GLOBAL INSTITUTE OF TECHNOLOGY, JAIPUR

DEFENCE RESESARCH AND DEVELOPMENT ORGANIZATION (DRDO)

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WEB BASED SOFTWARE FOR COMPUTING SHORTEST PATH AND MINIMUM SPANNING TREE IN GRAPHS

DRDO: DEFENCE RESEARCH AND DEVELOPMENT ORGANIZATION

- The **Defence Research and Development Organisation** (**DRDO**) is an agency of the Government of India, charged with the military's research and development, headquartered in New Delhi, India.

- It is under the administrative control of the Ministry of Defence, Government of India.

- With a network of 52 laboratories, which are engaged in developing defence technologies covering various fields, like aeronautics, armaments, electronics, land combat engineering, life sciences, materials, missiles, and naval systems, DRDO is India's largest and most diverse research organisation. The organisation includes around 5,000 scientists belonging to the Defence Research & Development Service (DRDS) and about 25,000 other scientific, technical and supporting personnel.

GRAPH

- A Graph is a non-linear data structure consisting of nodes and edges. The nodes are sometimes also referred to as vertices and the edges are lines or arcs that connect any two nodes in the graph.
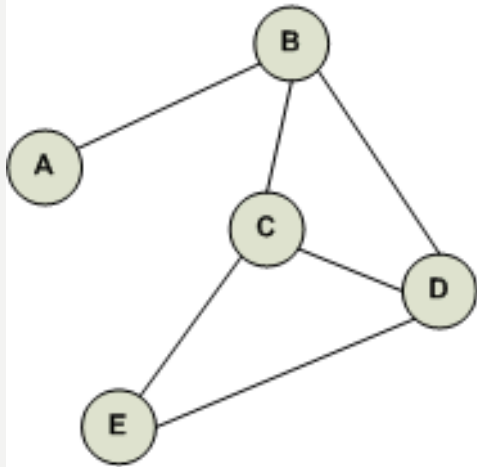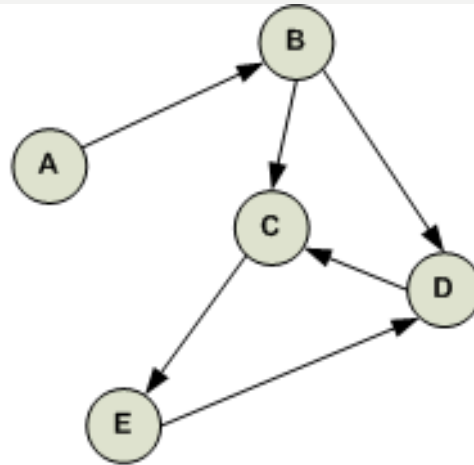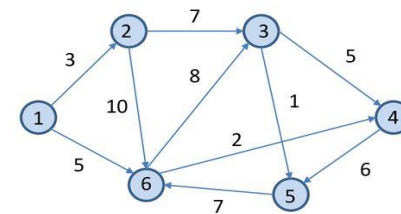

