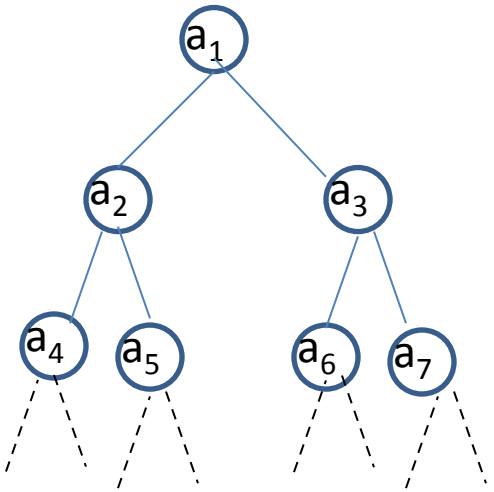
1.Consider a complete binary tree with n nodes. Apply Kernighan-Lin algorithm to this graph. As the initial partition, let v_a, for all internal vertices, be in one set and v_b, for all leaves, be in the other set.

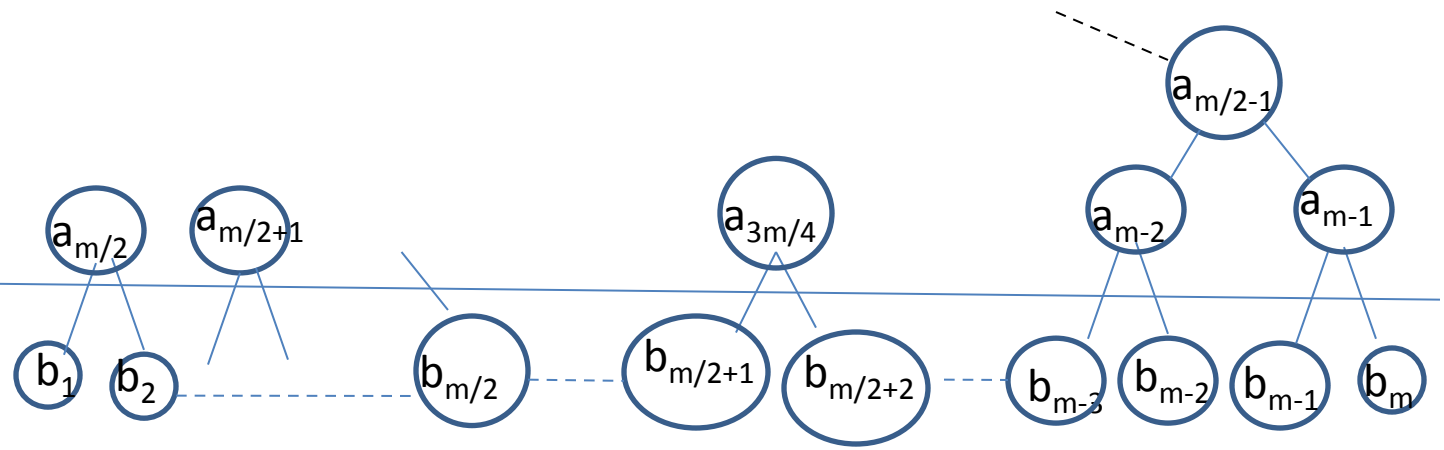
Answer: Say, $n= 2^k-1$, and $m=2^k$

