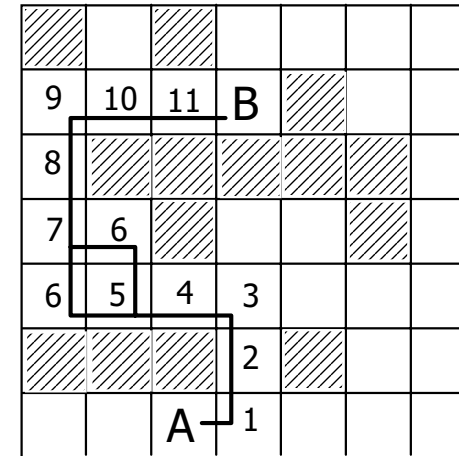
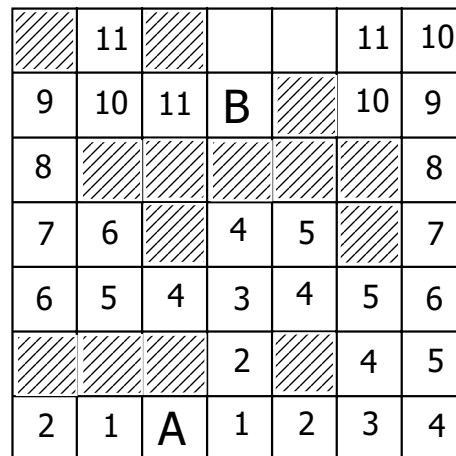
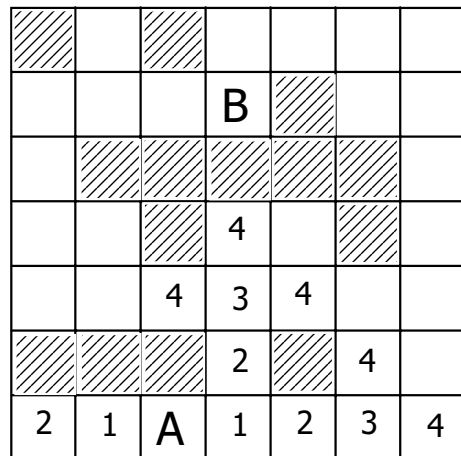
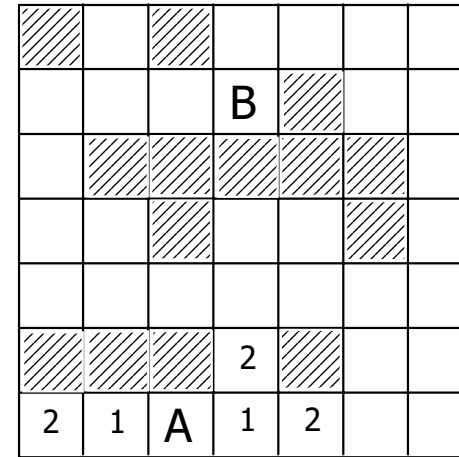
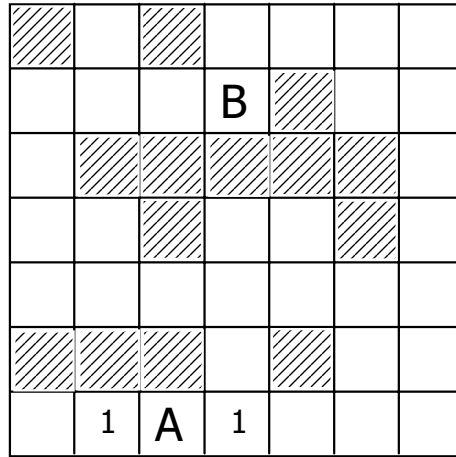
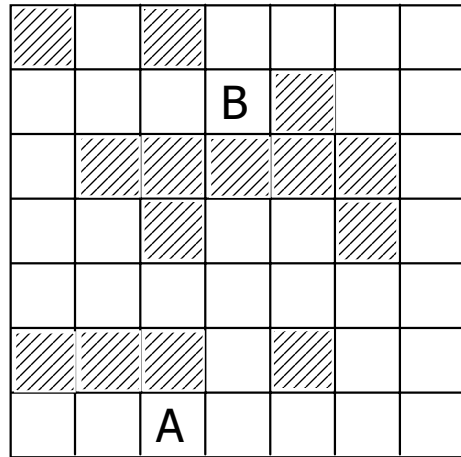
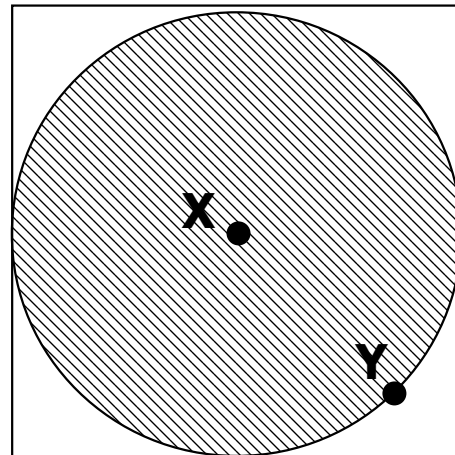
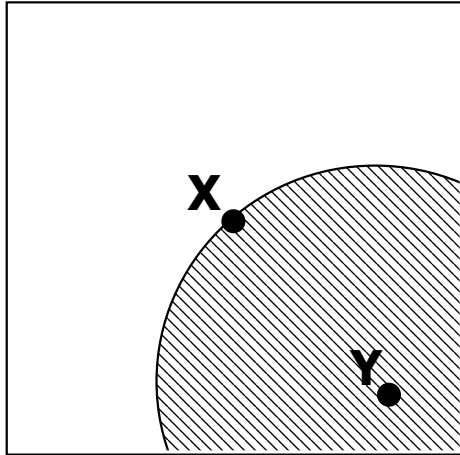

