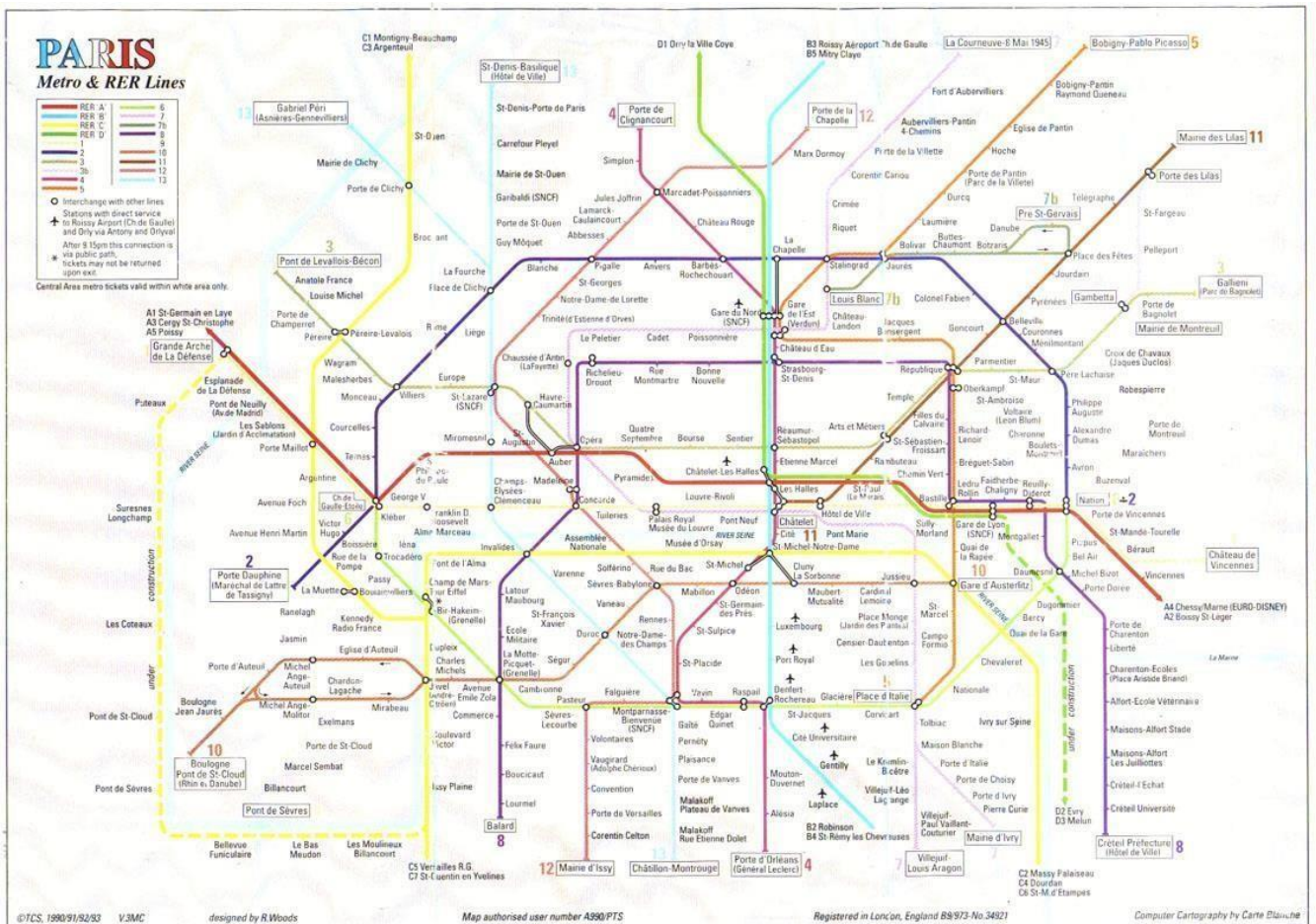


# HOMEWORK 4 (7.5%) COMPUTER SCIENCE

To return to BBL before 23h55 the 5th of December 2017

## Walk in the Paris Metro

The purpose of this assignment is simply to find the shortest path in a graph. Waiting for the light train to come to Halifax, we will consider the Metro of the city of Paris which is a good example of a graph with a great complexity.



**The Graph:**

The information required to build the graph corresponding to this metro network can be found in the enclosed text file. This file is organized as follows:

- The file starts with two integers specifying the number of vertices (metro stations) and the number of edges.
- Each of the stations are listed and associated with a number. It should be noted that the same station can appear more than once when it is on more than one subway line.
- The \$ symbol indicates the end of the station list.
- The remainder of the file provides a list of the edges, i.e. the connection between two stations and the time it takes (in seconds) to the subway to move from one station to another.
- This graph is oriented to consider a few cases of a few one-way cases.
- In some cases, it is also possible to transfer from one line to another by walking. These cases are at the end of the file and are identified with a weight of -1.

**Questions:**

1. You must read this file and produce a graph using the representation of your choice.
  - i) You will need to create a static ReadMetro (filename) read method.
  - ii) Create a Metro class containing the subway graph
  
2. From this graph, you must build a software allowing to automatically:
  - i) Identify all stations belonging to the same line as a specified station. These stations must be listed in the order of travel (including the specified station) with the two stations at the ends of the line at the beginning and end of this list.
  - ii) Find the fastest route between two stations.
  - iii) Find the fastest route between two stations when one of the lines is off (this line is identified by one of its ends).

In order to specify a station, you must use its associated number. When calculating travel time, use 90 seconds as the transfer time when moving from one line to another.

Give the route by listing all stations in order and give the total duration of the trip.

**Your program:**

In order to run your program, the call must be as follows:

```
Java ParisMetro N1 N2 N3
```

With N1, N2 and N3 numbers identifying metro stations.

- If only one number is specified, then the program provides the answer to question 2 (i) with N1 as the station identifying a line to be described.
- If two numbers are specified, then the program provides the answer to question 2 (ii) with N1 and N2 being the start and end stations.
- If three numbers are specified, then the program provides the answer to question 2 (iii) with N1 and N2 being the start and end stations and N3 a station at the end of a failed line.

You must submit your code in Java as well as a document describing:

- Your data structures (classes, attributes and methods).
- General description of used algorithms to respond to the questions of part 2.
- Examples of results obtained for the questions of part 2.