Initial partition with cut size = m

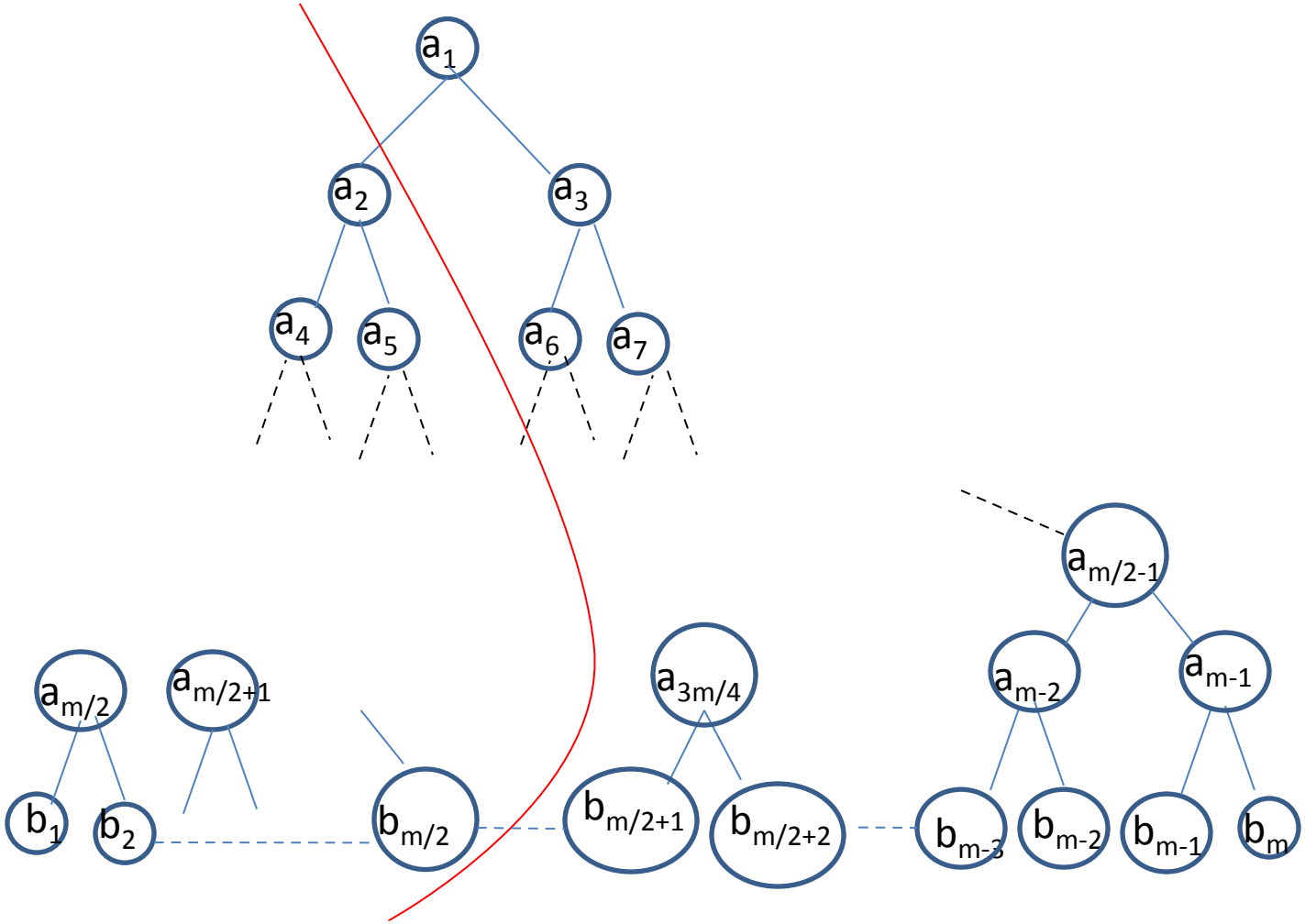


step	Vertex pair	Gain	Cut-cost
0	----------	0	m
1	$\{a_{m-1}, b_1\}$	2	m-2
2	$\{a_{m-2}, b_2\}$	2	m-4
…….	------	…….	……
m/4	$\{a_{3m/4}, b_{m/4}\}$	2	m/2
m/4+1	$\{a_{(m/2)-1}, b_{(m/4)+1}\}$	2	m/2+2
…….	…….	…….	……
m-1	$\{a_3, b_{(m/2)-1}\}$	2	2
m	$\{a_1, b_{m/2}\}$	1	1

