	<b>UNIVERSIDAD EAFIT</b> <b>ESCUELA DE INGENIERÍA</b> <b>DEPARTAMENTO DE INFORMÁTICA Y SISTEMAS</b>	Código: ST245
		Estructura de Datos 1

## Laboratory Nro. 5: Graphs

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### 3) Mock project support questions

- a) The problem in general was done in two ways:  
Implementation of a digit using adjacency matrices and with Array list:  
With the use of matrices, we have a value; which in this case would be the "price" if they have a zero, then they are not connected. There are several methods: Create the matrix, show the price of the trip, add new destination and show the events of a certain text in the matrix. For the Array list, a Linked list with array is implemented, making use of the pairs in order to connect the origin and destination in the array.
- b) For the numeral 1.3 about the representation the map of the city of the media is much better using the adjacency lists, since in the search of the relations between the city in the relationship in time it is much smaller than the matrices of the adjacency, will also occupy less space in the memory of the computer, making good use of memory. In addition, it allows us to easily find all the links that are directly connected to a particular city, being the case of a node that has several arcs.
- c) The advantage of the implementation of an adjacency list is that it allows a graph to be represented compactly. The adjacency list allows you to easily find the links that are directly connected to a particular vertex. In the adjacency list, less memory is consumed, because if an adjacent vertex is added, the only thing added is a node, whereas the matrix of Adjacency must create a new  $n \times n$  matrix. The adjacency list is usually added at the beginning, so it is disordered and accessing an adjacent vertex would be in order  $(n)$  in the worst case, whereas in the adjacency matrix it is of order  $(1)$ .
- d) Considering that the priority of the routing table is to find the shortest distance to go from one point to another, it would be better to use adjacency lists since it allows you to easily find the vertices that are connected.
- e) The complexity of this exercise is:  $O(n^2)$

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- f) In this exercise, we use adjacency matrix, for that we have to roam for each column an row, for that, n means the size of the graph.

2.

**4) evaluation test**

	0	1	2	3	4	5	6	7
0				1	1			
1	1		1			1		
2		1			1		1	
3								1
4			1					
5								
6			1					
7								

0 → [3,4]  
1 → [0,2,5]  
2 → [1,4,6]  
3 → [7]  
4 → [2]  
5 → []  
6 → [2]  
7 → []

3.  $O(n)$

**5) recommended reading**

**Graphs**

Graphs are data structures rather like trees, a graph is conformed by nodes and edges; for example: nodes in a graph represent cities, while edges represent airline flight routes between the cities.

Two methods are commonly used for graphs are: *The adjacency matrix* and *the adjacency list*. An adjacency matrix is a two-dimensional array in which the elements indicate whether an edge is represent between two vertices, if a graph has N vertices, the adjacency matrix is an NxN array. The list adjacency list refers to a linked list; each individual list shows what vertices a given vertex is adjacent to.

For represent a graph in a program is necessary to implement: *vertices*, (in a very abstract graph program you could simply number the vertices 0 to N-1 (where N is the number of vertices), and *edges* (Each vertex may be connected to an arbitrary number of other vertices). In general exists two principal kinds of graphs: Directed graphs: however, graphs are often used to model situations in which you can go in only one direction along an edge; from A to B but not from B to A, as on a one-way street, and weighted graphs: in some graphs, edges are given a weight, a number that can represent the physical distance between two vertices, or the time it takes to get from one vertex.

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Image took from:  
<https://naukas.com/2012/05/23/por-que-solo-cuatro-colores/>

## Graphs

Graphs are data structures rather like trees

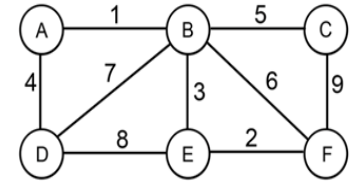
Is conformed by:

### Vertices

In a very abstract graph program you could simply number the vertices 0 to N-1 (where N is the number of vertices).

### Edges

Each vertex may be connected to an arbitrary number of other vertices.



Circles: Vertices  
Lines: Edges

### Characteristics of Graphs:

#### Directed graphs

However, graphs are often used to model situations in which you can go in only one direction along an edge; from A to B but not from B to A, as on a one-way street.

#### Weighted graphs

In some graphs, edges are given a weight, a number that can represent the physical distance between two vertices, or the time it takes to get from one vertex.

#### Adjacency

Two vertices are said to be adjacent to one another if they are connected by a single edge.

#### Paths

A path is a sequence of edges.

#### Cycles and trees

One kind of graph the topological-sort algorithm cannot handle is a graph with cycles. A graph with no cycles is called a tree.

#### Connected graphs

A graph is said to be connected if there is at least one path from every vertex to every other vertex. A non-connected graph consists of several connected components.

Image took from:  
<https://commons.wikimedia.org/wiki/File:Boruvka-example2.gif>