ROUTING

Somchai Prasitjutrakul

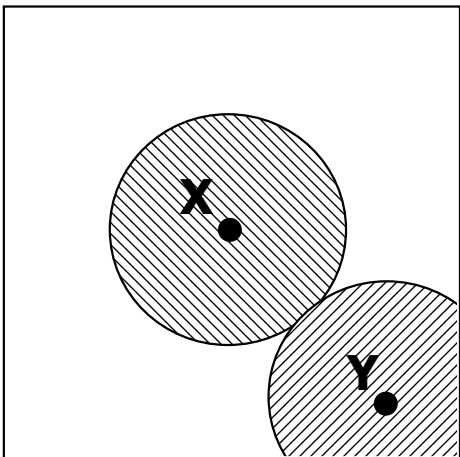
Lee's Algorithm (1961)



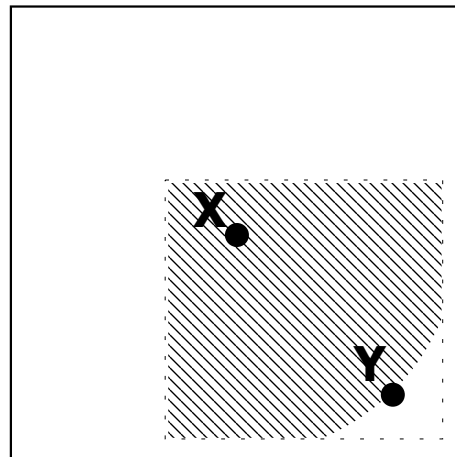
Lee's Algorithm: Speed-Up Techniques



Starting-point selection

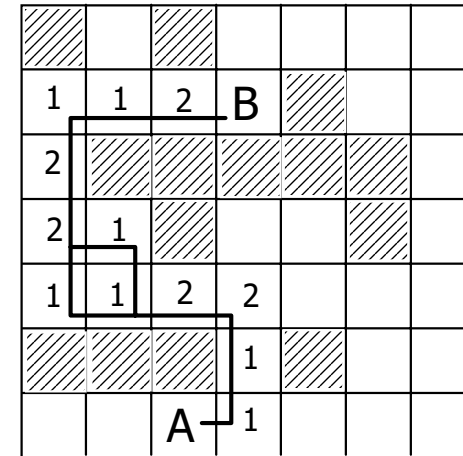
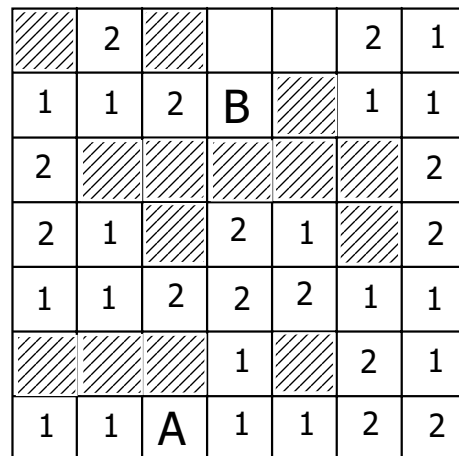
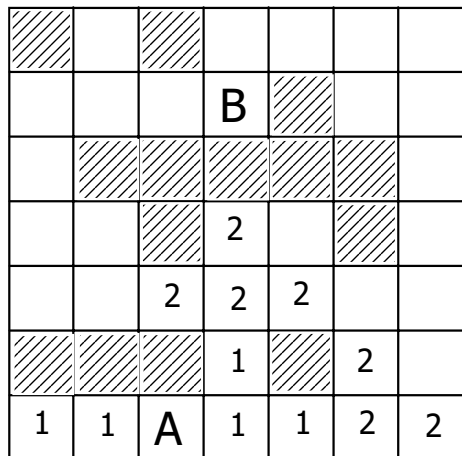
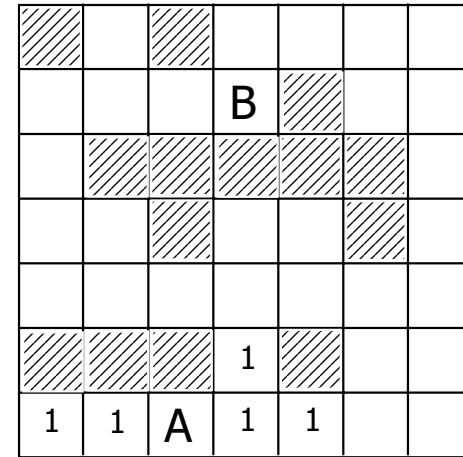
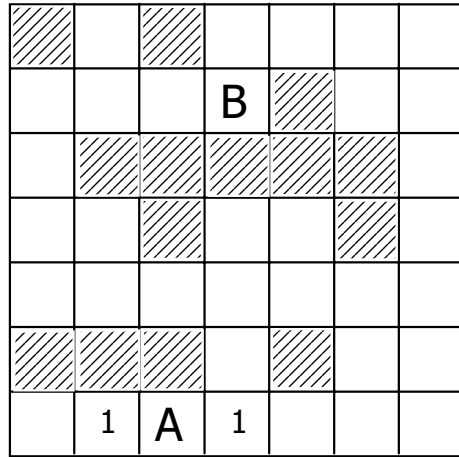
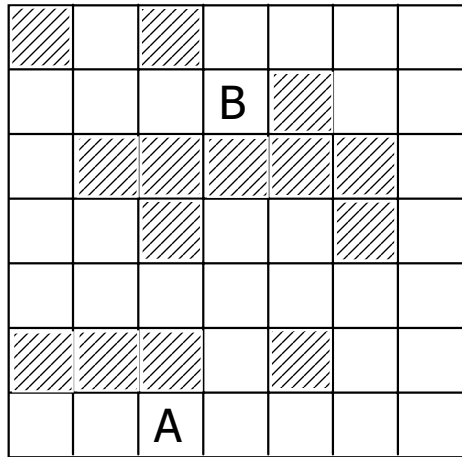