KL Algorithm: 1st iteration



After 1st iteration of KL Algorithm

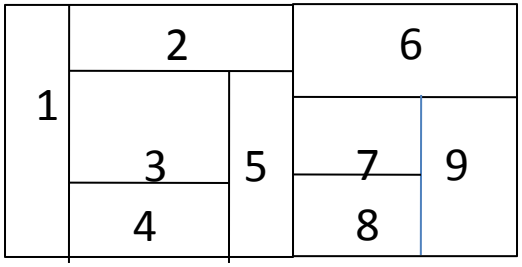


For any exchange after 1st iteration the gain is negative

Thus the partition obtained after 1st iteration is the final partition

2. Obtain the rectangular dual of the following adjacency graph. Is it sliceable?

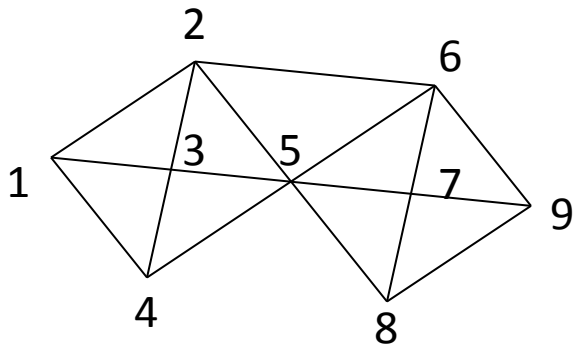
Answer:



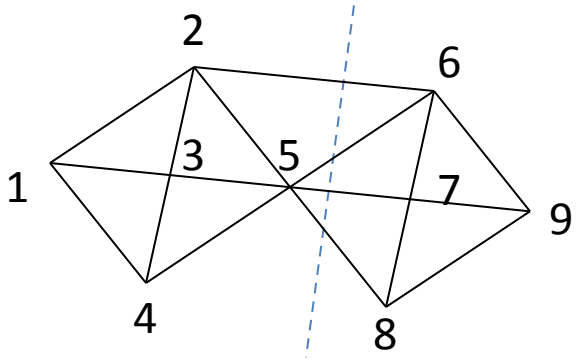
Sliceable

See next two slides to know how to get it

QUESTION 2

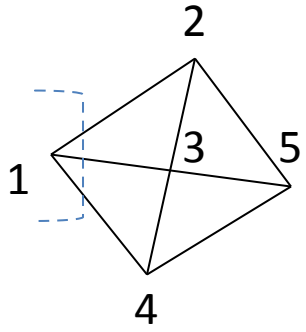


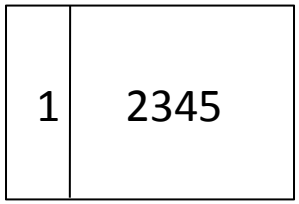
123456789

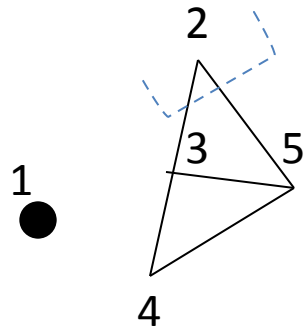


12345	6789

QUESTION 2


2
1
3
5
4


1
2345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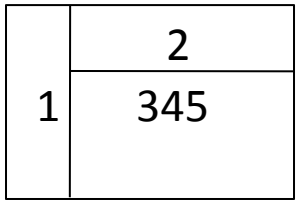
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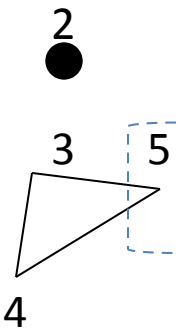
345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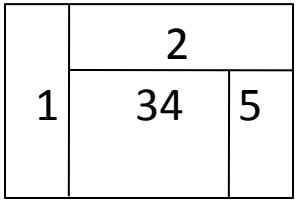
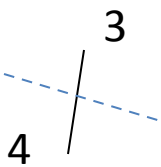