Fig 1. Undirected Graph

Fig 2. Directed Graph

Example Weighted Graph

TREES

- A tree data structure can be defined recursively as a collection of nodes (starting at a root node), where each node is a data structure consisting of a value, together with a list of references to nodes (the "children"), with the constraints that no reference is duplicated, and none points to the root .
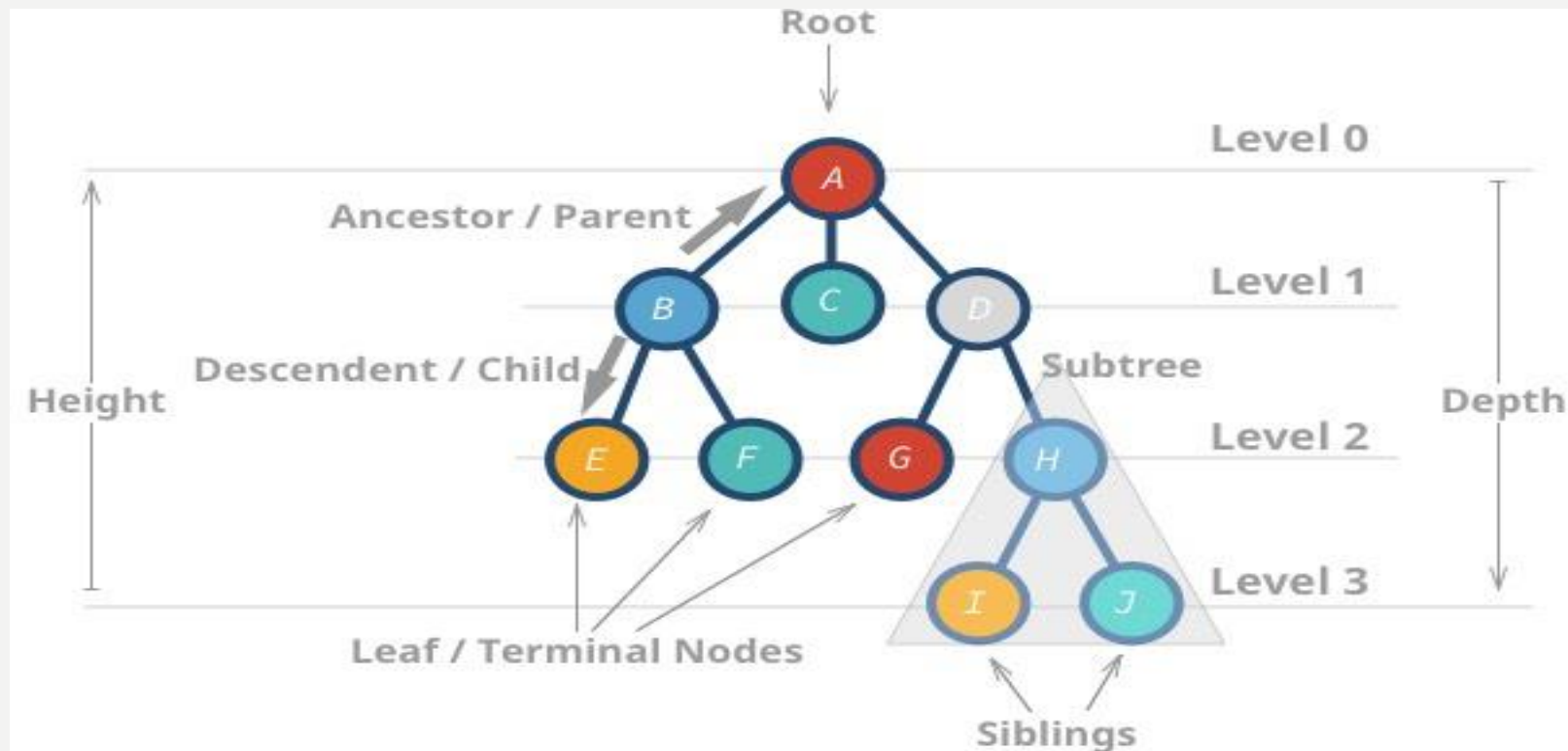
SHORTEST PATH ALGORITHMS

- In graph theory, the **shortest path problem** is the problem of finding a path between two vertices (or nodes) in a graph such that the sum of the weights of its constituent edges is minimized.

- It can be used for the problem of finding the shortest path between two intersections on a road map may be modelled as a special case of the shortest path problem in graphs, where the vertices correspond to intersections and the edges correspond to road segments, each weighted by the length of the segment.

- Here, we will see the following two algorithms:

    A) Dijkstra's algorithm

    B) Prim's algorithm

DIJKSTRA'S ALGORITHM

- Dijkstra's algorithm is also called single source shortest path algorithm. It is based on greedy technique. The algorithm maintains a list visited[ ] of vertices, whose shortest distance from the source is already known.

- If visited[1], equals 1, then the shortest distance of vertex i is already known. Initially, visited[i] is marked as 0, for source vertex.

- At each step, we mark visited[v] as 1. Vertex v is a vertex at shortest distance from the source vertex. At each step of the algorithm, shortest distance of each vertex is stored in an array distance[ ].

