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COMPARATIVE STUDY OF MINIMAL SPANNING TREE ALGORITHM AND FLOYDS ALGORITHM USED IN SHORTEST PATH PROBLEM.

Mathematics

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ABSTRACT

The report is concerned with shortest path problem. It concentrates on two shortest path algorithms. That are Floyd's algorithm and minimal spanning tree algorithm. The first algorithm finds the shortest path by using weights. The travelling salesman problem arises in many different contexts. In this paper we report on typical applications in Telecommunications, Crew scheduling problem, Drilling of printed circuit boards, X-ray crystallography, and Vehicle routing. Most applications originated from real world problems and thus seem to be of particular interest.

KEYWORDS

INTRODUCTION

Shortest path problem

There are two types of shortest path problem.

1) To find the shortest path from a vertex to all other vertices.

Dijkstras algorithm is used to find such a shortest path.

2) To find shortest path between every pair of vertices in the graph.

Floyds algorithm and Warshalls algorithm are used to find such shortest paths.

Dijkstras algorithm. Here we consider the labelled graph, if we want to find shortest path from P to Q,and the algorithm finds shortest path from a vertex to all other vertices. The strategy is to start at the initial vertex P and systematically build up a list of shortest paths to all vertices which lie between P and Q, in order of increasing distance from P until Q is reached.

Floyds algorithm

Suppose that the given directed graph has n vertices numbered 1, 2…n .Floyds algorithm updates the matrix n times and then stops. Each updating of the matrix is called an iteration of the algorithm. After i^{th} iteration, we get a matrix Ai and Ai shows, the length of shortest i path between every pair of vertices. An i path means the path that passes only through first i vertices. The iteration rule for Floyds algorithm is, their exist a shortest I path.

1) If there exist a shortest i-1.
2) If there exist shortest i-1 paths from x to i and i to y.

The iteration rule is that
Ai (x, y)= Mini(Ai-1(x, y), Ai-1(x, i)+Ai-1(i, y))

When the algorithm stops, we get a final matrix A_n, which shows shortest distances between every pair of vertices.

comparative study of Floyd's algorithm and minimal spanning tree algorithm

minimal spanning tree algorithm

$$\text{Matrix } A_{0=} \begin{matrix} 0 & 4 & 7 & 3 & 4 \\ 4 & 0 & 6 & 3 & 4 \\ 7 & 6 & 0 & 7 & 5 \\ 3 & 3 & 7 & 0 & 7 \\ 4 & 4 & 5 & 7 & 0 \end{matrix}$$

We start with vertex A after initialization steps, we have
Vertex(v): A B C D E
Status(v): ! ? ? ? ?
Cost(v): 0 4 7 3 4
Next(v): * AAAA
Cost of? vertex can be updated by, if cost(v)>l(v*, v)then,
Cost(v) becomes l(v*, v)

Here D is the? vertex with smallest cost, therefore status(D) becomes!

?vertex	Cost(v)	l(D,V)	change
B	4	3	Yes
C	7	7	No
E	4	7	no

So next table is
Vertex(v): A B C D E
Status(v): ! ? ? !?
Cost(v): 0 3 7 3 4
Next(v): * D DA D

Now B is the? vertex with smallest cost,so status(B) becomes!

?vertex	Cost(v)	l(D,V)	change
C	7	6	yes
E	4	4	no

So next table is
Vertex(v): A B C D E
Status(v): ! ! ? ! ?
Cost(v): 0 3 6 3 4
Next(v): * D B A B

now E is the? vertex with minimum cost, so status€ becomes!

?vertex	Cost(v)	l(D,V)	change
C	7	6	yes

So the next table is

Vertex(v): A B C D E
Status(v): ! ! ? !!
Cost(v): 0 3 5 3 4
Next(v): * D E A B

Now the only vertex with? is C, therefore status© becomes!
Final table is
Vertex(v): A B C D E
Status(v): ! ! !! !
Cost(v): 0 3 5 3 4
Next (v): * D E A B
Shortest path from A to E is 4.

Floyd's Algorithm

Floyd's algorithm is used to find shortest path in a weighted graph. It is an example of dynamic programming. It is extremely useful in networking. The general equation is used to find the shortest path is given below.
$A_i(x,y)= \min (A_{i-1}(x,y), A_{i-1}(x,i) + A_{i-1}(i,y))$

Ao=

∞	4	7	3	4
4	∞	6	3	4
7	6	∞	7	5
3	3	7	∞	7
4	4	5	7	∞

A1=

∞	4	7	3	4
4	8	6	3	4
7	6	14	7	5
3	3	7	6	7
4	4	5	7	8

A2=

8	4	7	3	4
4	8	6	3	4
7	6	12	7	5
3	3	7	6	7
4	4	5	7	8

A3=

8	4	7	3	4
4	8	6	3	4
7	6	12	7	5
3	3	7	6	7
4	4	5	7	8

A4=

6	4	7	3	4
4	6	6	3	4
7	6	12	7	5
3	3	7	6	7
4	4	5	7	8

A5=

6	4	7	3	4
4	6	6	3	4
7	6	10	7	5
3	3	7	6	7
4	4	5	7	8

Applications

Shortest path algorithms are used to find direction between locations, such as Google Maps or MapQuest. Here it represents as a graph where vertices are represented by states and edges represents possible transitions, shortest path algorithm can be used to find an optimal choice to reach a certain state. It is also used for puzzle like a Rubik's Cube, if vertices represent the states of the puzzle and each edge corresponds to a single move or turn, shortest path algorithm can be used to find an optimal solution with minimum number of moves.

1) Telecommunications

In telecommunications, the shortest path problem is called the min-delay path problem. In this algorithm, we find the shortest (min-delay) widest path or widest shortest (min-delay) path.

2) Crew scheduling problem

In thisdeposits need to be picked up at branch banks and returned to the central office by a crew of messengers. The problem is to find the routes having a total minimum cost.

3) Drilling of printed circuit boards

It is used to position the pins of integrated circuits and drill the holes of the board, here we have to drill some holes with some diameter and another with next diameter where the holes are the initial positions and the holes that can be drilled with one and the same drill. The distance between two cities is given by the time it takes to move the drilling board from one position to the other. The objective is to minimize the travel time for the machine head.

4) X-ray crystallography

We have to analyse the intensity of X –ray reflections of the crystal from various positions. The problem consists of finding the sequence that minimizes the total positioning time, which leads to shortest path problem.

5) Vehicle routing

Suppose that in a town, certain school students have to be picked every day within a particular period of time. The problem is to find the minimum number of school buses to do this and the shortest time to pick students from different areas.

CONCLUSION

The conclusion that is derived from this paper is that, by using minimal spanning tree algorithm and floyds algorithm, we get, minimum distance from a vertex to any other vertices. We have seen two methods for computing the the shortest path. Both are applicable to find the same.

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