Depth First search

Algorithm Club

4.14.24

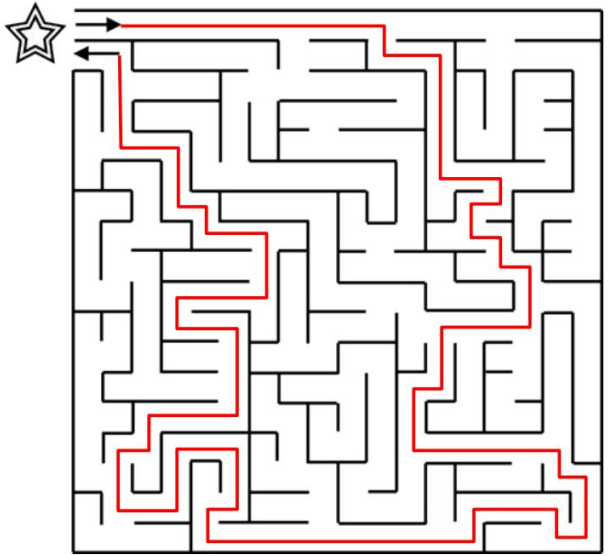
Terminology

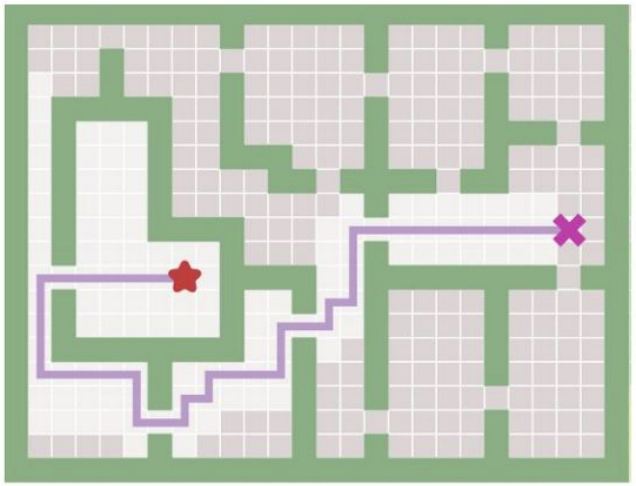
Graph Traversal / **Graph Search**: Visit each node/vertex in the graph. The order in which nodes are visited can be used to categorize the graph traversal.

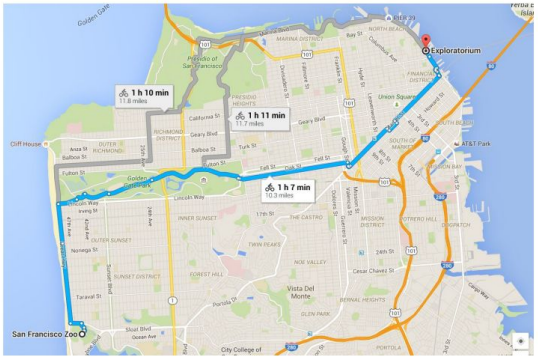
Spanning Tree: A subset of Graph G, such that all the vertices are connected using minimum number of possible number of edges. Hence, a spanning tree does not have cycles and a graph may have more than one spanning tree.

Graph Traversal Algorithm: These algorithms specify the order to search through nodes of a graph.
Ex: Depth first search (DFS), Breadth first search (DFS), A* search

Problem space :



