ADJACENCY MATRIX AND LIST

Section Overview

- Learn how to represent graphs
  - Adjacency Matrix
  - Adjacency List
- Implementation in next lecture

Adjacency Matrix

- One of the easiest ways to implement a graph is to use a two-dimensional matrix.
- In this matrix implementation, each of the rows and columns represent a vertex in the graph.
- The value that is stored in the cell at the intersection of row **v** and column **w** indicates if there is an edge from vertex **v** to vertex **w**.
- When two vertices are connected by an edge, we say that they are **adjacent**.

Adjacency Matrix

	V0	V1	V2	V3	V4	V5
V0		5				2
V1			4			
V2				9		
V3					7	3
V4	1					
V5			1		8	

Adjacency Matrix

- The advantage of the adjacency matrix is that it is simple, and for small graphs it is easy to see which nodes are connected to other nodes.
- However, notice that most of the cells in the matrix are empty.
- Because most of the cells are empty we say that this matrix is “sparse.”
- A matrix is not a very efficient way to store sparse data.

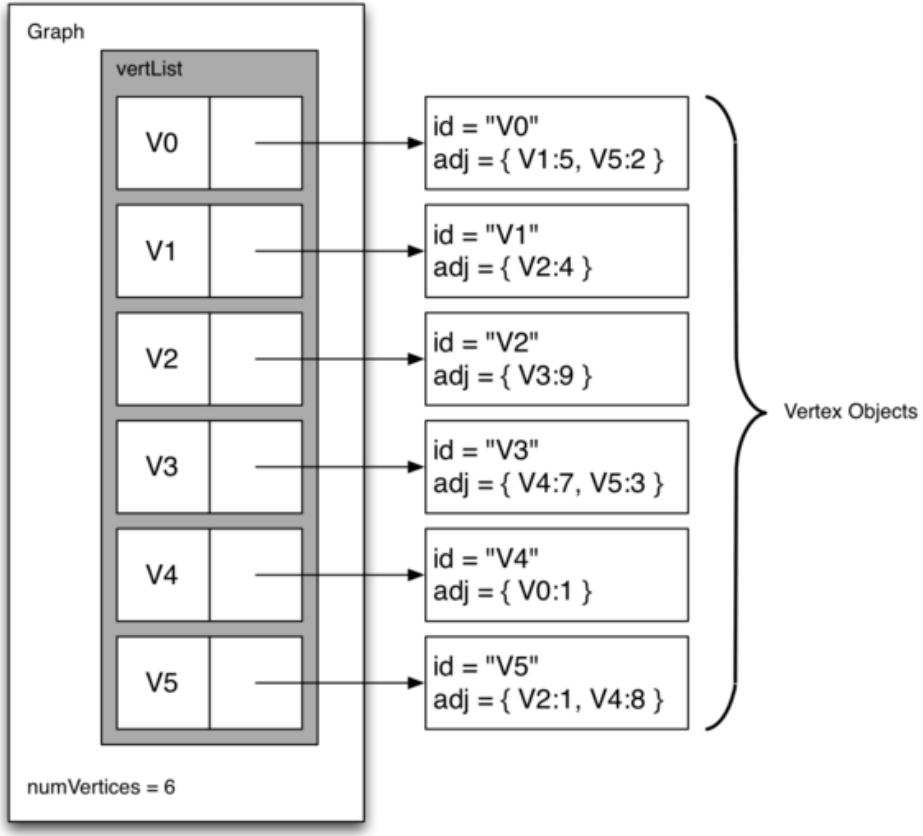
Adjacency Matrix

- The adjacency matrix is a good implementation for a graph when the number of edges is large.
- Since there is one row and one column for every vertex in the graph, the number of edges required to fill the matrix is $|V|^2$.
- A matrix is full when every vertex is connected to every other vertex.

Adjacency List

- A more space-efficient way to implement a sparsely connected graph is to use an adjacency list.
- In an adjacency list implementation we keep a master list of all the vertices in the Graph object and then each vertex object in the graph maintains a list of the other vertices that it is connected to.
- In our implementation of the Vertex class we will use a dictionary rather than a list where the dictionary keys are the vertices, and the values are the weights.

Adjacency List



Adjacency List

- The advantage of the adjacency list implementation is that it allows us to compactly represent a sparse graph.
- The adjacency list also allows us to easily find all the links that are directly connected to a particular vertex.

Adjacency List

- Coming up ... Implementation of an Adjacency List