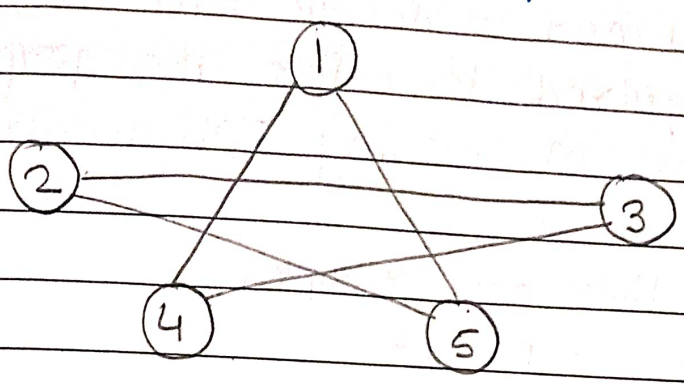
Q.1]. Explain Briefly what is mean by graph colouring problem and color following graph using given colors m = (R, G, B) , & explain with state space tree.



→ Graph Coloring Problem :

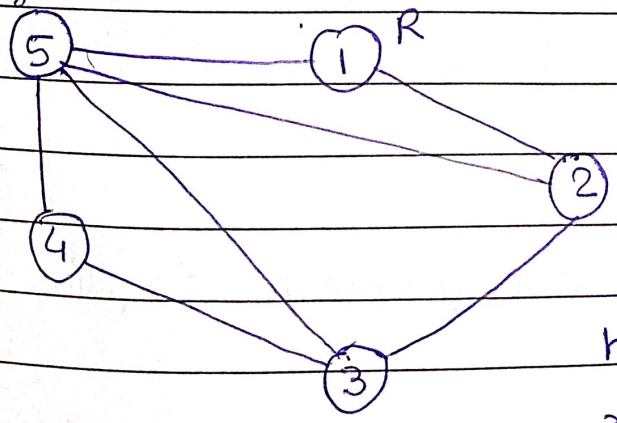
1] Graph coloring problem involves assigning colors to certain elements of a graph subject to certain restrictions and constraints. In other words, the process of assigning colors to the vertices such that no two adjacent vertex have the same color is called Graph colouring.

2] There are two types of graph coloring problem :

a) M-coloring Decision Problem

b) M-coloring optimization Problem.

3] e.g. ..



1	2	3	4	5
R	G	R	G	B

here, colours = R G B (i.e. 3 red, Green & blue colours).

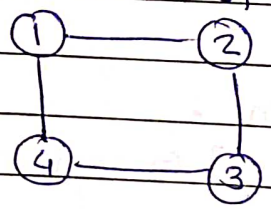
4] m coloring Decision Problem : In this graph & colours are given and you need to decide wheather that graph can be colored or not.

5] m coloring Optimization Problem : In this only graph is given to you and you need to decide min. how many colours we will required to color the graph. This problem is known as m coloring optimization problem.

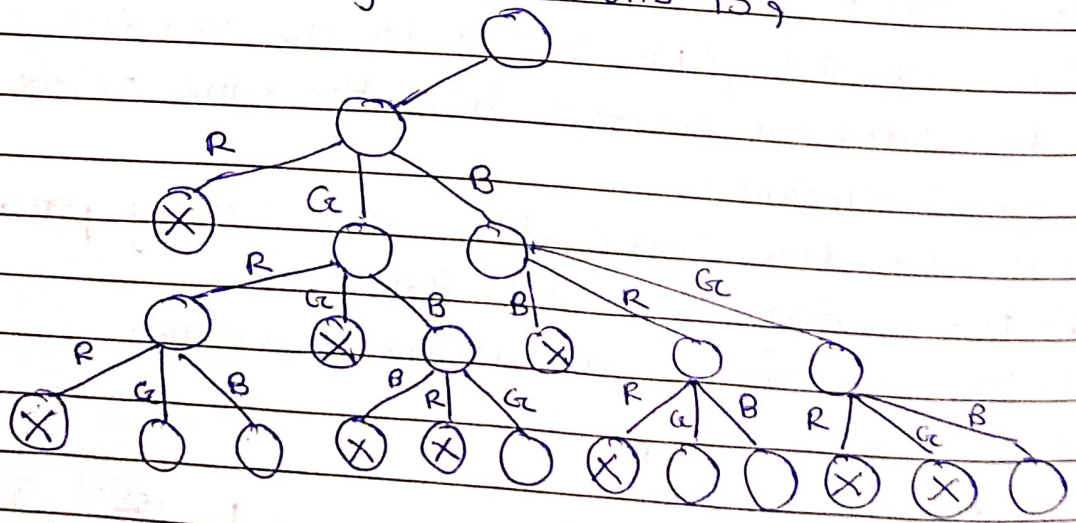
let's take another one example,

m=3 , colours = R, G, B.