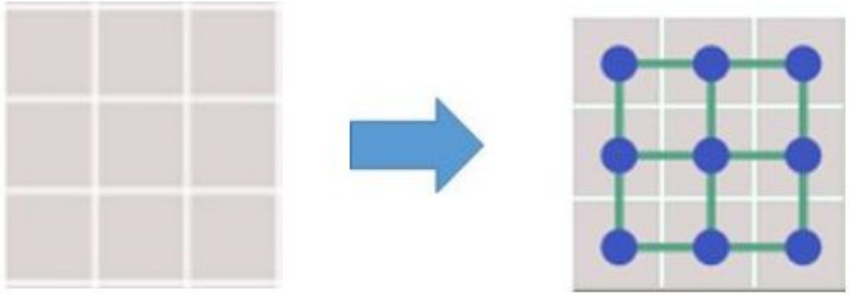




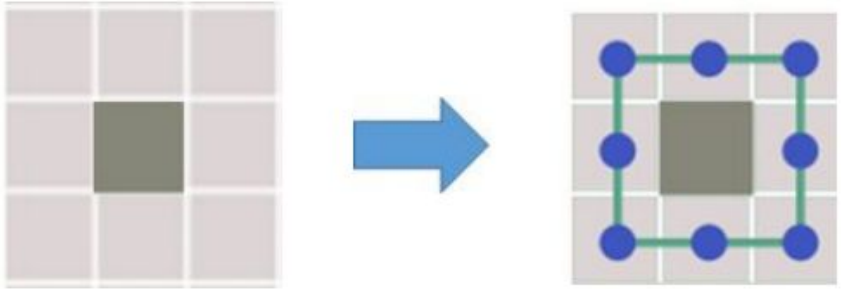
4	3	5	2	6	9	7	8	1
6	8	2	5	7	1	4	9	3
1	9	7	8	3	4	5	6	2
8	2	6	1	9	5	3	4	7
3	7	4	6	8	2	9	1	5
9	5	1	7	4	3	6	2	8
5	1	9	3	2	6	8	7	4
2	4	8	9	5	7	1	3	6
7	6	3	4	1	8	2	5	9

How to represent grids as graphs?

Each cell is a node. Edges connect adjacent cells.



Walls have no edges

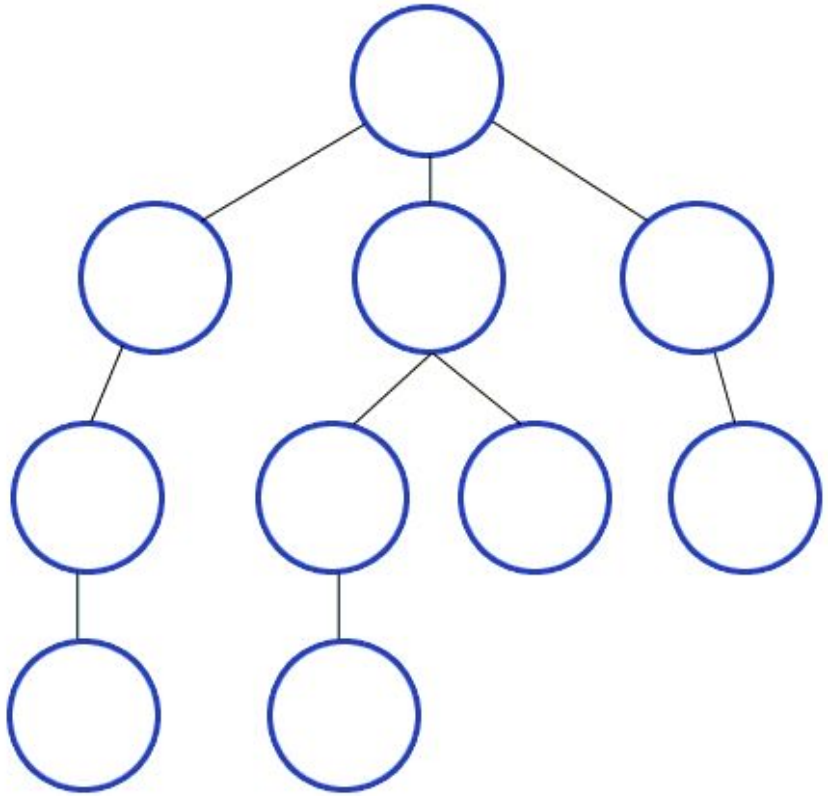


Depth first search: Algorithm for finding spanning trees

- Time complexity: O(V+E)
- Recursively explore graph, backtracking as necessary
- As the name suggests, a DFS plunges depth first into a graph without regard for which edge it takes next until it cannot got further at which point it backtracks and continues.

