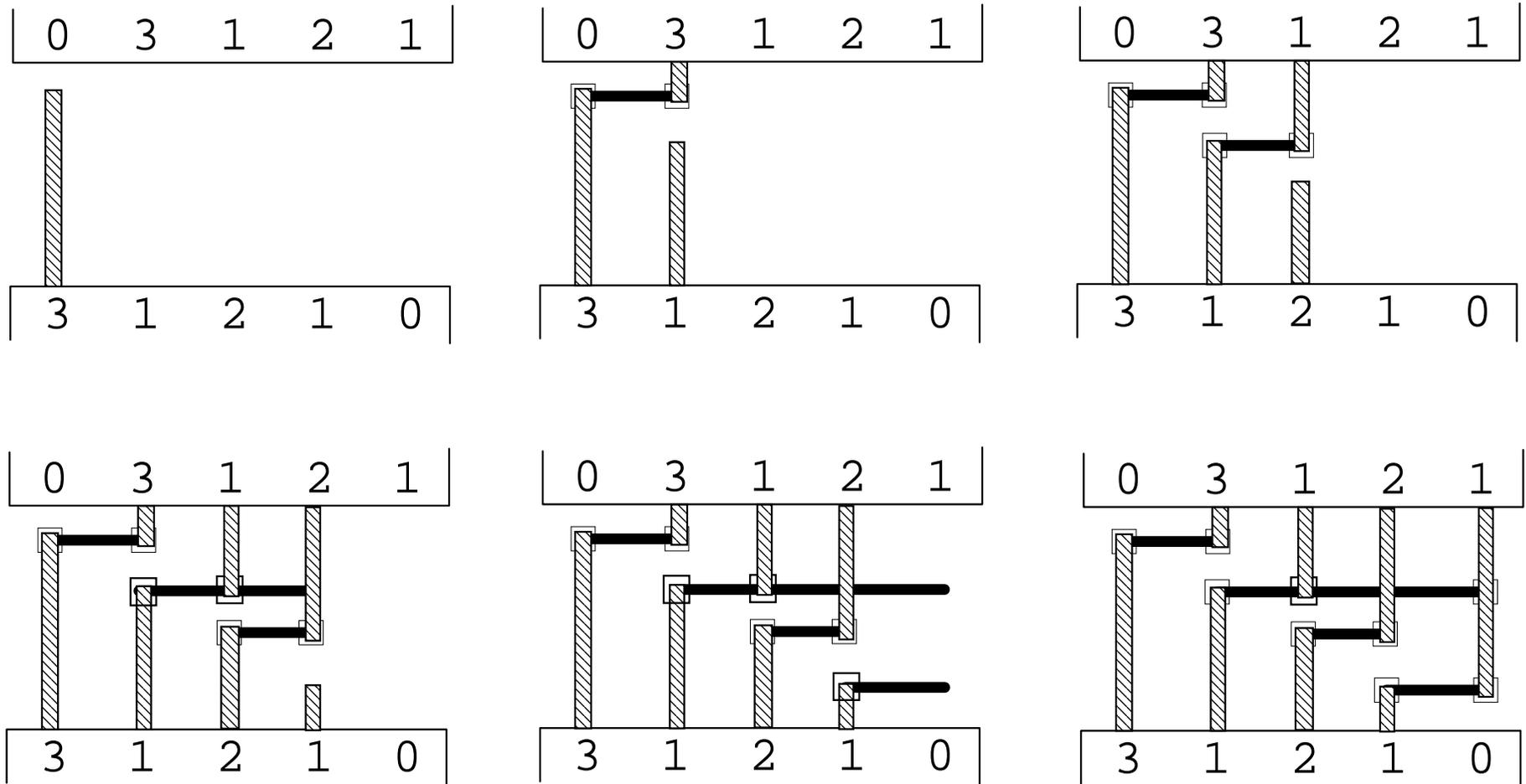
Doglegs



Horizontal Constraint Graphs



Greedy Channel Router



Hierarchical Channel Router

