Intellectual logistic system for passenger railway transportations in town

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ABSTRACT

For a passenger most comfortably, when a transport provides delivery "from a door to the door". On small distances this problem successfully decides through the use of motor transport. But growth of amount of cars resulted in supersaturating of motorways a transport and especially streets of cities. Corks appear, the rate of movement goes down as a result, muddiness of environment is increased.

Development of network infrastructure of claotype transport is offered on the followings directions:

- integration of claotype transport in the single system with other types of transport;
- development of the system of city reports on a type a «streetcar – bus – trolleybus – train», which foresees the use of all of types of transport in a city environment. Use of conception a «streetcar – bus – trolleybus – train» is given by possibility to decide many problems of intercity transportations of the capital. Passing from the line of one system to the area other is accomplished in strictly certain clamp points on connecting ways;
- improvement of terms of transplantation between the kinds of transport with the concordance of time-tables, by creation of the single stations — lining-out knots, will allow to reduce loading on knots and shorten moving of passengers, both at times and is, in «corks», in the clock of lances;

For the decision of this task an algorithm which determines minimum time on the way between tops in simple орграфе with non-negative scales is examined. To such орграфам many types of counts are taken. If a count is not simple, he can be done such, casting aside all of loops and, replacing every great number of parallel ribs the shortest rib (by a rib with the least weight) from this great number; every undirected edge is replaced the pair of the directed edges. If a count is not self-weighted, it is possible to consider that all of ribs have one weight.

The result of calculation are saved in the destination file of Short.out with the following structure: tops of way, time on the way.

Keywords: purpose of value, algorithm of decision

For a passenger most comfortably, when a transport provides delivery "from a door to the door". On small distances this problem successfully decides through the use of motor transport. But growth of amount of cars resulted in supersaturating of motorways a transport and especially streets of cities. Corks appear, the rate of movement goes down as a result, muddiness of environment is increased.

The examined algorithm determines distances between tops in simple orgrafe with non-negative scales. To such orgrafe many types of counts are taken. If a count is not simple, he can be done such, casting aside all of loops and replacing every great number of parallel ribs the shortest rib (by a rib with the least weight) from this great number; every undirected edge is replaced the pair of the directed edges. If a count is not self-weighted, it is possible to consider that all of ribs have one weight.

Let $G = (X, U, \Phi)$ it is an outage of orgrafe, for every rib $u \in U$ weight is *w* certain (u) > 0. We will find a short cut between the selected tops of x_0 and *z* (fig. 1.). Will consider non-existent ribs with endless scales. On the way will name the sum of scales of ribs weighing go a pathlength. We will designate $w_{ij} = w(u)$ rib $u = (x_i, x_j)$. The algorithm search of short cut, beginning from the top of x_0, looks over count breadthways, marking tops x_j values — marks of their distances from x_0. Marks can be temporal and final. A temporal mark of top of x_j is minimum distance of x_0 to x_j, when in determination of way on a column not all of routes are taken into account from x_0 to x_j. A final mark x_j - minimum distance on a column from x_0 and x_j. Thus, at every the instant work of algorithm some tops will have final marks, and other their part — temporal. An algorithm is closed, when the top *z* gets a final mark, i.e. distance from x_0 to *z*.

In a final mark is the beginning appropriated the top x_0 0 (zero distance to itself), and to each of other $|X|$ — 1 a temporal mark is appropriated ∞ (endlessness). On every step with a temporal mark the final is appropriated one top and a search proceeds farther. On every step marks change as follows.

1. To every top x_j, not having a final mark, a new temporal mark is appropriated — the least from its temporal and numbers (w_{ij} + final marks x_i), where x_i - top which is appropriate a final mark on a previous step.
2. The least is determined from all of temporal marks, which becomes the final mark of the top. Any of them gets out in the case of equality of marks.

Cyclic process of p.1 + p. 2 proceeds until the top *z* will not get a final mark. Easily to see that a final mark of every top is the shortest distance from this top to beginning x_0.

We will consider the example of search of short cut on a count, presented on fig. 1.

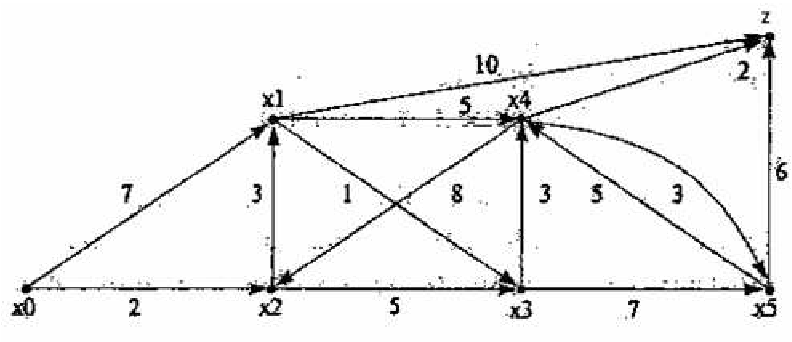

Fig. 1. Outage self-weighted orgraf

The process of setting is well-aimed the tops of count on every step comfortably to present as a next table.

	x0	x1	x2	x3	x4	x5	z
0	0	∞	∞	∞	∞	∞	∞
1		7	2	∞	∞	∞	∞
2		5		7	∞	∞	∞
3				6	10	∞	15
4					9	13	15
5						12	11

Squares are select final marks, i.e. distances from them to x_0. On such table easily to recover the way of moving from *z* to x_0, which is marked the broken curve.