Pseudo-code

1. Choose Starting node and mark as visited
2. Add unvisited adjacent node to the stack
3. If all children visited, pop top element from the stack and set as current node
4. Repeat steps 2 & 3



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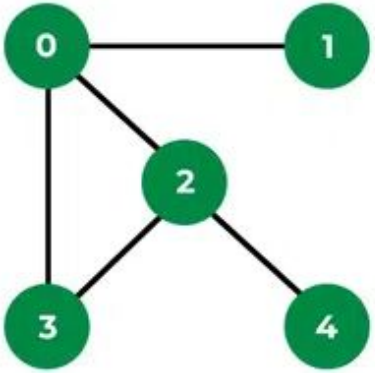

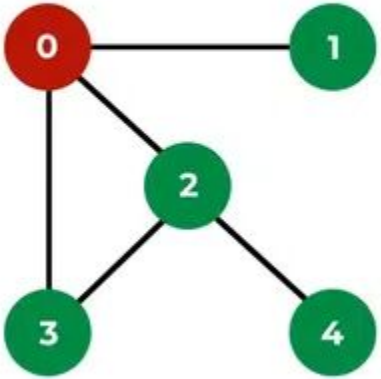

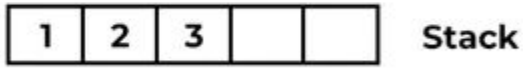

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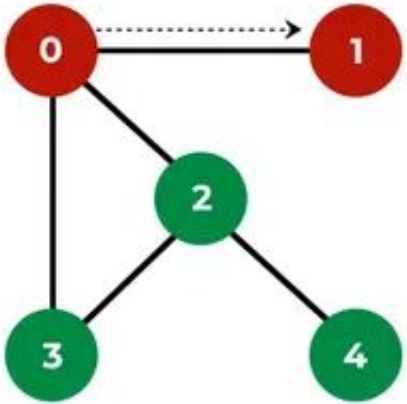

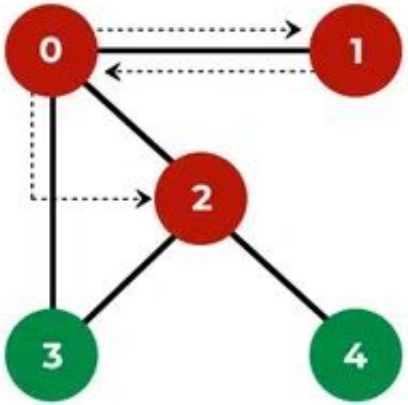

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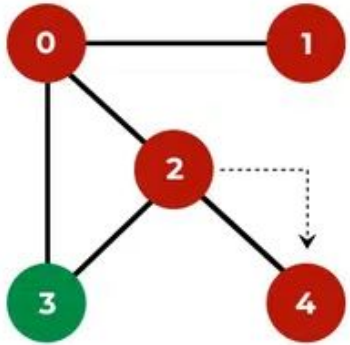

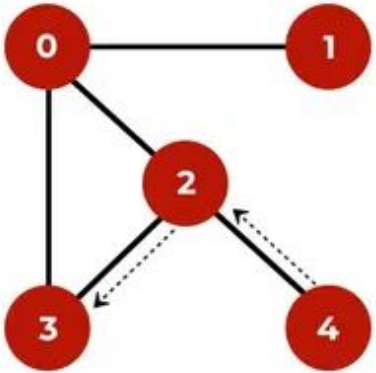

Applications in Bioinformatics

1. Evolutionary Relationships between Proteins or Genes

2. Traversing Biological Networks