Graph ⇒



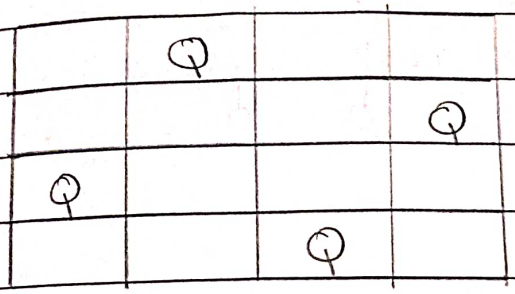
State space tree forget solutions is,



Q.2] What is mean by N-queen problem? Explain withe one example.

1] The N Queen is the problem of placing N queens (chess queens) on an N × N chessboard so that no two queens attack each other.

2] For example, the following is a solution for the 4 queen problem.

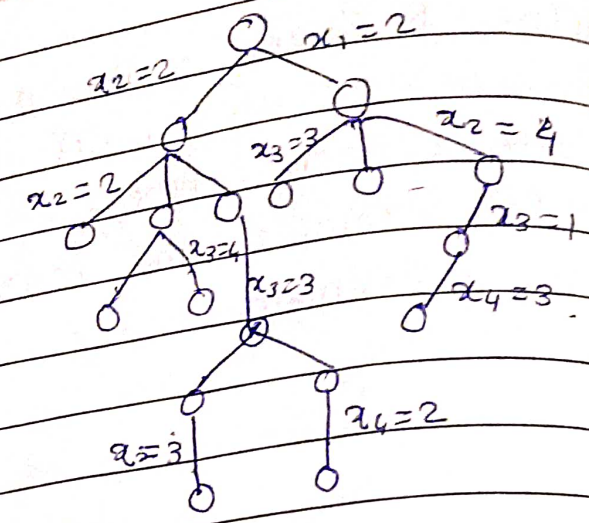


3] Two queens attack each other in case of if two queens adjacent to each other in same row, same column or diagonally adjacent.

4] Backtracking Algorithm by placing queen in columns -
In this method place queens one by one in a different columns, we ~~can~~ starting from the leftmost column.
when we place a queen in a column, we check for clashes with already placed queens. In the current column, if we find a row for which there is no clash, we mark this row & column as part of the solution. If we do not find such a row due to clashes, then we backtrack & return false.

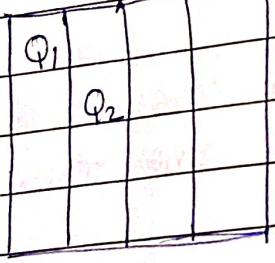
5] Backtracking Algorithm to solve Nqueen problem by placing queen in rows -
In this method we place queens one by one in different rows, starting from ~~different rows~~ topmost row. and same procedure ~~as~~ we taking in columns just here this procedure takes place in rows.

6]

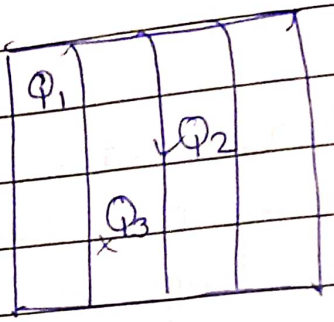


Steps to get result :-

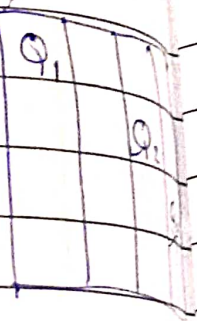
1)



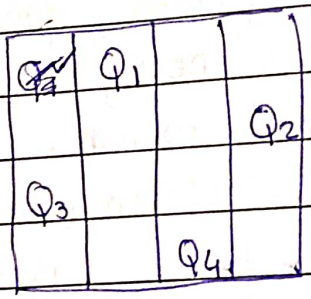
Backtracking →



Backtracking →

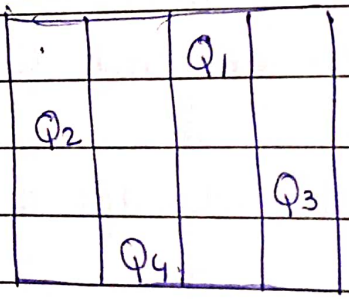


Backtracking →



& If we take Q_i in 3rd column.