Double fan-out



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		

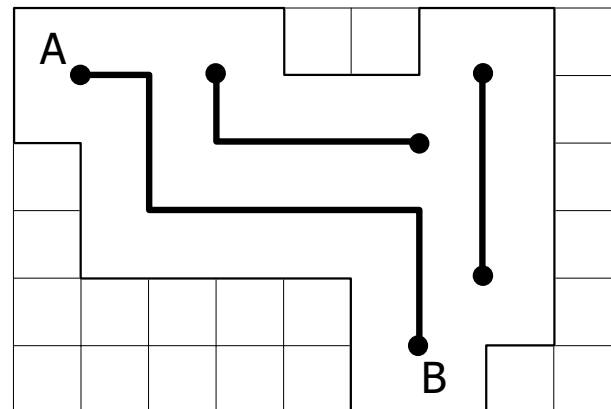
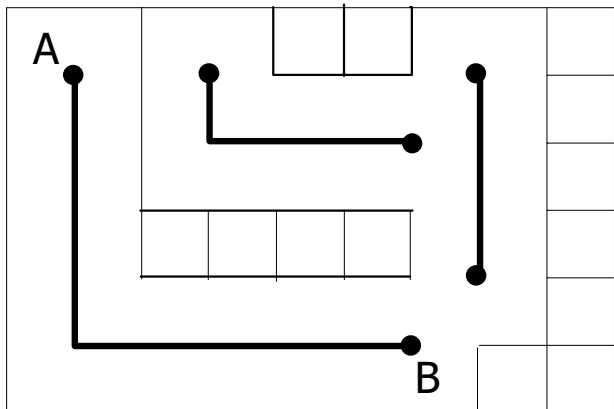
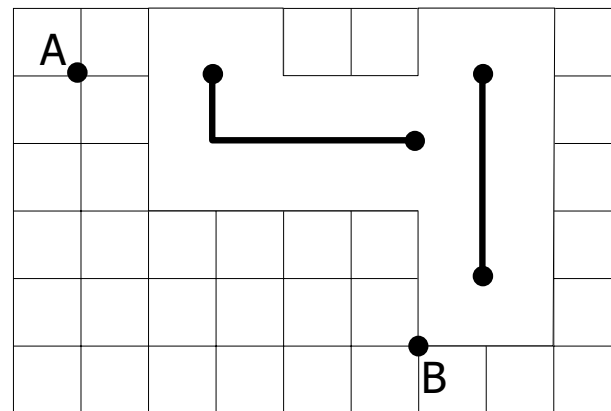
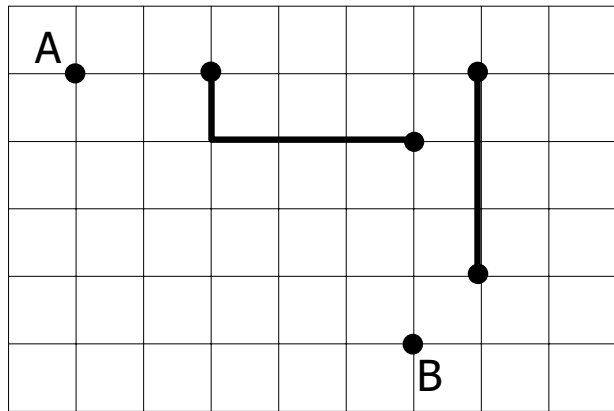
6	5	7	8	10	12	⑭			
5	A	5		11	⑬				
7	6	7							
9	9	10	12	14	⑯				
11	12	13	15	⑰					
13	15	16	⑱				B		
⑭	17	⑱							

Lee's Algorithm with Weights

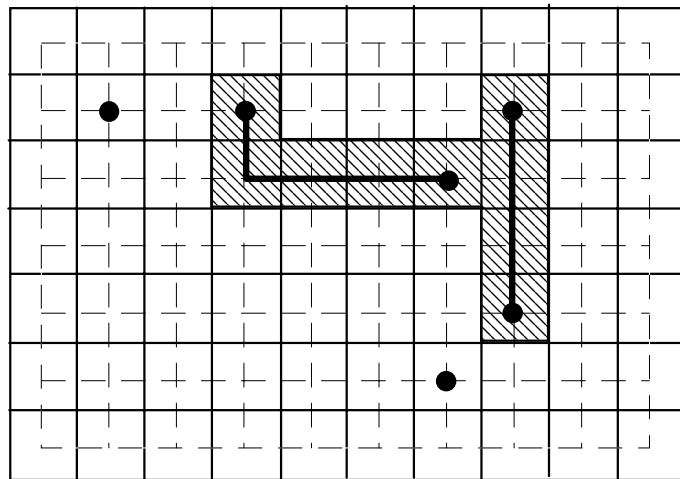
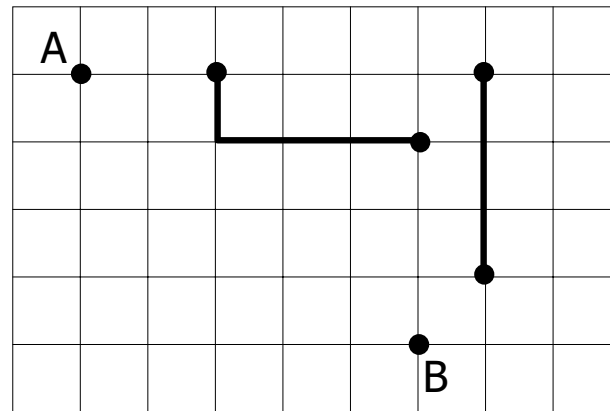
6	5	7	8	10	12	14	15	17	(18)
5	A	5		11	13	14		(19)	
7	6	7							
9	9	10	12	14	16	17			
11	12	13	15	17	19	19			
13	15	16	18	20	22	22			
14	16	18	21	22	(24)				

