

Tutorial 4

1. What are various methods to represent a graph in computer?
2. Do the BFS of the graph given in figure 1. Take the node 1 as your root node. Give the entries of queue in each step.
3. Enlist the properties of tree(cotree) found by BFS.
4. Find the shortest path from node 5 to 7 in figure 1. Use BFS search for this.
5. What is the running time of BFS algorithm, assume adjacency list representation of Graph.
6. A subset U of the vertex set of a graph G is called independent if for any u, v , in U , $\{u, v\}$ is not an edge in G . A graph is called bipartite if the vertex set can be partitioned into two parts such that each part is independent. (a) Argue that a graph is bipartite if and only if the graph does not have an odd cycle. (b) Given a graph as input give an algorithm to decide if you can partition the vertex set into two parts such that each part is independent. Hint: It can easily be done using BFS.
7. Do the DFS of the graph given in figure 1. Take the node 1 as your root node. At each point show data in your stack.
8. Enlist the properties of tree(cotree) found by DFS.
9. Find the path between nodes 5 and 7 in figure 1 using dfs. Hint: Form the tree with new node numbering done according to visiting order of dfs.
10. What is the running time of DFS algorithm, assume adjacency list representation of Graph.
11. Let $G = (V, E)$ be a connected, undirected graph. An articulation point of G is a vertex whose removal disconnects G . Give an algorithm to find all articulation points in a graph (This is done using DFS). What are the articulation points in the Graph.
12. For graph in figure 2 find the shortest path from node s to all other nodes using Dijkstra's algorithm.

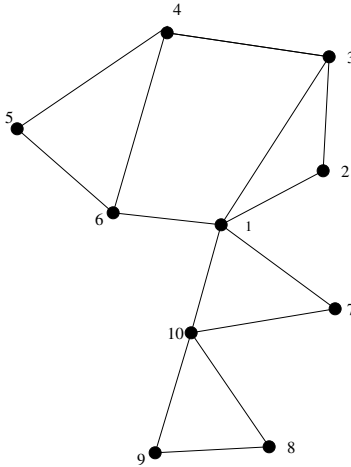


Figure 1: Graph for DFS and BFS searching.

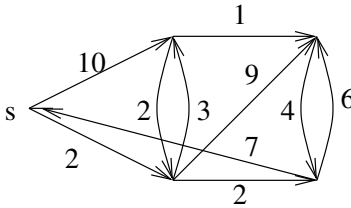


Figure 2: Graph for finding shortest paths.

13. Given the matrix chain $A_1_{(2 \times 5)} A_2_{(5 \times 3)} A_3_{(3 \times 6)} A_4_{(6 \times 10)} A_5_{(10 \times 2)} A_6_{(2 \times 6)} A_7_{(6 \times 2)}$. Paranthesize the product of matrices in a way that mimimizes the number of scalar multimplications. Follow your algorithm to find the paranthesis, show each step of your proceeding.
14. A maximum heap has all root nodes in a heap greater than or equal to its children. Construct a heap with elements 5,3,8,19,12,14,6,8. After heap is constructed do the following:(note that heap property should always be maintained.) (a)add elements 10,7 to the heap. (b)remove elements 19 and 12 from it. (c)get 3 elements which have maximum value from heap by successively deleting root.
15. Find the maximum matching of bipartite graph given in figure 3.Assume 1,2,3,4,5 nodes are in one partition and remaining in other partition. Use network flows to solve this. Find the minimum cover for the same graph.
16. Find the maximum flow of the graph of figure 4. Given in figure are capac-
ity values of edges. By manually finding minimum value of flow through

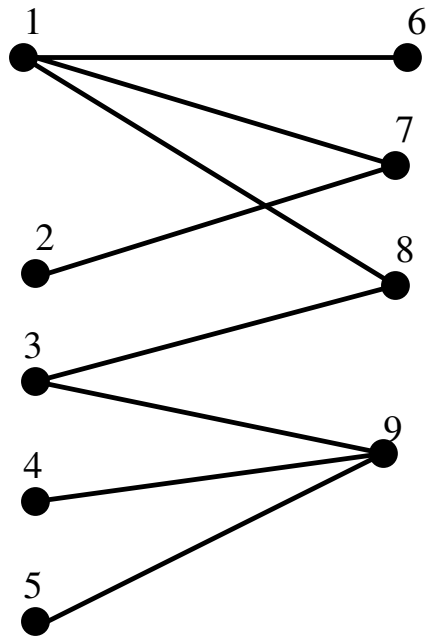


Figure 3: Graph for finding maximum matching.

all possible surfaces which include source, verify the maximum flow equals minimum flow value of all these surfaces.

17. Find the minimum spanning tree of graph given in figure 5. Use prims algorithm for this purpose.

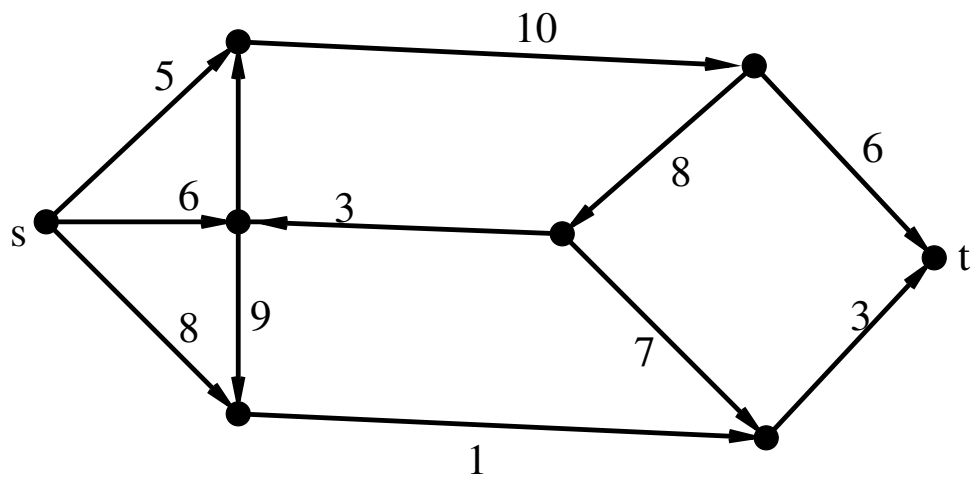


Figure 4: Maximum flow problem.

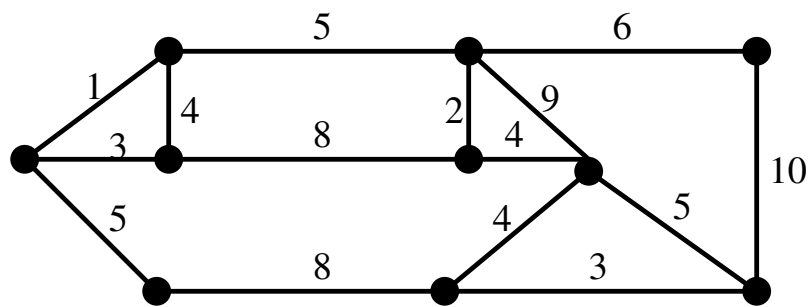


Figure 5: Graph for finding minimum spanning tree.