2
1
34
5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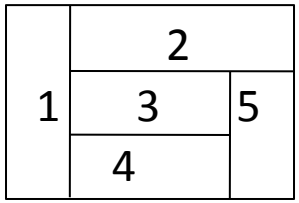
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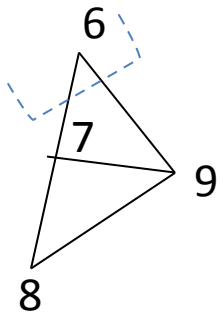
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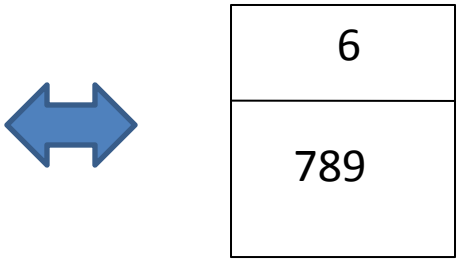
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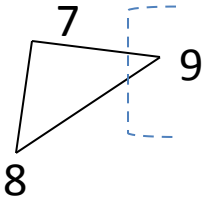
789


7
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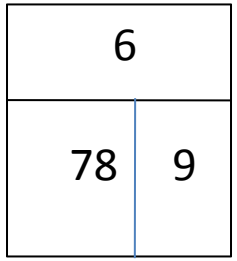
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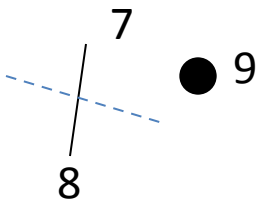
78
9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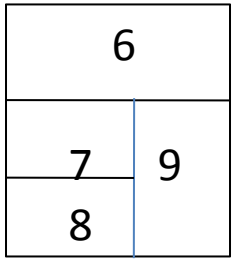
6
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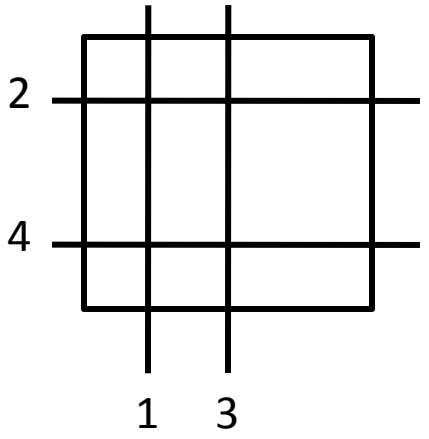
3. Explain the different procedures for Breuer's Algorithm for placement.

Cut oriented Min-cut Placement

1. The chip is first cut by a partition into two blocks

2. The circuit is also partitioned into two subcircuits so that the net cut is minimized

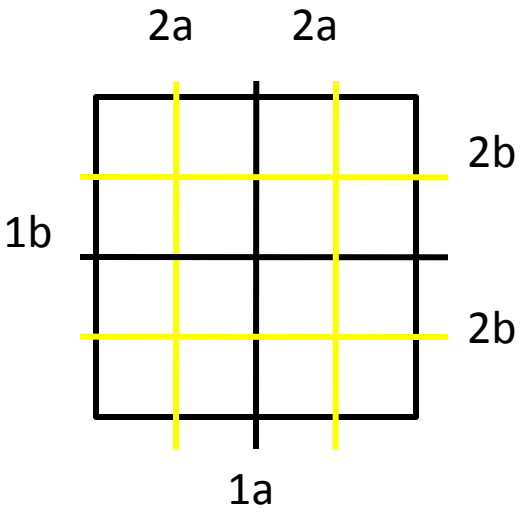
3. All the blocks formed by the partition are further partitioned by the second cut line and this process carried out