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

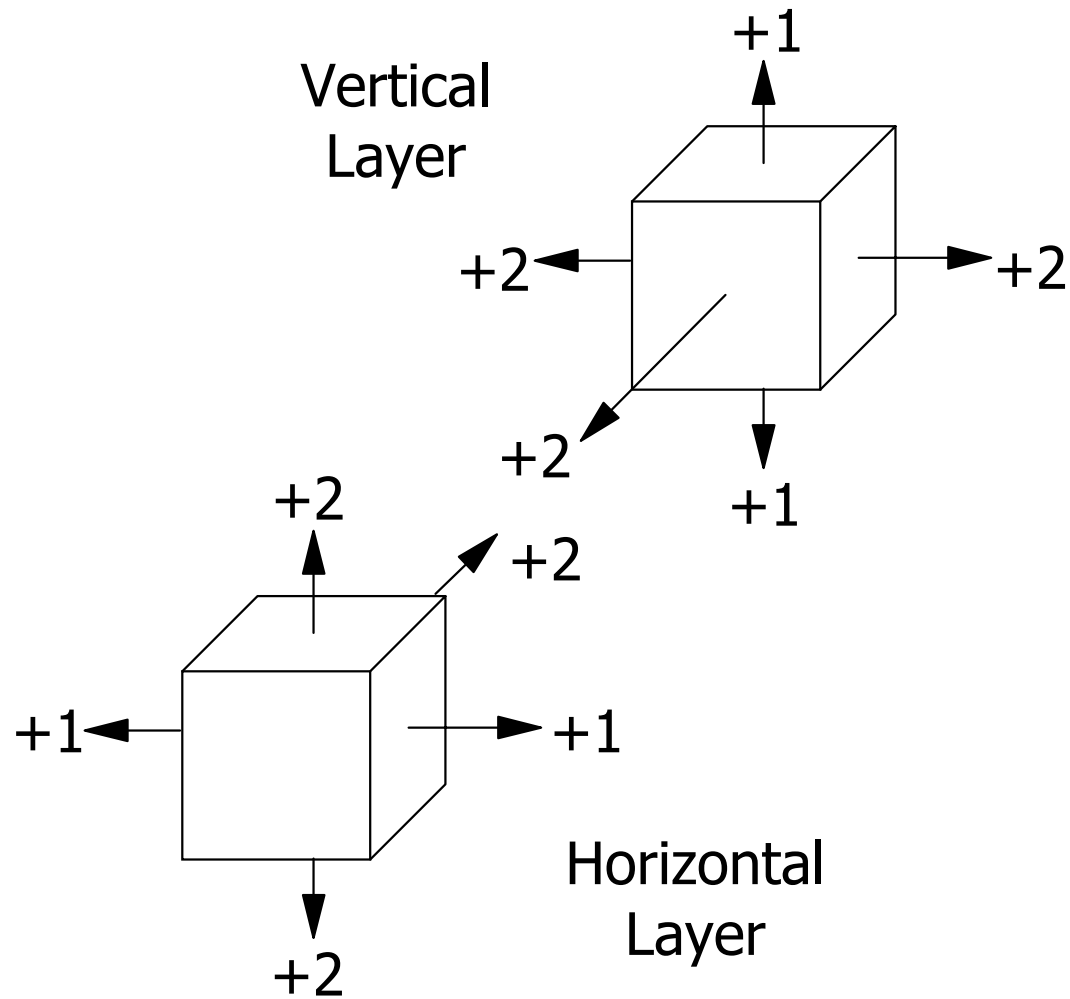


Routing to Preserve Grid Segments

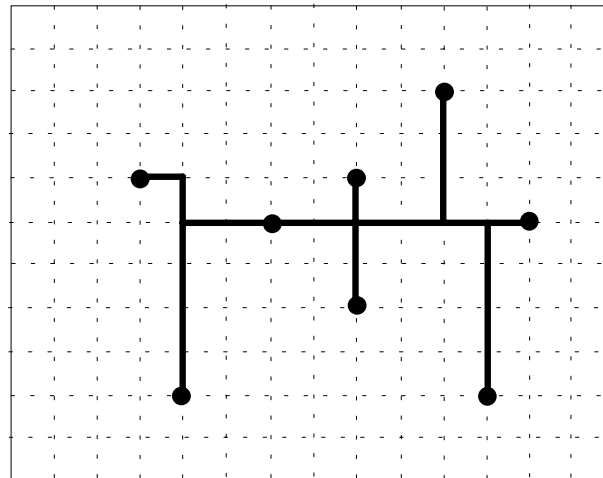
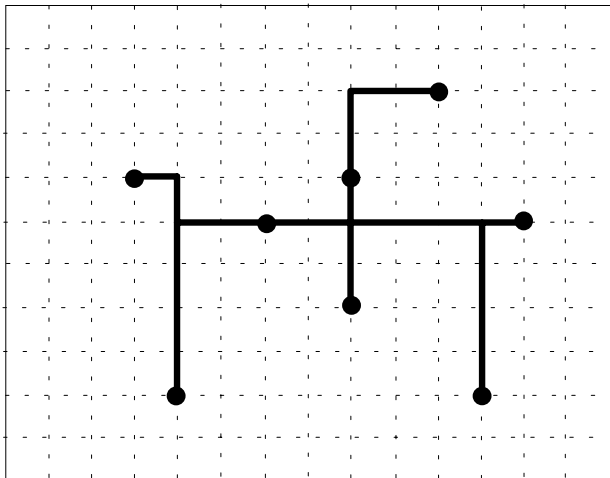
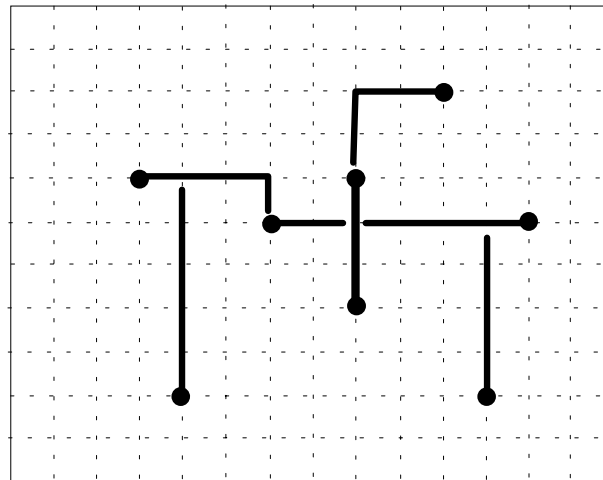
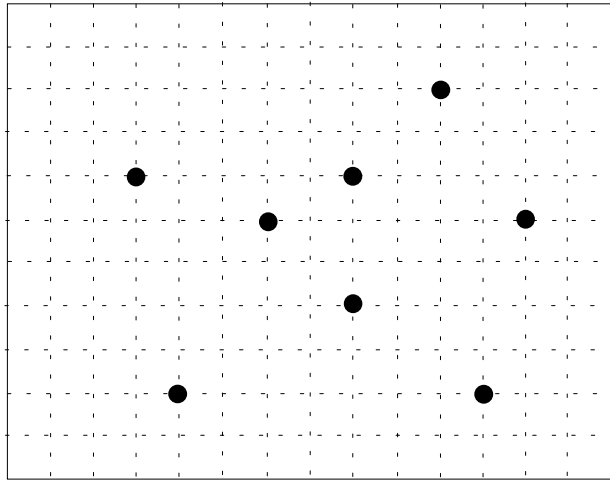