Soln ✓



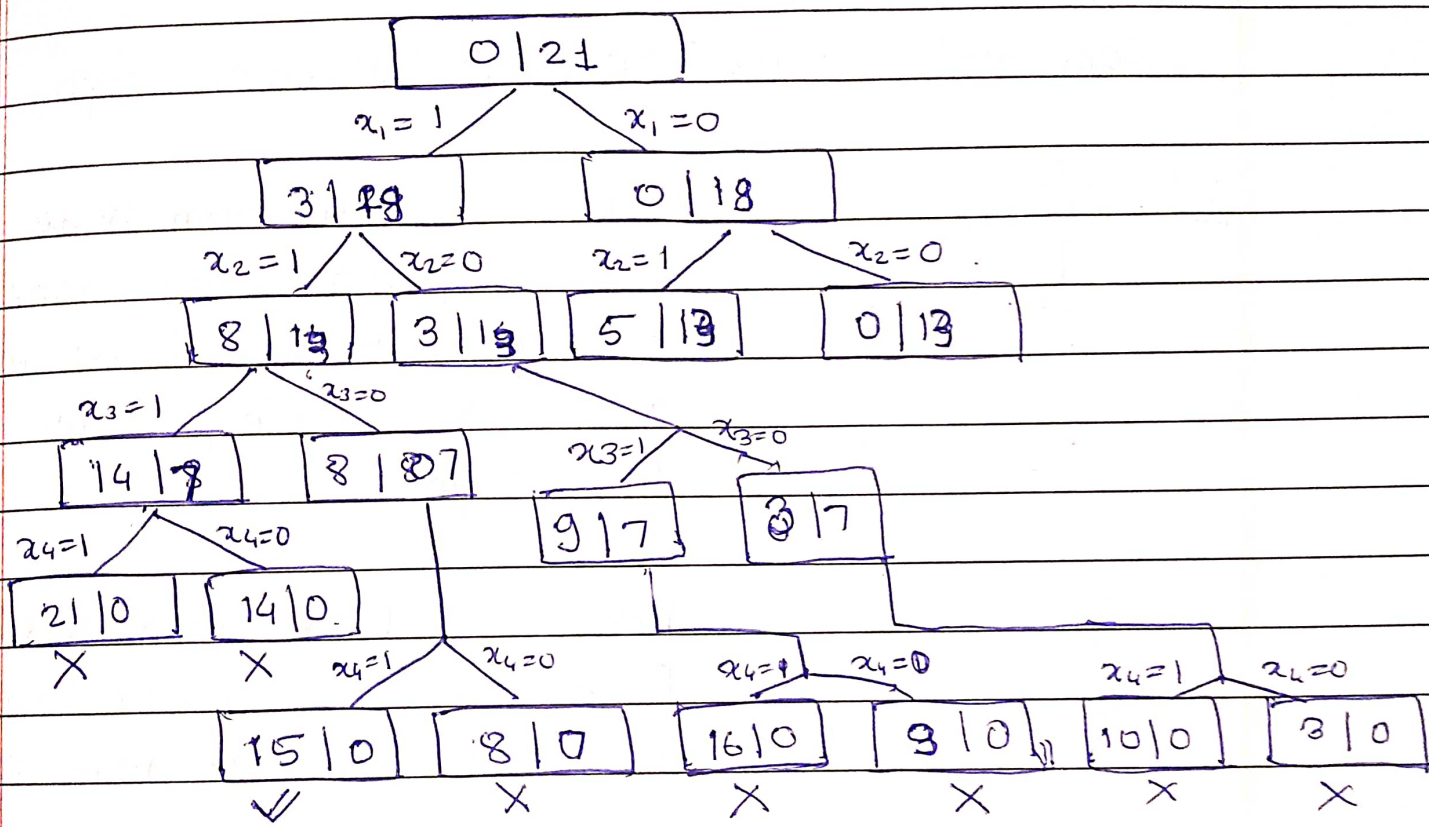
Q.3] Explain sum of subsets briefly & complete state-space tree of the backtracking algorithm applied to the instance $A = \{3, 5, 6, 7\}$ and $d = 15$ of the subset-sum problem.

