Transportation of Company workers for the reduction of traffic and pollution

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Data Structures

	1	2	3	4	5
1	0	5	4	3	2
2	5	0	13	21	1
3	4	13	0	20	2
4	3	21	20	0	7
5	2	1	2	7	0

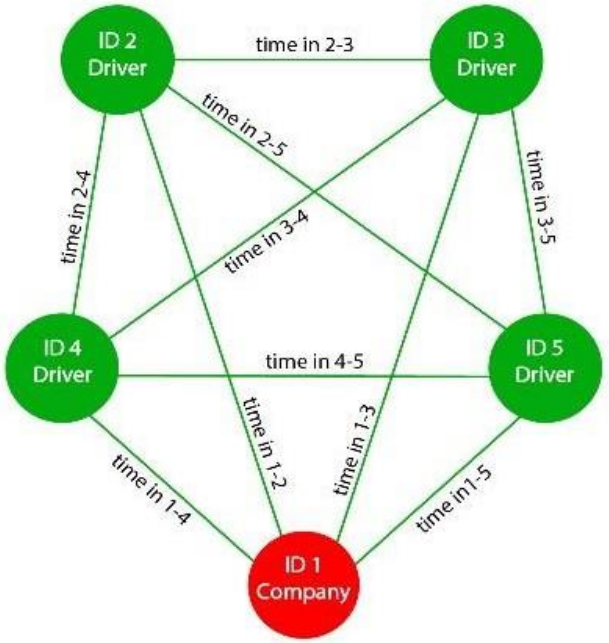

Figure 1: A matrix with the weights of the paths.
Figure 2: Structure of a complete graph

Algorithm and Complexity

```
332 Algorithm assign (Graph, initial, increment)
333     assigned cars = new List
334     Successors = new List in range(2, size of Graph)
335     ordered successors = sort(Successors)
336     While ordered successors not empty do
337         driver = last from ordered successors
338         car = new List
339         time limit = increment * get Weight(Graph, driver, initial)
340         closest from driver = sort(ordered successors)
341         for every successor in closest from driver do
342             if size of car = 5 then
343                 stop
344             end if
345             if can take (successor, car, time limit, Graph) then
346                 push(successor, car)
347                 erase(successor, ordered successors)
348             end if
349         end for
350         push(car, assigned cars)
351     end while
352     return assigned cars
353 end
```

Method	Complexity
Graph creation	O(n2)
Sorting	O(n2)
Erase	O(n)
canTake	O(c)
Assign	O(n2)
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Total =	O(n2)

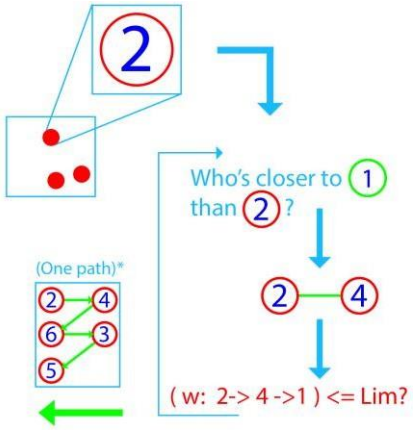
Where n is the graph's size and c the number of passengers inside a car.