1	2	2	1	2	2	2	1	2	1
2	3	2		3	3	3		2	2
2	3	2						2	2
2	3	3	2	2	2	2		2	2
2	3	3	3	3	3	2		2	2
2	3	3	3	3	3	3	2	3	2
1	2	2	2	2	2	2	2	2	3

Routing on a Two-Layer Board



Layout of Complete Nets

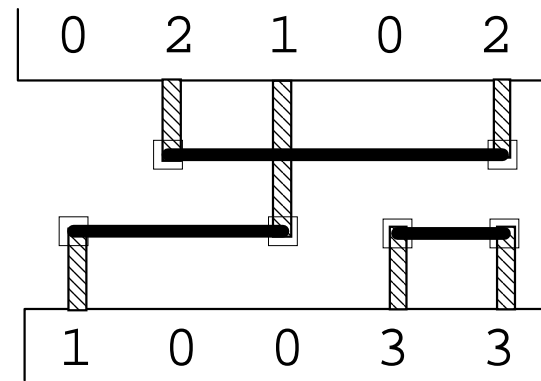
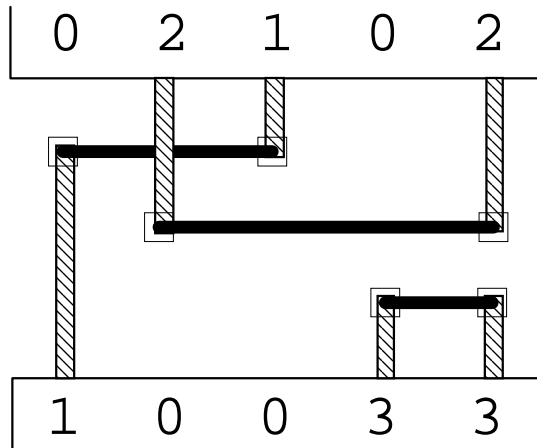