Quadrature Placement

1. Each region is partitioned into four regions of equal sizes by using horizontal and vertical lines alternatively

2. During each partitioning, the cutsize of the partition is minimized

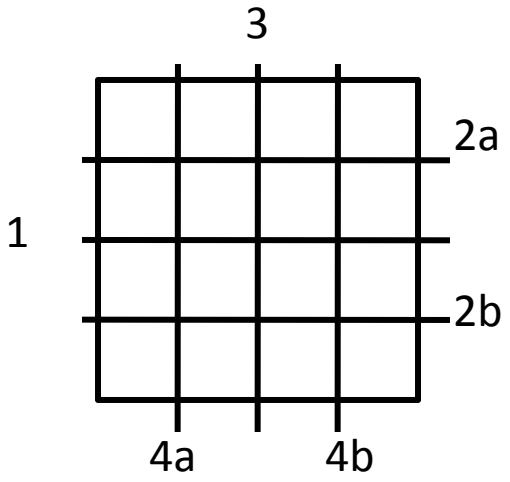


QUESTION 3 continued

Bisection Placement

1. The layout area is repeatedly bisected into two equal parts by horizontal cut lines until each subregion consists of one row

2. Each of these rows are repeatedly bisected by vertical cut lines till each resulting subregion contains only one slot thus fixing the position of all blocks

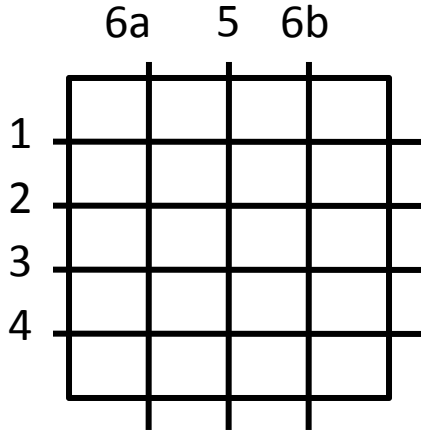


Slice Bisection Placement

1. A suitable number of blocks are partitioned from the rest of the circuit and assigned to a row (called as slicing), by horizontal cut line

2. Step-1 is repeated until each block is assigned to a row

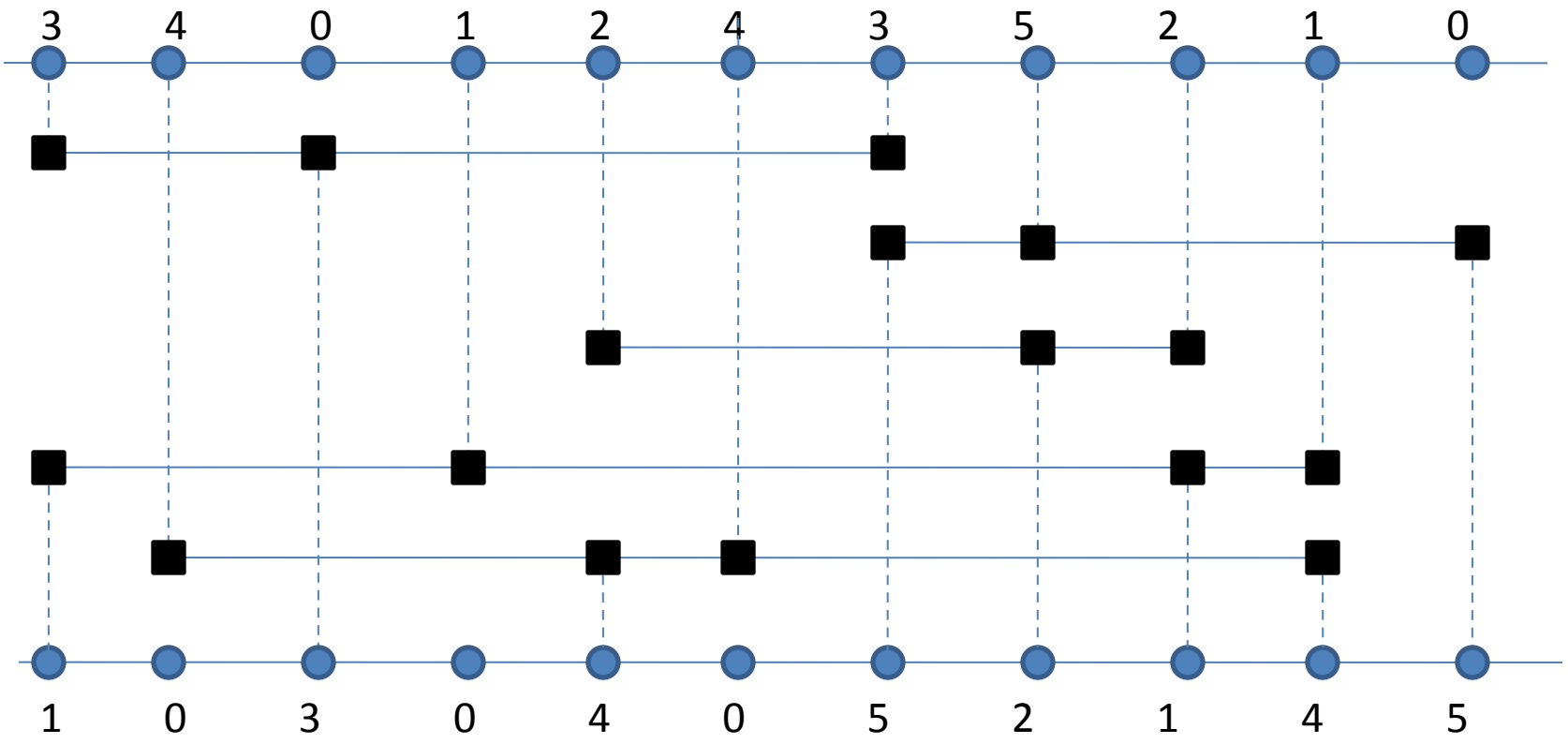
3. The blocks in each row are then assigned to columns by bisecting using vertical cut lines



