Données sur 15 lycées nantais

Données (https://data.education.gouv.fr) :

Lycée	Latitude	Longitude
MICHELET	47.23520254	-1.558483809
NELSON MANDELA	47.20839373	-1.532906619
GABRIEL GUISTHAU	47.21617542	-1.568772278
LIVET	47.22548714	-1.545196577
GASPARD MONGE	47.25409597	-1.572974528
CARCOUET	47.23134146	-1.592959036
CLEMENCEAU	47.21871524	-1.544246595
FRANCOIS ARAGO	47.25026484	-1.552931253
LA COLINIERE	47.23679425	-1.512407267
ALBERT CAMUS	47.20468891	-1.609970996
IFOM	47.20296012	-1.545680149
JULES VERNE	47.21700089	-1.561011057
LEONARD DE VINCI	47.23850093	-1.522586743
DE BOUGAINVILLE	47.19854222	-1.592619048
LES BOURDONNIERES	47.18575491	-1.517969274

Visualisation (https://www.dcode.fr/geolocalisation-coordonnees) :

```
Distances entre établissements (gpsdistancier.jl) :

  1 -   2 =  3.552 km | MICHELET <-> NELSON MANDELA
  1 -   3 =  2.254 km | MICHELET <-> GABRIEL GUISTHAU
  1 -   4 =  1.474 km | MICHELET <-> LIVET
  1 -   5 =  2.369 km | MICHELET <-> GASPARD MONGE
  1 -   6 =  2.638 km | MICHELET <-> CARCOUET
  1 -   7 =  2.125 km | MICHELET <-> CLEMENCEAU
  1 -   8 =  1.727 km | MICHELET <-> FRANCOIS ARAGO
  1 -   9 =  3.483 km | MICHELET <-> LA COLINIERE
  1 -  10 =  5.161 km | MICHELET <-> ALBERT CAMUS
  1 -  11 =  3.713 km | MICHELET <-> IFOM
  1 -  12 =  2.033 km | MICHELET <-> JULES VERNE
  1 -  13 =  2.735 km | MICHELET <-> LEONARD DE VINCI
  1 -  14 =  4.823 km | MICHELET <-> DE BOUGAINVILLE
  1 -  15 =  6.293 km | MICHELET <-> LES BOURDONNIERES
  2 -   3 =  2.844 km | NELSON MANDELA <-> GABRIEL GUISTHAU
  2 -   4 =  2.115 km | NELSON MANDELA <-> LIVET
  2 -   5 =  5.914 km | NELSON MANDELA <-> GASPARD MONGE
  2 -   6 =  5.204 km | NELSON MANDELA <-> CARCOUET
  2 -   7 =  1.432 km | NELSON MANDELA <-> CLEMENCEAU
  2 -   8 =  4.895 km | NELSON MANDELA <-> FRANCOIS ARAGO
  2 -   9 =  3.517 km | NELSON MANDELA <-> LA COLINIERE
  2 -  10 =  5.836 km | NELSON MANDELA <-> ALBERT CAMUS
  2 -  11 =  1.138 km | NELSON MANDELA <-> IFOM
  2 -  12 =  2.329 km | NELSON MANDELA <-> JULES VERNE
  2 -  13 =  3.437 km | NELSON MANDELA <-> LEONARD DE VINCI
  2 -  14 =  4.642 km | NELSON MANDELA <-> DE BOUGAINVILLE
  2 -  15 =  2.759 km | NELSON MANDELA <-> LES BOURDONNIERES
  3 -   4 =  2.060 km | GABRIEL GUISTHAU <-> LIVET
  3 -   5 =  4.228 km | GABRIEL GUISTHAU <-> GASPARD MONGE
  3 -   6 =  2.486 km | GABRIEL GUISTHAU <-> CARCOUET
  3 -   7 =  1.874 km | GABRIEL GUISTHAU <-> CLEMENCEAU
  3 -   8 =  3.975 km | GABRIEL GUISTHAU <-> FRANCOIS ARAGO
  3 -   9 =  4.834 km | GABRIEL GUISTHAU <-> LA COLINIERE
  3 -  10 =  3.364 km | GABRIEL GUISTHAU <-> ALBERT CAMUS
  3 -  11 =  2.281 km | GABRIEL GUISTHAU <-> IFOM
  3 -  12 =  0.593 km | GABRIEL GUISTHAU <-> JULES VERNE
  3 -  13 =  4.281 km | GABRIEL GUISTHAU <-> LEONARD DE VINCI
  3 -  14 =  2.663 km | GABRIEL GUISTHAU <-> DE BOUGAINVILLE
  3 -  15 =  5.116 km | GABRIEL GUISTHAU <-> LES BOURDONNIERES
  4 -   5 =  3.810 km | LIVET <-> GASPARD MONGE
  4 -   6 =  3.665 km | LIVET <-> CARCOUET
  4 -   7 =  0.756 km | LIVET <-> CLEMENCEAU
  4 -   8 =  2.816 km | LIVET <-> FRANCOIS ARAGO
  4 -   9 =  2.777 km | LIVET <-> LA COLINIERE
  4 -  10 =  5.411 km | LIVET <-> ALBERT CAMUS