EXAMPLE
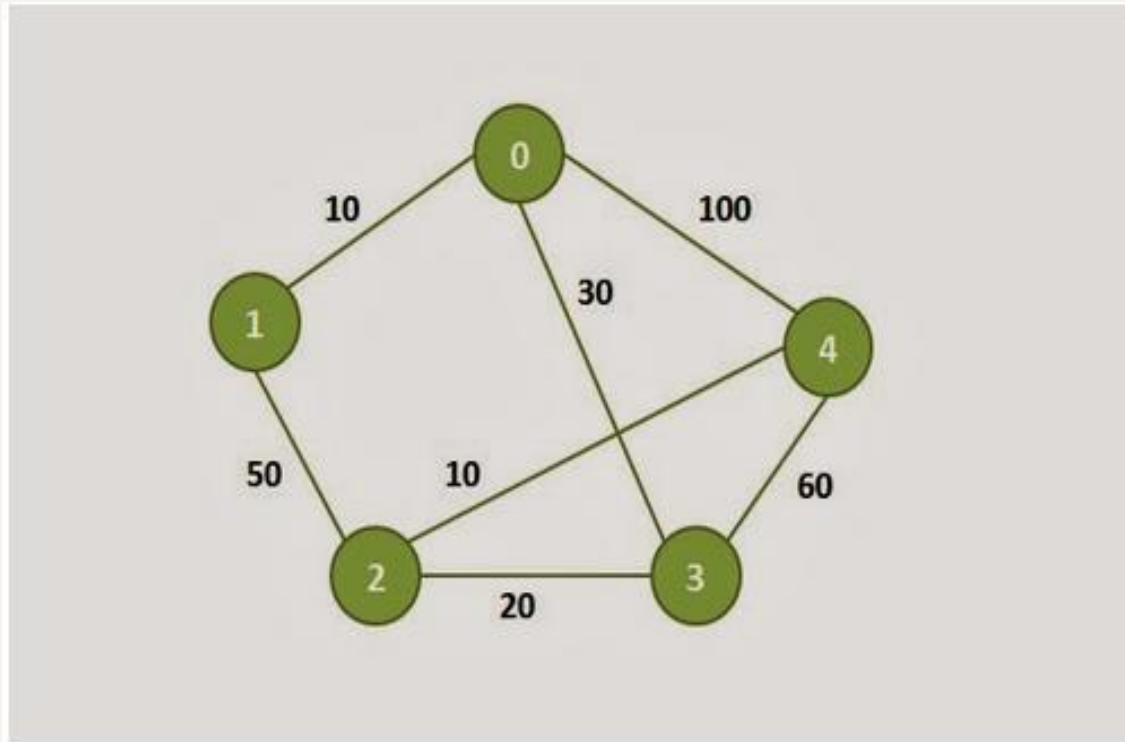
Enter the starting node:0

Distance of node1=10
Path=1<-0
Distance of node2=50
Path=2<-3<-0
Distance of node3=30
Path=3<-0
Distance of node4=60
Path=4<-2<-3<-0

Enter your choice(1-3):

PRIM'S ALGORITHM

- Prim's Algorithm is an approach to determine minimum cost spanning tree.

- In this case, we start with single edge of graph and we add edges to it and finally we get minimum cost tree. In this case, as well, we have (n-1) edges when number of nodes in graph are n. We again and again add edges to tree and tree is extended to create spanning tree, while in case of Kruskal's algorithm there may be more than one tree, which is finally connected through edge to create spanning tree.

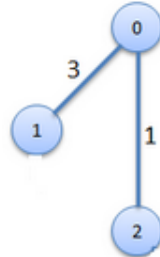# EXAMPLE
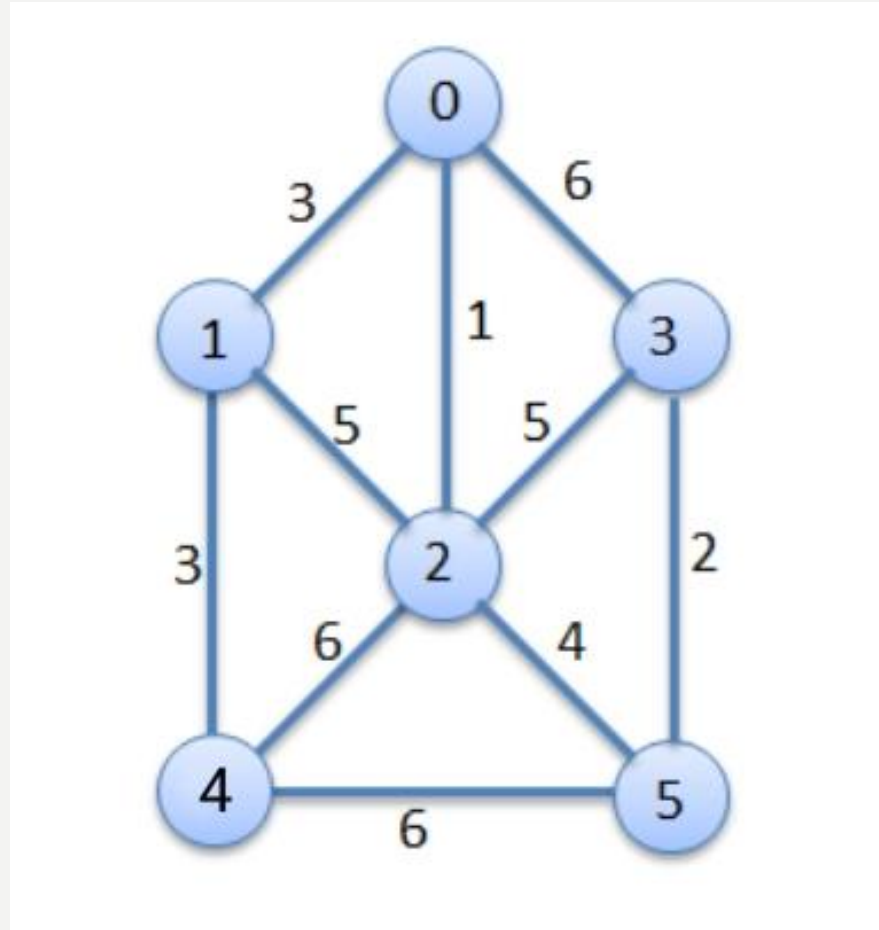
Procedure for finding Minimum Spanning Tree

Step1

No. of Nodes	0	1	2	3	4	5
Distance	0	3	**1**	6	∞	∞
Distance From		0	0	0		

Step2

No. of Nodes	0	1	2	3	4	5
Distance	0	**3**	0	5	6	4
Distance From		0		2	2	2

Step3

No. of Nodes	0	1	2	3	4	5
Distance	0	0	0	5	**3**	4
Distance From				2	1	2
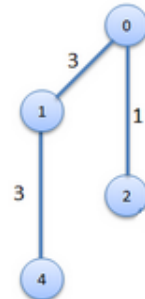
Step4

No. of Nodes	0	1	2	3	4	5
Distance	0	0	0	5	0	**4**
Distance From				2		2
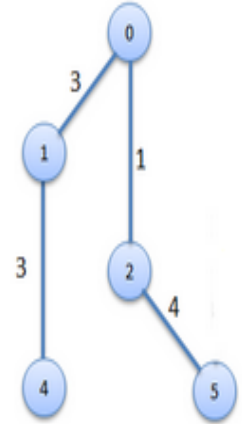
Step5

No. of Nodes	0	1	2	3	4	5
Distance	0	0	0	**3**	0	0
Distance From				2		2
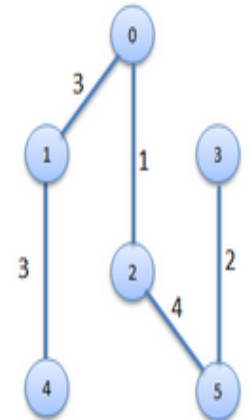
Minimum Cost = 1+2+3+3+4 = 13

OUTPUT SNIPPETS

Web Based Software for computing shortest path and minimum spanning tree in graphs

USERNAME

username

PASSWORD

password

SUBMIT

SIGN UP

NAME

enter your name

NEW EMAIL

enter your email

NEW PASSWORD

enter your password

Submit Query

ALGORITHMS

- PRIM'S ALGORITHM
- DIJKSTRA'S ALGORITHM

PRIM'S ALGORITHM

DIJKSTRA's ALGORITHM

PROGRAM FOR COMPUTING SHORTEST PATH AND MINIMUM SPANNING TREE IN A GRAPH

```
1.Dijkstra algorithm for computing shortest path in a graph
2.Prim's algorithm for minimum spanning tree of a graph
3.Exit

Enter your choice(1-3):
```

```
Enter your choice(1-3):1


Enter no. of vertices:5

Enter the adjacency matrix:
0
10
0
30
100
10
0
50
0
0
0
50
0
20
10
30
0
20
```

```
20
10
30
0
20
0
60
100
0
10
60
0


Enter the starting node:0

Distance of node1=10
Path=1<-0
Distance of node2=50
Path=2<-3<-0
Distance of node3=30
Path=3<-0
Distance of node4=60
Path=4<-2<-3<-0

Enter your choice(1-3):
```

```
Enter your choice(1-3):2

Enter the number of nodes:6

Enter the adjacency matrix:
0
3
1
6
0
0
3
0
5
0
3
0
1
5
0
5
6
4
6
0
5
```

```
0
0
2
0
3
6
0
0
6
0
0
4
2
6
0


 Edge 1:(1 3) cost:1
 Edge 2:(1 2) cost:3
 Edge 3:(2 5) cost:3
 Edge 4:(3 6) cost:4
 Edge 5:(6 4) cost:2
 Minimun cost=13

Enter your choice(1-3):_
```

DESERT ENVIRONMENTAL SCIENCE AND TECHNOLOGY(DEST)

- DEST Division is engaged in the R&D in the fields of water, soil & heat to enhance the efficiency of the troops operating under harsh conditions of Desert. Basic as well as applied research is being pursued leading to development of technologies and products for water, heat and terrain management for military applications.
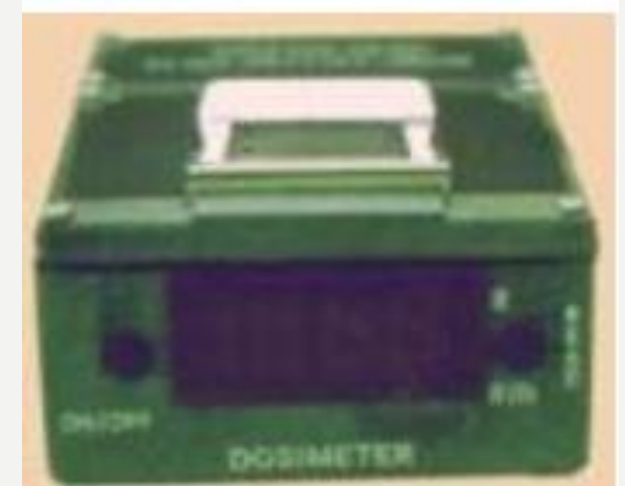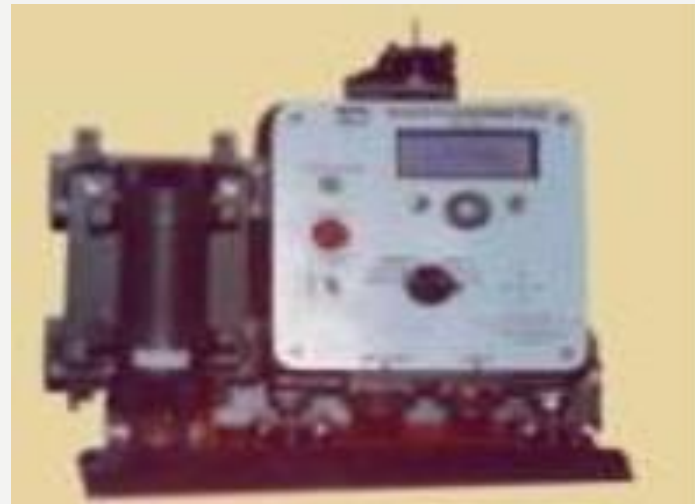
THANK YOU!

PRODUCTS AND TECHNOLOGIES

Radiation Monitoring Equipments :

- Gamma Flash Sensor, Roentgen meter, PDRM, PDM, RADMAC, RPL Dosimeter and Reader, Integrated Field Shelter etc for monitoring radiation dose rate and total dose in radiation environment.

- **<u>Radiation Surveillance Systems :</u>**

- NBC Recce Vehicle, Mobile Reconnaissance Laboratory, Mobile Nuclear Field Laboratory for surveillance of radiation levels over a large contaminated area.