Channel Routing

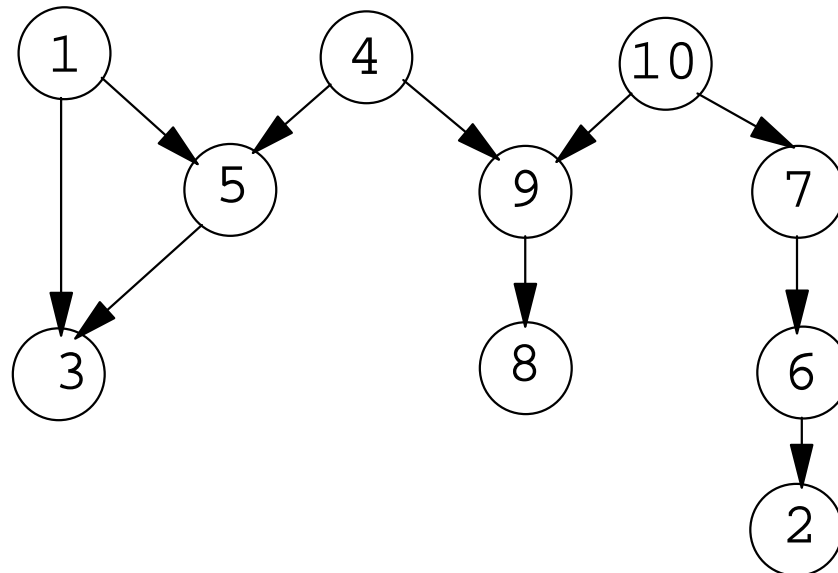
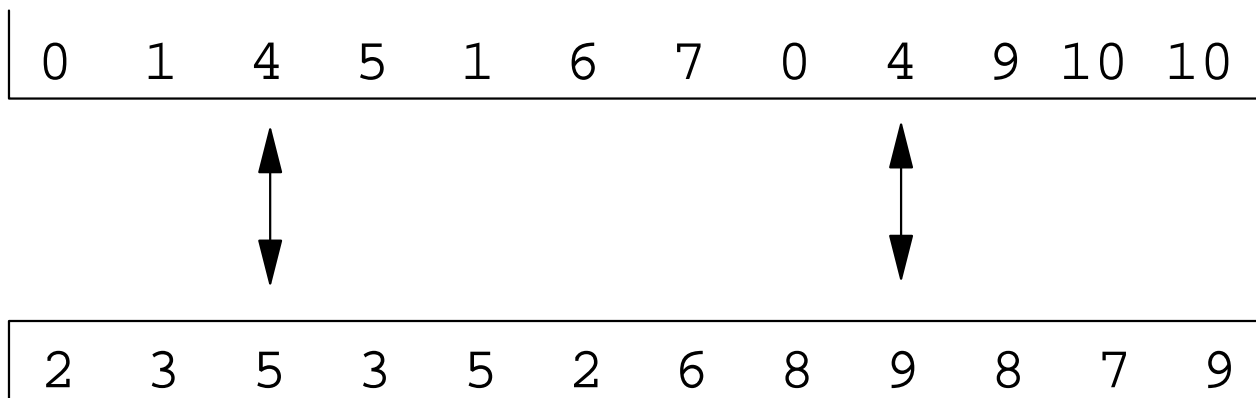
0 2 1 0 2

Channel

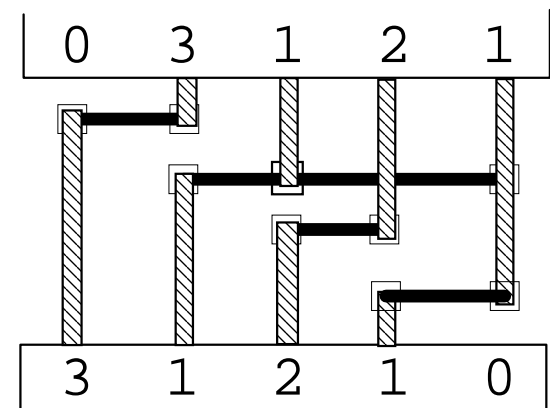
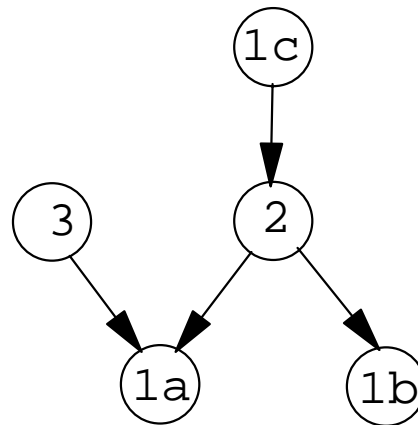
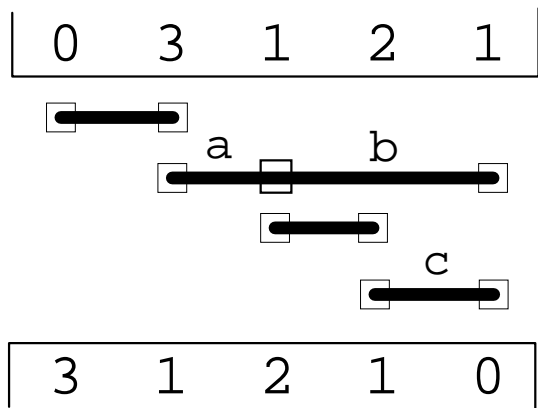
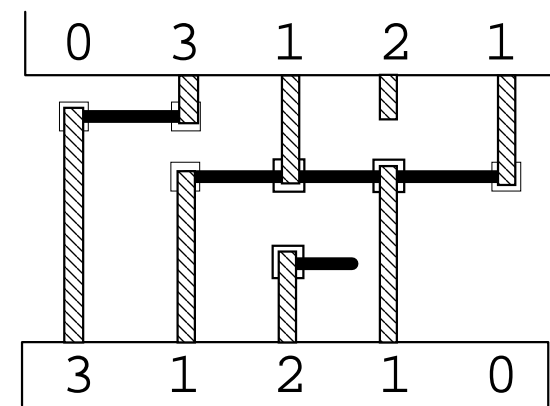
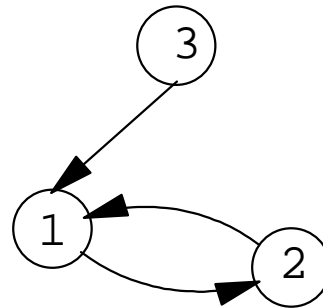
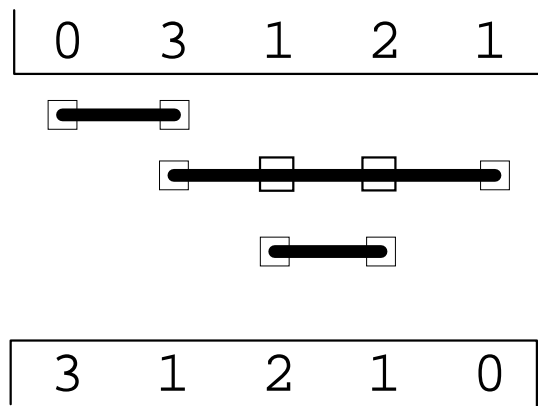
1 0 0 3 3