  4 -  11 =  2.505 km | LIVET <-> IFOM
  4 -  12 =  1.522 km | LIVET <-> JULES VERNE
  4 -  13 =  2.238 km | LIVET <-> LEONARD DE VINCI
  4 -  14 =  4.670 km | LIVET <-> DE BOUGAINVILLE
  4 -  15 =  4.873 km | LIVET <-> LES BOURDONNIERES
  5 -   6 =  2.946 km | GASPARD MONGE <-> CARCOUET
  5 -   7 =  4.492 km | GASPARD MONGE <-> CLEMENCEAU
  5 -   8 =  1.572 km | GASPARD MONGE <-> FRANCOIS ARAGO
  5 -   9 =  4.960 km | GASPARD MONGE <-> LA COLINIERE
  5 -  10 =  6.163 km | GASPARD MONGE <-> ALBERT CAMUS
  5 -  11 =  6.048 km | GASPARD MONGE <-> IFOM
  5 -  12 =  4.223 km | GASPARD MONGE <-> JULES VERNE
  5 -  13 =  4.180 km | GASPARD MONGE <-> LEONARD DE VINCI
  5 -  14 =  6.353 km | GASPARD MONGE <-> DE BOUGAINVILLE
  5 -  15 =  8.660 km | GASPARD MONGE <-> LES BOURDONNIERES
  6 -   7 =  3.937 km | CARCOUET <-> CLEMENCEAU
  6 -   8 =  3.682 km | CARCOUET <-> FRANCOIS ARAGO
  6 -   9 =  6.112 km | CARCOUET <-> LA COLINIERE
```

```
 6 - 10 =   3.230 km | CARCOUET <-> ALBERT CAMUS
 6 - 11 =   4.765 km | CARCOUET <-> IFOM
 6 - 12 =   2.892 km | CARCOUET <-> JULES VERNE
 6 - 13 =   5.372 km | CARCOUET <-> LEONARD DE VINCI
 6 - 14 =   3.647 km | CARCOUET <-> DE BOUGAINVILLE
 6 - 15 =   7.601 km | CARCOUET <-> LES BOURDONNIERES
 7 -  8 =   3.569 km | CLEMENCEAU <-> FRANCOIS ARAGO
 7 -  9 =   3.134 km | CLEMENCEAU <-> LA COLINIERE
 7 - 10 =   5.204 km | CLEMENCEAU <-> ALBERT CAMUS
 7 - 11 =   1.755 km | CLEMENCEAU <-> IFOM
 7 - 12 =   1.280 km | CLEMENCEAU <-> JULES VERNE
 7 - 13 =   2.741 km | CLEMENCEAU <-> LEONARD DE VINCI
 7 - 14 =   4.288 km | CLEMENCEAU <-> DE BOUGAINVILLE
 7 - 15 =   4.168 km | CLEMENCEAU <-> LES BOURDONNIERES
 8 -  9 =   3.406 km | FRANCOIS ARAGO <-> LA COLINIERE
 8 - 10 =   6.651 km | FRANCOIS ARAGO <-> ALBERT CAMUS
 8 - 11 =   5.288 km | FRANCOIS ARAGO <-> IFOM
 8 - 12 =   3.749 km | FRANCOIS ARAGO <-> JULES VERNE
 8 - 13 =   2.638 km | FRANCOIS ARAGO <-> LEONARD DE VINCI
 8 - 14 =   6.485 km | FRANCOIS ARAGO <-> DE BOUGAINVILLE
 8 - 15 =   7.644 km | FRANCOIS ARAGO <-> LES BOURDONNIERES
 9 - 10 =   8.187 km | LA COLINIERE <-> ALBERT CAMUS
 9 - 11 =   4.524 km | LA COLINIERE <-> IFOM
 9 - 12 =   4.280 km | LA COLINIERE <-> JULES VERNE
 9 - 13 =   0.792 km | LA COLINIERE <-> LEONARD DE VINCI
 9 - 14 =   7.402 km | LA COLINIERE <-> DE BOUGAINVILLE
 9 - 15 =   5.691 km | LA COLINIERE <-> LES BOURDONNIERES
10 - 11 =   4.861 km | ALBERT CAMUS <-> IFOM
10 - 12 =   3.943 km | ALBERT CAMUS <-> JULES VERNE
10 - 13 =   7.595 km | ALBERT CAMUS <-> LEONARD DE VINCI
10 - 14 =   1.478 km | ALBERT CAMUS <-> DE BOUGAINVILLE
10 - 15 =   7.263 km | ALBERT CAMUS <-> LES BOURDONNIERES
11 - 12 =   1.944 km | IFOM <-> JULES VERNE
11 - 13 =   4.320 km | IFOM <-> LEONARD DE VINCI
11 - 14 =   3.580 km | IFOM <-> DE BOUGAINVILLE
11 - 15 =   2.836 km | IFOM <-> LES BOURDONNIERES
12 - 13 =   3.760 km | JULES VERNE <-> LEONARD DE VINCI
12 - 14 =   3.149 km | JULES VERNE <-> DE BOUGAINVILLE
12 - 15 =   4.759 km | JULES VERNE <-> LES BOURDONNIERES
13 - 14 =   6.908 km | LEONARD DE VINCI <-> DE BOUGAINVILLE
13 - 15 =   5.875 km | LEONARD DE VINCI <-> LES BOURDONNIERES
14 - 15 =   5.817 km | DE BOUGAINVILLE <-> LES BOURDONNIERES
```

