Assignment-3 (Tutorial-5)

) What is difference between DFS and BFS. Please write the applications of both the algorithms.

BFS	DFS
① BFS stands for Breadth first search.	① DFS stands for depth first Search.
② BFS uses queue data structure for finding shortest path.	② DFS uses stack data structure.
③ BFS can be used to find single source shortest path in an ~~weigh~~ unweighted graph, because in BFS, we reach a vertex with minimum number of edges from a source vertex.	③ In DFS, we might traverse through more edges to reach a destination vertex from a source.
④ BFS considers all neighbors first and therefore not suitable for decision making trees used in games or puzzles.	④ DFS is more suitable for game or puzzle problems. We make a decision, then explore all paths through this decision. And if this decision leads to win situation, we stop.
⑤ Here, siblings are visited before the children.	⑤ Here, children are visited before the siblings.
⑥ Time Complexity = $O(V+E)$ (V: vertices, E: edges)	⑥ Time Complexity = $O(V+E)$

Applications of DFS are —

) If we Perform DFS on unweighted graph, then it will create minimum Spanning tree for all Pair shortest Path tree.

) we can detect cycles in a graph using DFS. If we get one back-edge during BFS, then there must be one cycle.

) Using DFS we can find Path b/w two given vertices u and v.

) we can Perform topological Sorting is used to Scheduling jobs ~~for~~ from given dependencies among jobs. Topological Sorting can be done using DFS algorithm.

Applications of BFS are —

① In Peer-to-Peer network like bit-torrent, BFS is used to find all neighbor nodes.

② Search egine crawlers are used BFS to build index. Starting from source Page, it finds all links in it to get new Pages.

③ Using GPS navigation system BFS is used to find neighboring Places.

④ Path finding algorithm is ~~used~~ based on BFS or DFS.

2) Which data structures are used to implement BFS and DFS and why?

Ans The data structure used in BFS is a queue and a graph. because this algorithm makes sure that every node is visited not more than once.

Stack is used in the standard implementation of depth first search. because we might traverse through more edges to reach a destination vertex from a source.

3) What do you mean by sparse and dense graphs? which representation of graph is better for sparse and dense graphs?

Ans) Sparse :- A graph in which the number of edges is much less than the possible number of edges.

dense graph :- A dense graph is a graph in which the number of edges is close to the maximal number of edges.

If the graph is sparse, we should store it as a list of edges. and if the graph is dense, we should store it as an adjacency matrix.

4) How can you detect a cycle in a graph using BFS and DFS?

Ans Steps involved in detecting cycle in a directed graph using BFS —

(1) Compute in degree for each of the vertex present in the graph and initialize the count of visited nodes as 0.

(2) Pick all the vertices with in degree as 0 and add them into a queue.

(3) Remove a vertex from the queue.

(4) Repeat step 3 until the queue is empty.

(5) If Count of visited nodes is not equal to the number of nodes in the graph, has cycle (4) ; otherwise not.

There is a cycle in a graph only if there is a back edge present in the graph. A back edge is an edge that is from a node to itself or one of its ancestors in the tree produced by DFS.

5) What do you mean by disjoint set data structure? Explain 3 operations along with examples, which can be performed on disjoint sets.

Ans Disjoint data structure is a data structure that stores a collection of disjoint sets. Equivalently, it stores a partition of a set into disjoint subsets.

The operations which can be performed on disjoint sets—

(1) ~~Intersection~~
Intersection :- Intersection of two sets. Since sets are disjoint, it's always empty unless these two sets coincide.

(2) Union :- Union of two sets - supported out of the box.

(3) get an element :- It is most likely the result of find.