Realization of the considered chart of search of short cut is presented in an algorithm 1, where count $G = (X, U, \Phi)$ appears the matrix of scales $We = [w_{ij}]$, weight of non-existent ribs rely equal $+\infty$. The vector *Mark[x]* of marks tops is set by belonging top $x \in X$ to the permanent (*TRUE*) or temporal (*FALSE*) mark. The vector of *Dist*[x] in an algorithm fixes the current values of marks of tops. The vector of *Prex* [x] allows to recover the tops of short cut in a reverse sequence.

Algorithm 1. *Algorithm of short cut on orgrafe*

```
Step 1
 for x ∈ X do begin
        Mark[x] = FALSE; Dist[x]= ∞;
end;
Step 2
    y = x0; Mark[x0]= TRUE; Dist[x0]= 0;
Step 3
    while not Mark[z] do begin
        for x ∈ X do
            if not Mark[x] and dist[x] > dist[y] + w[y, z] then begin
                dist[x]= dist[y]+ w[y, x];
                prev[x]= y;
            end;
Step 4
    {Search of new top y ∈ X with a minimum temporal mark}
        dist[y]=        min      dist[x];
                x ∈ X and Mark[x]= FALSE
        Mark[y]= TRUE;
end.
```

Prev[x] specifies on a top with a final mark, the nearest to the top *x.* A sequence of tops of short cut will be has the following kind:

Z, prev[z], prev[prev[z]], prev[prev[prev[z]]], ..., x0,

and a value *Dist*[z] will make a pathlength from x_0 in z. A next new top, applying on a permanent mark, is designated through *y*.

Complication of algorithm. An algorithm speaks to the cycle *while* body no [X] more — 1 time, and number of operations, required at each such appeal, 0(|X|) is equal. Then complication of algorithm will be $0(|X|^2)$.

Interestingly to notice that if it is required to find lengths of short cuts from x_0 to all of tops of count, in an algorithm 1 condition of cycle ***while*** *not Mark[z]* ***do begin*** it is necessary to substitute by the condition *of* ***while*** *not Mark[x]* ***do begin***. Thus complication of algorithm will remain former.

Programmatic realization of algorithm of search of short cut is presented in an algorithm 2 on Pascal'e, which close corresponds plural description of algorithm 1.

Algorithm 2. *Program of short cut on orgrafe*

Step 1

Program Short; { Short cuts on a column)

uses CRT,DOS;

Const

nVertex = 50; { Maximal amount of tops}

Type

TypeMark = array[O..nVertex] of Boolean; TypeDist = array[O..nVertex] of LongInt; TypePrev = array[O..nVertex] of Integer; TypeWeight = array[O..nVertex, 0..nVertex] of Integer;

Step 2

Var

f :Text; { Text file } nX :Integer; { An amount of tops is in a column } Mark :TypeMark; { Signs of temporal and permanent marks} Dist :TypeDist; { Values of current marks of tops (distances)} Prev :TypePrev; { Pointer to the nearest top } We :TypeWeight; (Matrix of scales of ribs of count } xO : Integer; { A top began ways } z :Integer; { Top of end of way } y :Integer; { Last top with a permanent mark}

Step 3

Var

i, j, x :Integer; weight :LongInt;

Step 4

begin

Assign (f, 'Short.in'); Reset (f) ; {File is opened for reading}

{ Entry of basic data)

Read (f, x0); { Initial top of way} Read (f, z); { Eventual top of way} Read (f, nX); { An amount of tops is in a column} nX: = nX-1; (* X = {0,1,2,..., nX} - great number of tops *)

for i:= 0 to nX do begin

for j:=0 to nX do begin

Read (f, We [i,j]); { Input of matrix scales }

if We [i,j] = 0 then We [i,j]: = $7fff; {+ endlessness}

end;

end;

Close (f); Assign (f,’Short.out'); Rewrite (f); {File is opened for a record}

Step 5

```
for x:=0  to  nX do begin

   Mark[x]:= FALSE; Dist[x]:=
   $7fffffff;

end;

 y: = x0; { Last top with a permanent mark} Mark[y]:=
 TRUE; Dist[y]:= 0;
```

Step 6

```
 while  not Mark[z]  do  begin

    {To renew temporal marks}

    for x := 0 to nX do if not Mark[x] and ( Dist[x] > Dist[y] +
    We[y,x]) then begin

       Dist[x]: == Dist[y] + We[y,x]; Prev[x]:= y;

    end;

    {Search of top with a minimum temporal mark)

    weight := $7fffffff;

    for x:=0 to nX do if not Mark[x] then if weight > Dist[x]
    then begin

       weight := Dist[x]; y := x; Mark[y]:=TRUE;

 end;
```

Step 7

```
 Write (f’’Tops of way =' );
```

```
x:=z; while x<>x0 do begin Write (f,x:2); x:=Prev[x];

end;

WriteLn (f, x : 2); WriteLn (f, Length of way = ‘, Dist[z]); Close (f);
```

end.

We will consider the example of calculation on the program of algorithm 2 searches of short cut on a count, rotined on fig. 1. Basic data of count appear the matrix of scales of his ribs in the text file of Short.in with the following structure:

- the number of initial top of way x_0 is determined in the first line;
- the number of eventual top of way of z is determined in the second line;
- in the third line the amount *nX* tops is specified in a column;
- the lines of matrix of scales $[w_{ij}]$ of count are determined in next *nX* lines.

0	7	2	0	0	0	0
0	0	0	1	5	0	10
0	3	0	5	0	0	0
0	0	0	0	3	7	0
0	0	8	0	0	5	2
0	0	0	0	1	0	6
0	0	0	0	0	0	0

The results of calculations are saved in the destination file of Short.out with the following structure:

Tops of way = 6 4 3 1 2 0

Length of way = 11 (min)

Conclusions:

Inculcating a railway transport in the city network of city, will allow reducing loading on knots and shortening moving of passengers, both at times and is in «corks», in the clock of lances.

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