Distancier (gpsdistancier.jl) :

```
julia> dist
15×15 Array{Float64,2}:
0.0      3.55209  2.25386   1.47432   2.36857  2.63815  2.12528  1.72651  3.48324  5.16062  3.71331  2.03291   2.73486  4.82328  6.29261
3.55209  0.0      2.84387   2.11524   5.91423  5.20383  1.43208  4.89523  3.51702  5.83609  1.13849  2.32857   3.43728  4.64211  2.75873
2.25386  2.84387  0.0       2.05964   4.22849  2.48596  1.87372  3.97479  4.8345   3.36388  2.28078  0.593323  4.28085  2.6626   5.11597
1.47432  2.11524  2.05964   0.0       3.81017  3.66482  0.756411 2.81636  2.77675  5.41141  2.50516  1.52211   2.23794  4.66984  4.87334
2.36857  5.91423  4.22849   3.81017   0.0      2.94581  4.49242  1.57163  4.96025  6.16327  6.04804  4.22252   4.18015  6.35291  8.66049
2.63815  5.20383  2.48596   3.66482   2.94581  0.0      3.93733  3.68223  6.11196  3.23015  4.7655   2.89194   5.37247  3.6472   7.60147
2.12528  1.43208  1.87372   0.756411  4.49242  3.93733  0.0      3.56891  3.13393  5.20364  1.75523  1.28041   2.7414   4.28755  4.16813
1.72651  4.89523  3.97479   2.81636   1.57163  3.68223  3.56891  0.0      3.40612  6.65088  5.28847  3.74875   2.63781  6.48534  7.64373
3.48324  3.51702  4.8345    2.77675   4.96025  6.11196  3.13393  3.40612  0.0      8.18739  4.5242   4.27951   0.791602 7.40211  5.69084
5.16062  5.83609  3.36388   5.41141   6.16327  3.23015  5.20364  6.65088  8.18739  0.0      4.86065  3.94345   7.59509  1.47839  7.26323
3.71331  1.13849  2.28078   2.50516   6.04804  4.7655   1.75523  5.28847  4.5242   4.86065  0.0      1.94386   4.31968  3.58007  2.8362
2.03291  2.32857  0.593323  1.52211   4.22252  2.89194  1.28041  3.74875  4.27951  3.94345  1.94386  0.0       3.7595   3.1486   4.7587
2.73486  3.43728  4.28085   2.23794   4.18015  5.37247  2.63781  2.63781  0.791602 7.59509  4.31968  3.7595    0.0      6.90774  5.87545
4.82328  4.64211  2.6626    4.66984   6.35291  3.6472   4.28755  6.48534  7.40211  1.47839  3.58007  3.1486    6.90774  0.0      5.81711
6.29261  2.75873  5.11597   4.87334   8.66049  7.60147  4.16813  7.64373  5.69084  7.26323  2.8362   4.7587    5.87545  5.81711  0.0
```