1] Subset sum problem is to find subsets of elements that are selected from a given set of whose sum adds up to a given number k.

2] Here, we are considering the set of non-negative values. It is assumed that the input set is unique.

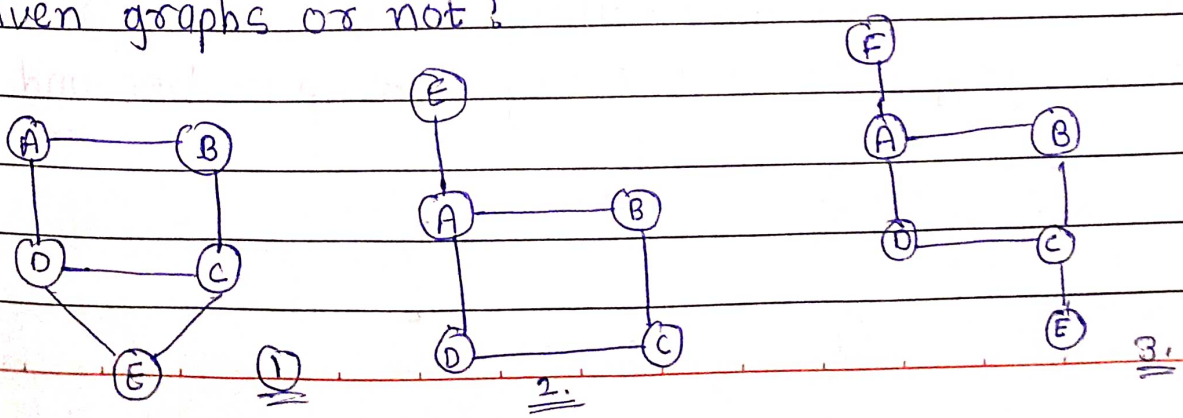
3] Time complexity of sum of subset problem runs in exponential order.

4] e.g. $A = \{3, 5, 6, 7\}$ & $d = 15$ = sum.

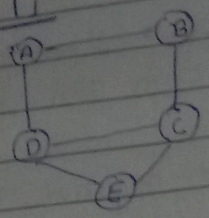


∴ soln is ⇒ 3 + 5 + 7 = 15

Q.4] Determine whether Hamiltonian cycle present in below given graphs or not?



1]



1) The given graph has hamiltonian cycle if & only if the graph is connected.

here, lets start from node A.

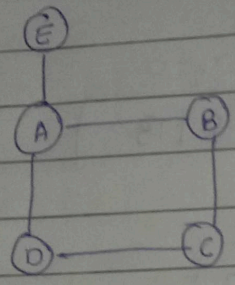
path → 1) A - B - C - E - D - A

2) A - D - E - C - B - A

so, by visiting each node only once we will get hamiltonian cycle.

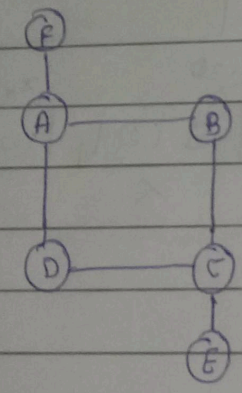
∴ Hamiltonian cycle is present in above graph.

2]



here, lets start from node E but the graph is not connected and so that there is no any hamiltonian cycle present in this graph.

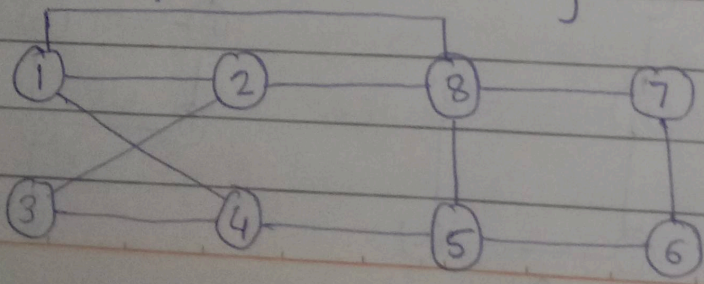
3]



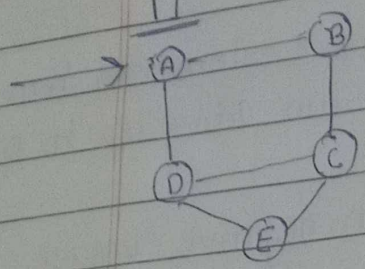
here, let's start from node E. from graph it is clear that it contains pendant node and graph is not connected.