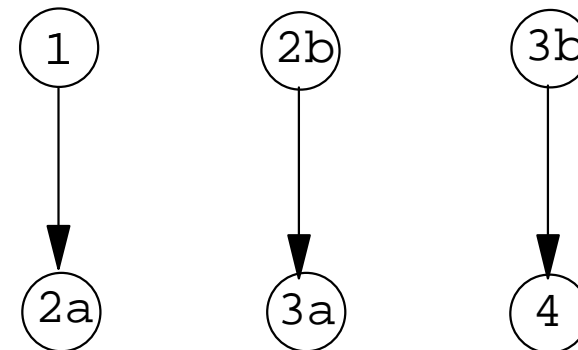
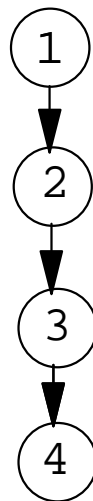
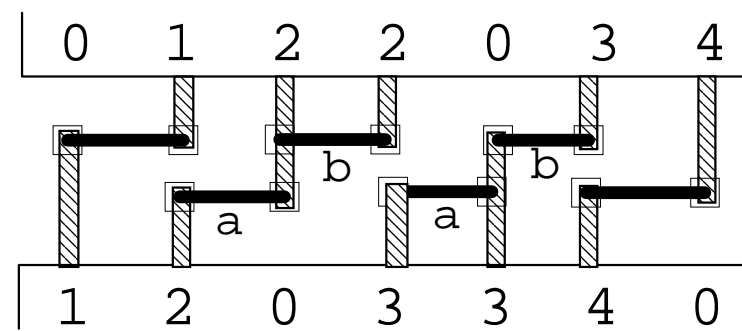
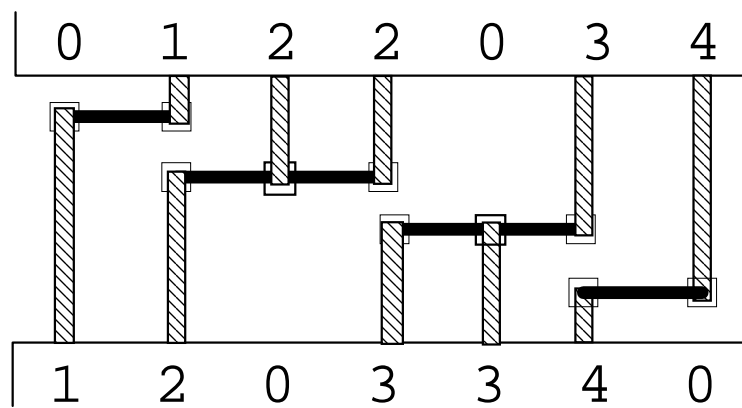
Vertical Constraint Graphs



