# GPBR Exercise 6

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Matriculation Number: 22-132-245

1. First Zagreb Index: 40

Narumi Simple Topological Index: 18

Polarity Number: 1

Wiener Index: 88.0

Randic Index: 5.166666666666666

Balaban-J Index: 46.49999999999999

1. Leading Eigenvalues: [-8.88178420e-16 2.02856483e-01]

Eigen-mode Volumes: [1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.]

Inter-mode Adjacency Matrix:

[[-0.87309353 -0.04913514 0.14621881 0.18881727 -0.13048749 0.09481683

-0.12532808 0.52480219 1.08044329 -0.50583916 0.11808845 0.3348249

0.315707 -0.52495707]

[-0.04913514 0.08409588 0.24917055 -0.04305821 -0.49385774 0.29070892

-0.26443928 0.58098395 -0.14983877 0.22180233 -1.08013904 0.15309539

0.40372162 0.47242856]

[ 0.14621881 0.24917055 -0.33406804 0.20176115 -0.5155665 0.72492676

-0.07572684 0.50137801 -0.66127547 0.04694891 -0.7625591 -0.03026924

-0.16938124 -0.0921631 ]

[ 0.18881727 -0.04305821 0.20176115 -0.31363746 -0.24685302 0.14535113

0.0931408 -0.52393376 0.20959865 0.38452596 -0.14975412 -0.22764639

-0.48632477 0.12584757]

[-0.13048749 -0.49385774 -0.5155665 -0.24685302 -0.79688549 0.12533669

0.4704523 0.47226197 1.544896 -0.32832189 0.33672553 -0.12492382

0.05635106 -0.14704701]

[ 0.09481683 0.29070892 0.72492676 0.14535113 0.12533669 -0.0628914

0.81242186 0.19830826 -0.13108055 -0.3549715 -0.85485039 0.15245148

-0.27203 0.63476058]

[-0.12532808 -0.26443928 -0.07572684 0.0931408 0.4704523 0.81242186

0.50698156 -0.12186043 1.41647906 0.62095822 -0.35421921 -0.32450348

-0.64794913 0.29751257]

[ 0.52480219 0.58098395 0.50137801 -0.52393376 0.47226197 0.19830826

-0.12186043 0.45950792 0.12551497 -0.07756505 -0.6858474 0.32220734

0.77074332 -1.04324263]

[ 1.08044329 -0.14983877 -0.66127547 0.20959865 1.544896 -0.13108055

1.41647906 0.12551497 1.64801922 -0.18452663 -0.55058295 -0.4422199

-0.13909014 0.11860313]

[-0.50583916 0.22180233 0.04694891 0.38452596 -0.32832189 -0.3549715

0.62095822 -0.07756505 -0.18452663 -0.03518082 -0.31836388 0.04483708

-0.47569848 -0.01452028]

[ 0.11808845 -1.08013904 -0.7625591 -0.14975412 0.33672553 -0.85485039

-0.35421921 -0.6858474 -0.55058295 -0.31836388 0.17055167 -0.52671645

-0.31106471 -0.10271214]

[ 0.3348249 0.15309539 -0.03026924 -0.22764639 -0.12492382 0.15245148

-0.32450348 0.32220734 -0.4422199 0.04483708 -0.52671645 -1.0157973

0.47733689 0.23140831]

[ 0.315707 0.40372162 -0.16938124 -0.48632477 0.05635106 -0.27203

-0.64794913 0.77074332 -0.13909014 -0.47569848 -0.31106471 0.47733689

0.49799743 -0.99623403]

[-0.52495707 0.47242856 -0.0921631 0.12584757 -0.14704701 0.63476058

0.29751257 -1.04324263 0.11860313 -0.01452028 -0.10271214 0.23140831

-0.99623403 0.06440035]]

1. Selected Prototypes:

Apply the Spanning Prototype Selector (SPS) with to the given graph dataset using the distance matrix .

We first initialize the set of prototypes as an empty set. Then we find the median graph (graph with the median row sum of the distance matrix ) and add it to . We remove the median graph from (the set of remaining graphs). Next, we iteratively find the graph in with the maximum minimum distance to the prototypes in and add it to . We repeat this process until we have (in this case, ) prototypes in .

1. Pairwise Euclidean distances in the embedding space:

[[ 0. 1.73205081 4.35889894 11.04536102 17.05872211]

[ 1.73205081 0. 3.46410162 11.53256259 17.54992877]

[ 4.35889894 3.46410162 0. 10.04987562 17.20465053]

[11.04536102 11.53256259 10.04987562 0. 9. ]

[17.05872211 17.54992877 17.20465053 9. 0. ]]

Absolute Differences:

[[0. 0.73205081 1.35889894 4.04536102 6.05872211]

[0.73205081 0. 1.46410162 2.53256259 9.54992877]

[1.35889894 1.46410162 0. 4.04987562 3.20465053]

[4.04536102 2.53256259 4.04987562 0. 6. ]

[6.05872211 9.54992877 3.20465053 6. 0. ]]