Page:
Date: / /

ASSIGNMENT 7

Aim: Represent any real world graph using adjacency list / adjacency matrix find minimum spanning tree using Kruskal's algorithm.

Objective: 1. Learn the concepts of graph as a data structure and their applications in everyday life.
2. Understand graph representation (adjacency matrix, adjacency list, adjacency multi list).

Theory:

Definition of graph: A graph is a triple $G = (V, E, \phi)$ where - V is a finite set, called vertices of G,
- E is a finite set, called the edges of G,
- ϕ is a function with domain E and codomain $P2(V)$

Loops: A loop is an edge that connects a vertex to itself.

Degrees of vertex: Let $G = (V, E, \phi)$ be a graph and $v \in V$ a vertex. Define the degree of v, $d(v)$ to be the number of $e \in E$ such that $v \in \phi(e)$ i.e. e is incident on v.

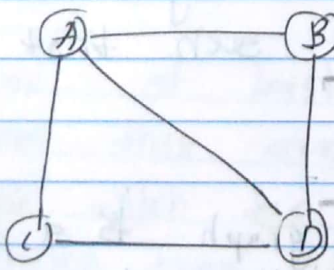
Directed graph: A directed graph is a triple $D = (V, E, \phi)$ where V and E are finite sets and ϕ is a function with domain E and codomain $V \times V$. We can call E the set of edges of the diagraph D and call V the set of vertices of D.

Page :
Date : / /

Path: let $G = (V, E, \phi)$ be a graph. let $e_1, e_2, \dots e_{n-1}$ be a sequence of elements of E (edges of G) for which there is a sequence of $a_1, a_2 \dots a_n$ of distinct elements of V such that $\phi(e_i) = \{a_i, a_{i+1}\}$ for $i = 1, 2, \dots n-1$. The sequence of edges $e_1, e_2, \dots e_{n-1}$ is called a path in G. The sequence of vertices $a_1, a_2, \dots a_n$ is called the vertex sequence of path.

Circuit and cycle: let $G = (V, E, \phi)$ be a graph and let $e_1 \dots e_n$ be a trail with vertex sequence $a_1 \dots a_n, a_1$. The subgraph G' of G induced by set of edges $\{e_1, \dots e_n\}$ is called a circuit of G. The length of circuit is n.

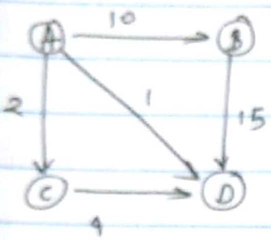
Adjacency matrix: Graph $G = (V, E)$ can be represented by adjacency matrices $G[v_1 \dots v_{|V|}, v_1 \dots v_{|V|}]$ where the rows and columns are indexed by the nodes, and the entries $G[v_i, v_j]$ represent the edges. In the case of unlabeled graphs, the entries are just boolean values.



	A	B	C	D
A	0	1	1	1
B	1	0	0	1
C	1	0	0	1
D	1	1	1	0

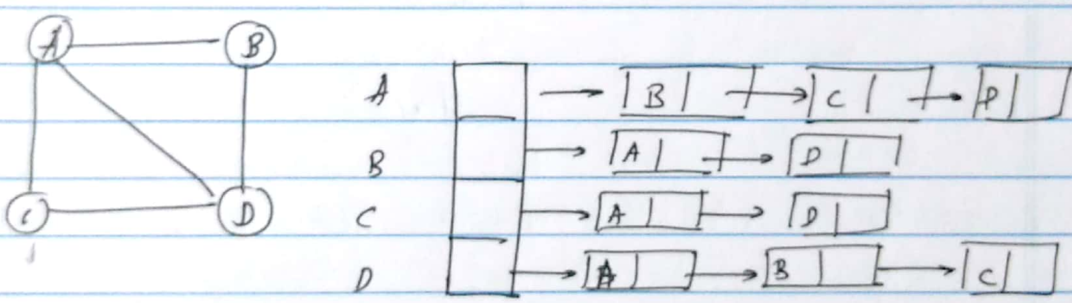
Page:
Date: / /

In case of labelled graphs, the labels themselves may be introduced into the entries



	A	B	C	D
A	∞	10	4	1
B	∞	∞	∞	15
C	∞	∞	∞	9
D	∞	∞	∞	∞

Adjacency List: A representation of the graph consisting of a list of nodes, with each node containing a list of its neighboring nodes.



Kruskal's algorithm:

1. Choose arc of least weight
2. Choose from those arcs remaining the arc of least weight which does not form a cycle with already chosen arcs.
3. Repeat step 2 until n-1 arcs have been chosen.

Page :
Date : / /

Conclusion: Minimum spanning tree using Kruskal's algorith of any real world graph was implemented successfully.