Optimisation :
Solveur : https://developers.google.com/optimization/routing/tsp

```
[ 0.0,      3.55209,  2.25386,  1.47432,  2.36857,  2.63815,  2.12528,  1.72651,  3.48324,  5.16062,  3.71331,  2.03291,  2.73486,  4.82328,  6.29261 ]
[ 3.55209,  0.0,      2.84387,  2.11524,  5.91423,  5.20383,  1.43208,  4.89523,  3.51702,  5.83609,  1.13849,  2.32857,  3.43728,  4.64211,  2.75873 ]
[ 2.25386,  2.84387,  0.0,      2.05964,  4.22849,  2.48596,  1.87372,  3.97479,  4.8345,   3.36388,  2.28078,  0.593323, 4.28085,  2.6626,   5.11597 ]
[ 1.47432,  2.11524,  2.05964,  0.0,      3.81017,  3.66482,  0.756411, 2.81636,  2.77675,  5.41141,  2.50516,  1.52211,  2.23794,  4.66984,  4.87334 ]
[ 2.36857,  5.91423,  4.22849,  3.81017,  0.0 ,     2.94581,  4.49242,  1.57163,  4.96025,  6.16327,  6.04804,  4.22252,  4.18015,  6.35291,  8.66049 ]
[ 2.63815,  5.20383,  2.48596,  3.66482,  2.94581,  0.0,      3.93733,  3.68223,  6.11196,  3.23015,  4.7655,   2.89194,  5.37247,  3.6472,   7.60147 ]
[ 2.12528,  1.43208,  1.87372,  0.756411, 4.49242,  3.93733,  0.0,      3.56891,  3.13393,  5.20364,  1.75523,  1.28041,  2.7414,   4.28755,  4.16813 ]
[ 1.72651,  4.89523,  3.97479,  2.81636,  1.57163,  3.68223,  3.56891,  0.0,      3.40612,  6.65088,  5.28847,  3.74875,  2.63781,  6.48534,  7.64373 ]
[ 3.48324,  3.51702,  4.8345,   2.77675,  4.96025,  6.11196,  3.13393,  3.40612,  0.0,      8.18739,  4.5242,   4.27951,  0.791602, 7.40211,  5.69084 ]
[ 5.16062,  5.83609,  3.36388,  5.41141,  6.16327,  3.23015,  5.20364,  6.65088,  8.18739,  0.0,      4.86065,  3.94345,  7.59509,  1.47839,  7.26323 ]
[ 3.71331,  1.13849,  2.28078,  2.50516,  6.04804,  4.7655,   1.75523,  5.28847,  4.5242,   4.86065,  0.0,      1.94386,  4.31968,  3.58007,  2.8362  ]
[ 2.03291,  2.32857,  0.593323, 1.52211,  4.22252,  2.89194,  1.28041,  3.74875,  4.27951,  3.94345,  1.94386,  0.0,      3.7595,   3.1486,   4.7587  ]
[ 2.73486,  3.43728,  4.28085,  2.23794,  4.18015,  5.37247,  2.7414,   2.63781,  0.791602, 7.59509,  4.31968,  3.7595,   0.0,      6.90774,  5.87545 ]
[ 4.82328,  4.64211,  2.6626,   4.66984,  6.35291,  3.6472,   4.28755,  6.48534,  7.40211,  1.47839,  3.58007,  3.1486,   6.90774,  0.0,      5.81711 ]
[ 6.29261,  2.75873,  5.11597,  4.87334,  8.66049,  7.60147,  4.16813,  7.64373,  5.69084,  7.26323,  2.8362,   4.7587,   5.87545,  5.81711,  0.0  ]
```

Route for vehicle 0:
 0 -> 7 -> 4 -> 5 -> 9 -> 13 -> 2 -> 11 -> 3 -> 6 -> 10 -> 14 -> 1-> 8 -> 12 -> 0

julia> dist[1,8] + dist[8,5] + dist[5,6] + dist[6,10] + dist[10,14] + dist[14,3] +
dist[3,12] + dist[12,4] + dist[4,7] + dist[7,11] + dist[11,15] + dist[15,2] +
dist[2,9] + dist[9,13] + dist[13,1]
30.880564682447766

Lycée	Latitude	Longitude	ordre_de_visite
MICHELET	47.23520254	-1.558483809	0
FRANCOIS ARAGO	47.25026484	-1.552931253	1
GASPARD MONGE	47.25409597	-1.572974528	2
CARCOUET	47.23134146	-1.592959036	3
ALBERT CAMUS	47.20468891	-1.609970996	4
DE BOUGAINVILLE	47.19854222	-1.592619048	5
GABRIEL GUISTHAU	47.21617542	-1.568772278	6
JULES VERNE	47.21700089	-1.561011057	7
LIVET	47.22548714	-1.545196577	8
CLEMENCEAU	47.21871524	-1.544246595	9
IFOM	47.20296012	-1.545680149	10
LES BOURDONNIERES	47.18575491	-1.517969274	11
NELSON MANDELA	47.20839373	-1.532906619	12
LA COLINIERE	47.23679425	-1.512407267	13
LEONARD DE VINCI	47.23850093	-1.522586743	14
MICHELET	47.23520254	-1.558483809	0

Visualisation (https://www.dcode.fr/geolocalisation-coordonnees) :