4. Route the following channel of 11 columns using the Left edge algorithm, where 0 indicates an empty position

TOP = 3 4 0 1 2 4 3 5 2 1 0

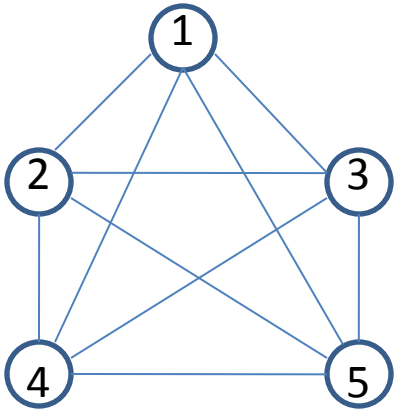
BOT = 1 0 3 0 4 0 5 2 1 4 5



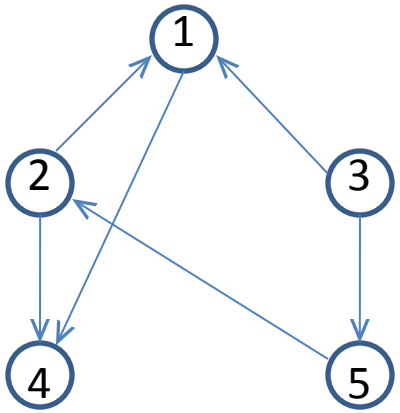
Why is it so? See the next slide

TOP = 3 4 0 1 2 4 3 5 2 1 0
BOT = 1 0 3 0 4 0 5 2 1 4 5

What HCG says:
Maximum clique is 5



HCG



VCG

What VCG says: Longest path is 2

Channel height = max(Maximum clique in HCG, longest path in VCG) =5

It implies, only 5 tracks are sufficient

What VCG says more:
3 is above 1,
3 is above 5,
5 is above 2,
2 is above 4,
2 is above 1,
1 is above 4
Thus the tracks may be
allotted as 3,5,2,1,4

5. The following Fig. shows a grid graph with several blocked vertices. It also shows terminals source(s) and target (t) of a two-terminal net. Use Lee's algorithm to find the path for this net.