Hence, the given graph has no hamiltonian cycle.

Q.5] Determine wheather hamiltonian cycle is present in below graph or not using state space tree and queue.



1]



1) The given graph has hamiltonian cycle if & only if the graph is connected.

here, lets start from node A.

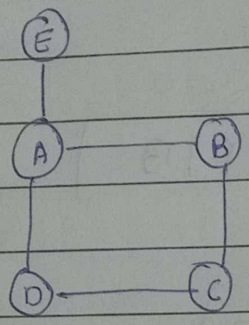
path → 1) A - B - C - E - D - A

2) A - D - E - C - B - A

so, by visiting each node only once we will get hamiltonian cycle.

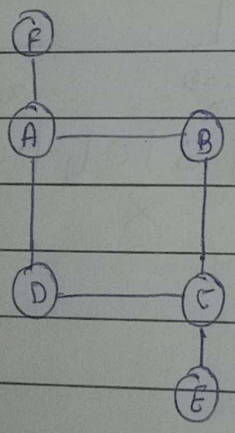
∴ Hamiltonian cycle is present in above graph.

2]



here, lets start from node E but the graph is not connected and so that there is no any hamiltonian cycle present in this graph.

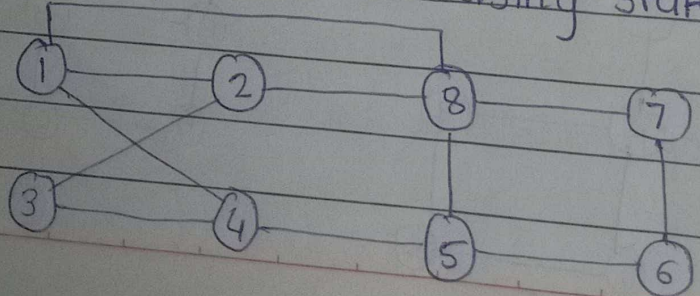
3]



here, let's start from node F. from graph it is clear that it contains pendant node and graph is not connected.

Hence, the given graph has no hamiltonian cycle.

Q. 5] Determine wheather hamiltonian cycle is present in below graph or not using state space tree and queue.



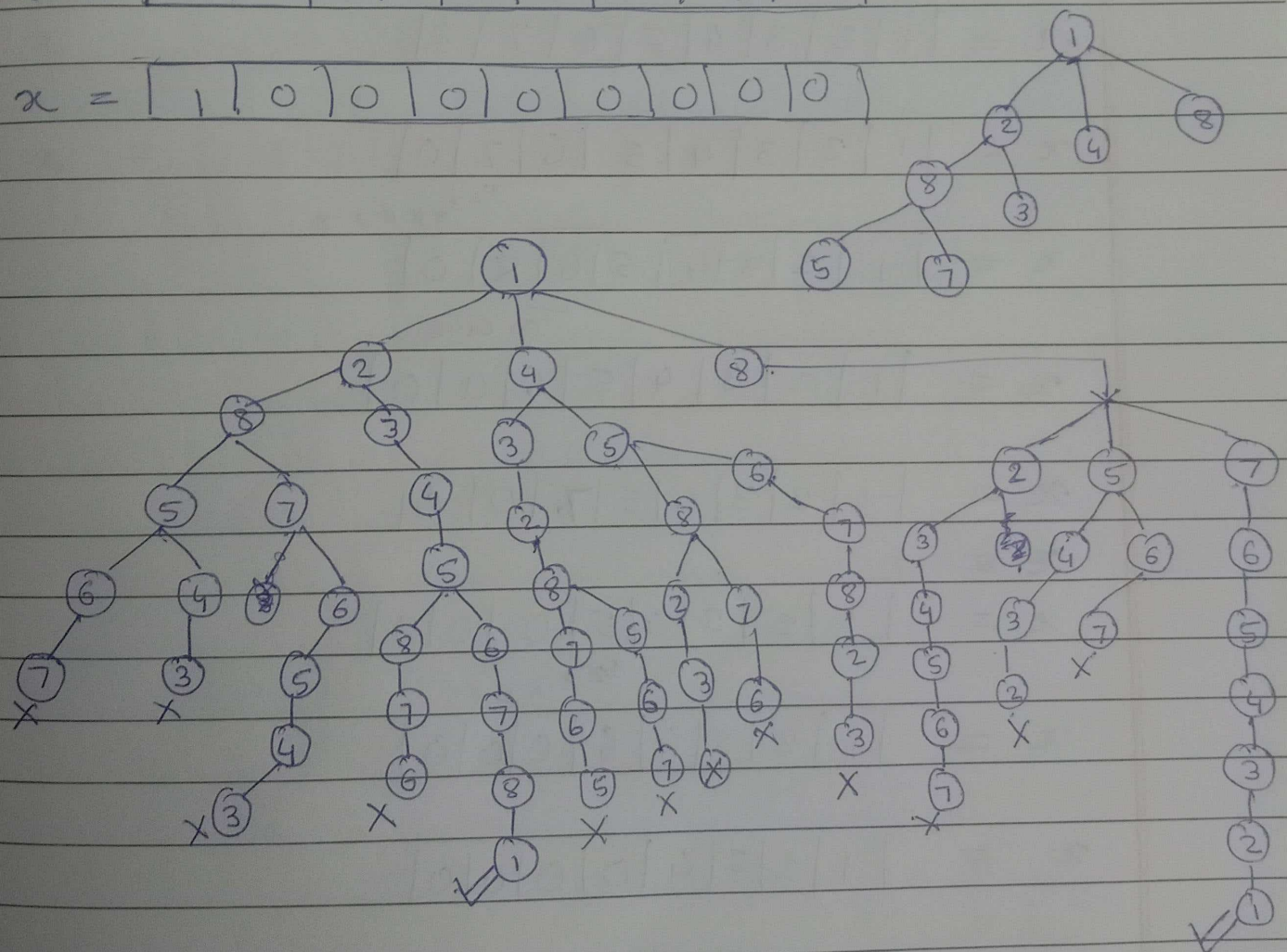
Let's take (1) as the starting node.