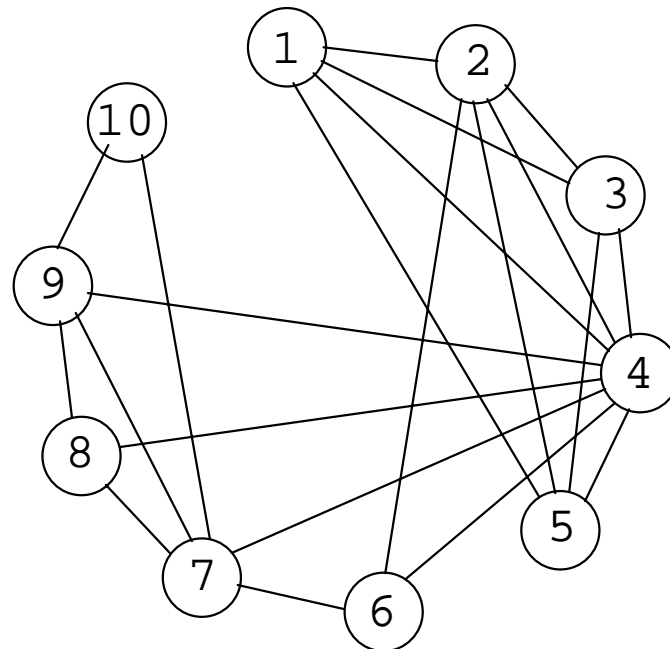
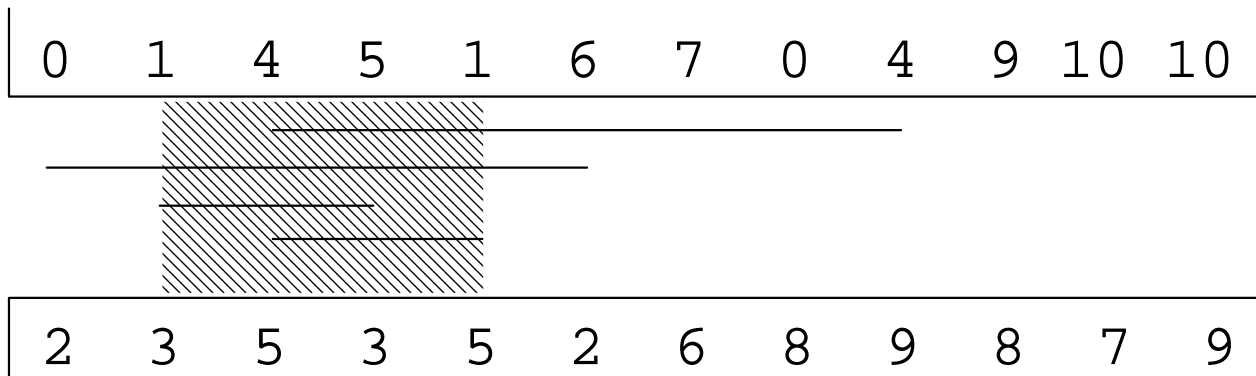
Directed Cycles in VCG



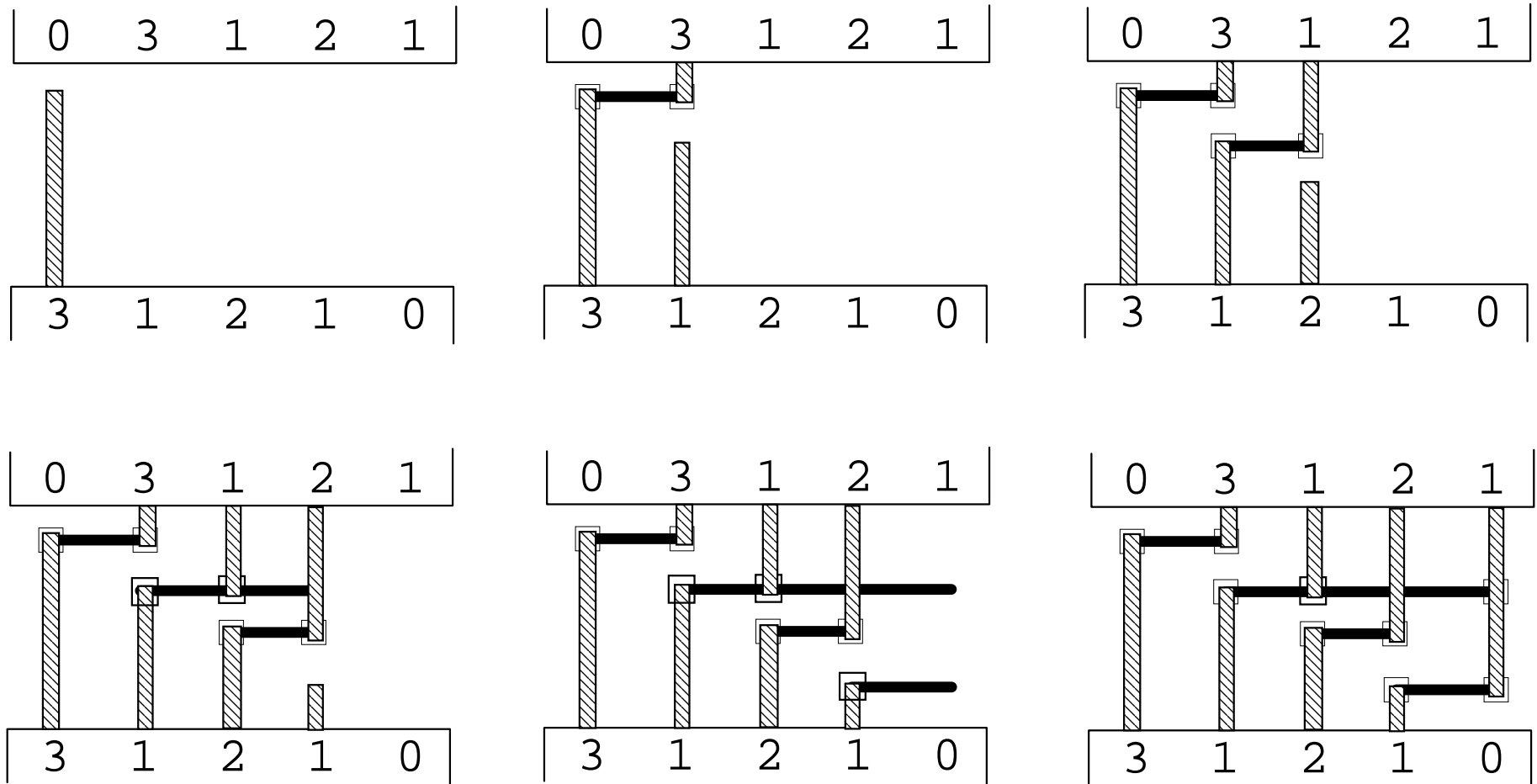
Doglegs



Horizontal Constraint Graphs



Greedy Channel Router



Hierarchical Channel Router

