STRUCTURES Laboratory
DATA AND ALGORITHMS
Degree in Data Science (1st)
Academic year 2023-24

VNIVERSITAT ID VALÈNCIA

Practice No. 7: Graphs

Classroom exercise (L1)

Taking as reference the program**"pr7_v1.py"**, which you must have already done and tested, a new program must be written, called**"pr7_final.py"**, to analyze the graph of bus routes between towns in the Valencian Community. To do this, it is necessary:

1. Build the graph with the bus routes by reading the information contained in the files " bus_stops_cv.dat"and "bus_routes_cv.csv".

   The process is analogous to that carried out in phase 1, but with other data files. In this case, the file with the routes (graph arcs) has a slightly different format than the one used previously. Each line has 3 fields:LineName;Source;Destination.

   In this case, it is an undirected graph and, therefore, it must be interpreted that each line of text represents 2 arcs, the arc <Origin,Destination>and the bow <Destination,Origin>.

   Example:L03;Xàtiva;València

   The text is indicating that the line identified as "L03" carries out the routes "Xàtiva – València" and "València – Xàtiva".

   This consideration must be taken into account when creating the arcs of the graph.

   It must also be taken into account that the line identifier must be associated as the weight of the arc in the graph.

2. Determine, using this bus network, all the possible route origins that can be used to reach a certain destination stop and what is the minimum number of stops that are necessary to make to reach that destination from each possible origin. Check the Graph class because it includes operations for traversing the graph that can be very useful.

3. The program must request the name of a destination stop and show on the screen the number of possible origins from which it can be reached and also the name of the origin stops and how many stops, at least, are required to get there from them. to the chosen destination. Output example:

   ```
   L'Eliana --> scales = 4 L'Oliveral and La Reva --
   > scales = 3 Macastre --> scales = 4

   Manises --> scales = 4 Mareny
   Blau (Direct, L5C)
   ```

   To properly display the results you must keep in mind that:

   • The number of stops can be calculated from the number of arcs required to reach the destination (BFS distance). The number of scales is always the distance value minus 1.

- • Destinations that can be reached without stops should be highlighted, indicating "Straight"and the line number (bow weight) after the destination name (seeMareny Blauin the example).

4. Try the program using the stop " as destinationBega de Mar".They must be obtained**400** possible destinations[1]. The last 10 possible origins in alphabetical order are:

> Xaló --> scales = 6 Xeraco -->
> scales = 5 Xeresa --> scales = 4
> Xirivella --> scales = 3 Xixona -->
> scales = 5 --> scales = 3 Yátova
> --> scales = 3
>
>
>
> Zorita del Maestrazgo --> scales = 6

There are only 2 origins with direct routes to the selected destination: ""Mareny Blau" and " Swedish."

---

[1]Not counting the destination itself, which is not a valid origin.