$G =$

	1	2	3	4	5	6	7	8
1	0	1	0	1	0	0	0	1
2	1	0	1	0	0	0	0	1
3	0	1	0	1	0	0	0	0
4	1	0	1	0	1	0	0	0
5	0	0	0	1	0	1	0	1
6	0	0	0	0	1	0	1	0
7	0	0	0	0	0	1	0	1
8	1	1	0	0	1	0	1	0

$x =$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

$x =$ | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |



∴ Cycles are, 1) 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 1

2) 1 - 8 - 7 - 6 - 5 - 4 - 3 - 2 - 1

x = | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |

x = | 1 | 2 | 3 | 0 | 0 | 0 | 0 | 0 |

x = | 1 | 2 | 3 | 4 | 5 | 0 | 0 | 0 | 0 |

x = | 1 | 2 | 3 | 4 | 5 | 6 | 0 | 0 | 0 |

x = | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 0 |

x = | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 1 |

Wow,

x = | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

x = | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 0 |

~~x 2 3 4 5 6 7~~ 8

x = | 1 | 2 | 3 | 4 | 5 | 6 | 8 | 0 |

no edge.

x = | 1 | 2 | 3 | 4 | 5 | 6 | 0 | 0 |

x = | 1 | 2 | 3 | 4 | 5 | ~~6~~ | 0 | 0 |

x = ~~t~~

x = | 1 | 2 | 3 | 4 | 5 | 0 | 0 | 0 |

~~1~~ 2 3 4 5 6

x = | 1 | 2 | 3 | 4 | 6 | 0 | 0 | 0 |

x = | 1 | 2 | 3 | 4 | 0 | 0 | 0 | 0 |

x = | 1 | 2 | 3 | 5 | 0 | 0 | 0 | 0 |

x = | 1 | 2 | 3 | 0 | 0 | 0 | 0 | 0 |

4

$x =$ | 1 | 2 | 4 | 0 | 5 | 0 | 0 | 0 |

x_3

$x =$ | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |

$x =$ | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

$x =$ | 1 | 8 | 0 | 0 | 0 | 0 | 0 | 0 |

$x =$ | 1 | 8 | 7 | 0 | 0 | 0 | 0 | 0 |

$x =$ | 1 | 8 | 7 | 6 | 0 | 0 | 0 | 0 |

$x =$ | 1 | 8 | 7 | 6 | 5 | 4 | 0 | 0 | 0 |

$x =$ | 1 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |