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Title :- Representing Flight paths Between cities as a Graph.

problem statement:- There are flight paths between cities If there is a flight between city A and city B then there is an edge between the cities The cost of the edge can be the time that flight take to reach city B from A, or the amount of fuel used for the journey Represent this as a graph The node can be represented by airport name or name of the city, use adjancency list representation of the graph or use adjancency matrix representation of the graph, check whether the graph is connected or not Justify the storage represented of the graph. Check whether the graph is connected or not Justify the storage representation used

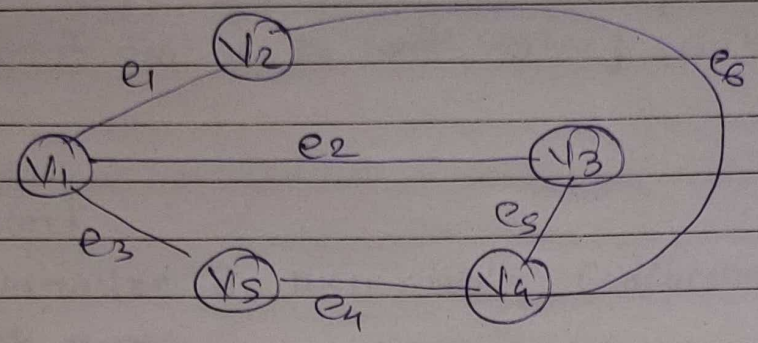
Objectives :- To use Graph data structur constisting of nodes. They flights paths between cities

Theory :- Graphs are the most general data structures They are also commonly used data structure

Graph :- A non-linear data structure constisting of nodes and links between the nodes An undirected graph is a set of links between the nodes Each node is known as vertex Each link is known as edge and each edge connects two vertices The order of the two connected vertices is important

- An undirected graph is finite set of vertices together with a finite set of edges Both sets might be empty which is called the empty graph.

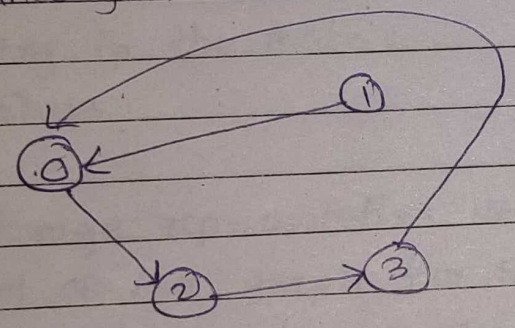
Example:



Graph implementation :- different kinds of graphs requires different kinds of implementation, but the fundamental concept of all graph implementation are similar

Representation of graph

1) Adjancency matrix



	0	1	2	3
0	1	0	1	0
1	1	0	0	0
2	0	0	0	1
3	1	0	1	0

Adjancency matrix

- An adjacency matrix is a square grid of the true / false or 0 / 1 values that represent the edges of a graph
- If the graph contains n vertices, then the grid contains n rows and n columns
- for two vertex numbers i and j the component at row (i) and column (j) is true if there is an edge from vertex i to vertex j otherwise the component is false.
- The adjacency matrix for an undirected graph is always symmetric

- Adjacency matrix is also used to represent weighted graphs. if adj [i][j] = w, then used to represent weighted graphs if adj i to ~~with~~ vertex j with weight w,

Algorithm:

1. Start
2. Initialize an n×n matrix (adjacency matrix) filled with zeros
3. for each edge (i, j) in the list of edges set adjacency matrix [i][j] to 1 to represent the presence of the edge from vertex i to vertex j
4. for each flight path, add an empty to the matrix for each city involved in the flight.
5. If the cost of the edge is the distance between two cities, store the distance in the corresponding entry in the matrix
6. Stop.

- The storage representation used depends on the size and sparsity of the graph for small and dense graphs an adjacency matrix representation may be more efficient in terms of space and time complexity.
- The time complexity for both representations is O(edges vertices)
- The space complexity for the adjacency list and matrix representation is ~~O(E+V)~~ and $O(V^2)$ respectively
- Therefore the adjacency list representation is more memory efficient for sparse graphs.

Conclusion :- The Graph data structure for representing flights path Between cities is more efficient using representation as adjacency matrix for small size of the graph.