Algorithm design criteria

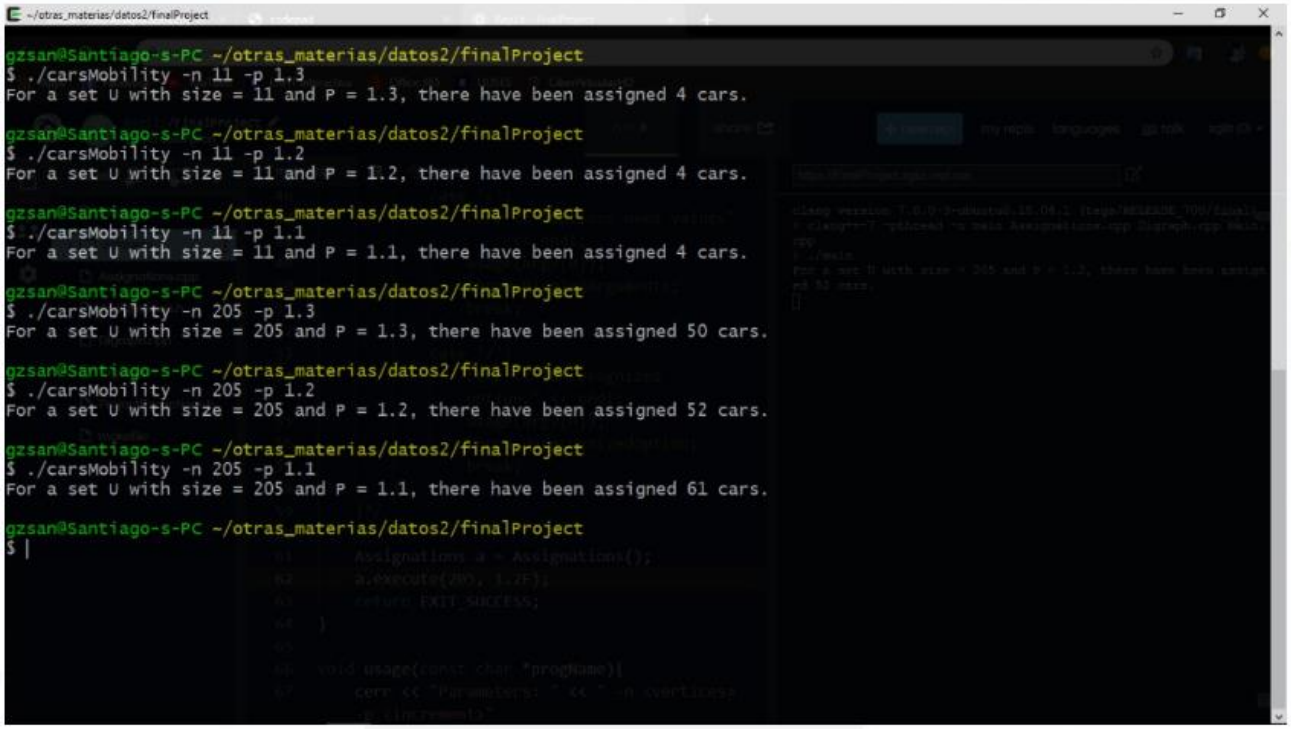
-It is fast

-Only uses the related data, and that reduces completely the needed storage.

-Reduces the traffic in a 69.5% for the worst case P=1.1



Execution


~/otras_materias/datos2/finalProject
gzsan@Santiago-s-PC ~/otras_materias/datos2/finalProject
$ ./carsMobility -n 11 -p 1.3
For a set U with size = 11 and P = 1.3, there have been assigned 4 cars.
gzsan@Santiago-s-PC ~/otras_materias/datos2/finalProject
$ ./carsMobility -n 11 -p 1.2
For a set U with size = 11 and P = 1.2, there have been assigned 4 cars.
gzsan@Santiago-s-PC ~/otras_materias/datos2/finalProject
$ ./carsMobility -n 11 -p 1.1
For a set U with size = 11 and P = 1.1, there have been assigned 4 cars.
gzsan@Santiago-s-PC ~/otras_materias/datos2/finalProject
$ ./carsMobility -n 205 -p 1.3
For a set U with size = 205 and P = 1.3, there have been assigned 50 cars.
gzsan@Santiago-s-PC ~/otras_materias/datos2/finalProject
$ ./carsMobility -n 205 -p 1.2
For a set U with size = 205 and P = 1.2, there have been assigned 52 cars.
gzsan@Santiago-s-PC ~/otras_materias/datos2/finalProject
$ ./carsMobility -n 205 -p 1.1
For a set U with size = 205 and P = 1.1, there have been assigned 61 cars.
gzsan@Santiago-s-PC ~/otras_materias/datos2/finalProject
$

Time and Memory Consumption

j) Time: 0.456 seconds

Memory consumption: 3.4 MB

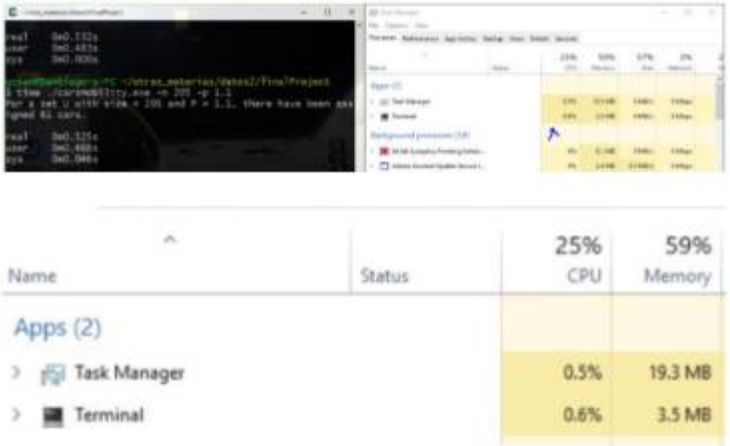
```
$ make
g++     -c -o main.o main.cpp
g++     -c -o Assignations.o Assignations.cpp
g++     -c -o Digraph.o Digraph.cpp
g++ -o carsMobility main.o Assignations.o Digraph.o -Wall

gzsan@Santiago-s-PC ~/otras_materias/datos2/finalProject
$ time ./carsMobility.exe -n 205 -p 1.1
For a set U with size = 205 and P = 1.1, there have been assigned 61 cars.

real    0m0.568s
user    0m0.437s
sys     0m0.061s

gzsan@Santiago-s-PC ~/otras_materias/datos2/finalProject
$ time ./carsMobility.exe -n 205 -p 1.1
For a set U with size = 205 and P = 1.1, there have been assigned 61 cars.

real    0m0.578s
user    0m0.453s
sys     0m0.046s
```




```
Structure complexity: O(N^2)
  In the biggest dataset= (32*205)^2 = 43.033.600 bits
Algorithm complexity: O(N)
  In the biggest dataset= (32*205) = 6560 bits
```