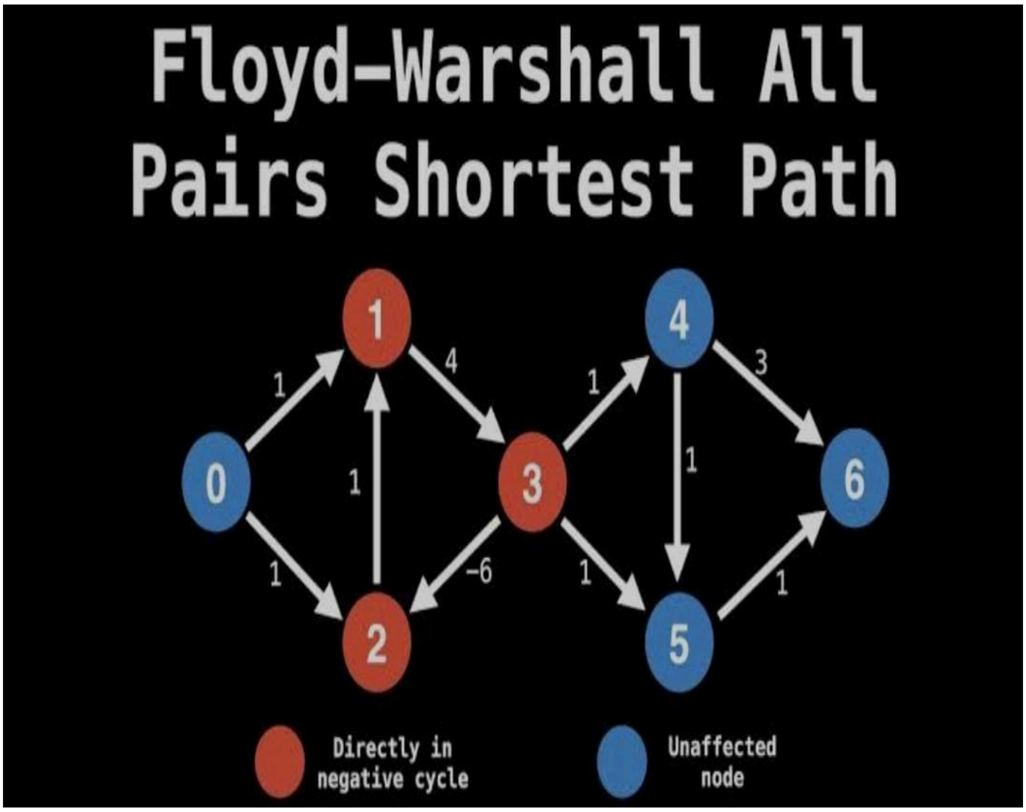
Concept : Shortest- path warshall's algorithm



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Executive Summary

The Floyd- Warshall algorithm is a popular algorithm for finding the shortest path for each vertex pair in a weighted directed graph.

In all pairs shortest path problems, we need to find out all the shortest paths from each vertex to all other vertices in the graph.

It is said to be very versatile, simple and efficient. This is relatively easy to understand and grasp.

This makes it an ideal choice for students and professionals who are just starting out with graph algorithms. It has a time complexity of $O(n^3)$.

Introduction

Let G be a directed graph with n nodes, v1,v2,__vn. Suppose G is weighted , that is, suppose each edge e in G is assigned a non negative number w(e) called the weight or the length of the edge e.

Then G may be maintained in memory by its weight matrix W= (wij), defined as follows:

Wij = { w(e) if there is an edge e from vi to vj
0 if there is no edge e from vi to vj

Shortest path from vi to vj is a path for which the sum of the weights of the edges on the path is minimum.

The path matrix P tells us whether or not there are paths between the nodes .
Now , we want to find a matrix Q which will tell us the lengths of the shortest paths between the nodes ,or, more exactly, a matrix Q= (qij) where

qij= length of a shortest path from vi to vj

Warshall algorithm can be modified further to obtain a matrix which gives the lengths of shortest paths between the nodes. For this purpose, let A be the adjacency matrix of the graph. Replace all those elements of A which are 0 by infinity, which shows that there is no edge between the nodes.

<u>Applicatios of warshall algorithm:</u>

Some of the most popular applications are finding the shortest path between two vertices in a graph, detecting negative cycles in a graph, and computing the transitive closure of a graph.

This can also be used for other purposes such as solving the all - pairs shortest path problem in weighted graphs , finding the closest pair of vertices in a graph, and computing the diameter of a graph.

Reflection

As a team , our goal is to make people aware about shortest path warshall algorithms, its usage, advantages, scope, areas of application and limitations.

Every member of our team made a contribution to achieve this goal.

Group Member: Jivesh

[Introduced the topic and explained about shortest - path warshall algorithm concept, its definition and all the types **]**

Group Member: Janvee

[Explained about shortest path's formula and proved it by taking an appropriate example and prepared the report **]**

Group Member: **Karmjeet**

[Explained about shortest path warshall algorithm procedure and concluded the topic **]**

Key findings

Algorithm: MINIMAL (W,N,Q)

Given a weighted graph G with N nodes . Given W is the weighted matrix of size N×N , in which the 0 elements are replaced by infinity the matrix Q produced by this algorithm shows the minimum length of paths between the nodes .

Step 1 : [Initialize]
Q:=W
Step 2 : [Perform a pass]
Repeat steps 3 and 4 for k =1 to N.
Step 3 : [Process rows]
Repeat steps 4 for i= 1 to N
Step 4 : [Process columns]
Repeat for j= 1 to N.
set Q[i,j] := MIN(Q[i,j],Q[i,k]+Q[k,j])
[end of for loop]
[end of step 3 for loop]
[end of step 2 for loop]
Step 5 : Exit

Limitations

There are several drawbacks of this algorithm along with its advantages .

- This algorithm is quite complex and difficult to understand.
- This algorithm can be slow when used on large graphs.
- This algorithm doesn't always find the shortest path between two vertices; it can sometimes find a path that is longer than the shortest path.
- It does a blind search there by consuming a lot of time and wasting necessary resources.
- It can't handle negative edges. This leads to an acyclic graph and most often cannot obtain the right shortest path.

References

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