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1: % Computational Experiment
2: % To demonstrate that the no: zero eigen values of the (unnormalized) graph
3: % Laplacian is equal to the no: disconnected components or disconnected subgraphs
4: % (or the clusters)
5: %
6: % *Toy examples*
7: %
8: % These are toy examples.
9: %
10: % Understand the concept using toy examples !
11: %
12: % Demonstrate your understanding using toy examples !
13: %%
14: % *Example* $1$
15: %
16: % $2$ zero eigen values  $\rightarrow$  $2$ components
17:
18: clearvars
19: rng(100)
20: N = 4; %no: nodes
21: %%
22: % Make a random adjacency matrix(square symmetric)
23:
24: A = rand(N);
25: A = A'*A;
26: Z = zeros(size(A));
27: %%
28: % Build the Laplacian matrix of a graph with $2$ disconnected components.
29:
30: W = [A Z ; Z A];
31: W = W-diag(diag(W));
32:
33: n = size(W,1);
34:
35: D = diag(sum(W));
36:
37: L_u = D - W;
38: L_n = eye(n) - pinv(D)*W;
39: L_ns = eye(n) - D^(-0.5)*W*D^(-0.5);
40:
41: subplot(1,2,1)
42: spy(W)
43: title("W")
44:
45: subplot(1,2,2)
46: plot(graph(W))
47: title("2 component Graph")
48:
49: [eig(L_u) eig(L_n) eig(L_ns)]
50: %%
51: % *Example* $2$
52: %
53: % $3$ zero eigen values  $\rightarrow$  $3$ components
54:
55: clearvars
56: rng(100)
57: N = 4; %no: nodes
58: %%
59: % Make a random adjacency matrix(square symmetric)
60:
61: A = rand(N);
62: A = A'*A;
63: Z = zeros(size(A));
64: %%
65: % Build the Laplacian matrix of a graph with $3$ disconnected components.
66:
67: W = [A Z Z; Z A Z; Z Z A];
68: W = W-diag(diag(W));
69:
70: n = size(W,1);
71:
72: D = diag(sum(W));
73: L_u = D - W;
74: L_n = eye(n) - pinv(D)*W;
75: L_ns = eye(n) - D^(-0.5)*W*D^(-0.5);
76:

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77: subplot(1,2,1)
78: spy(W)
79: title("W")
80: subplot(1,2,2)
81: plot(graph(W))
82: title("3 component Graph")
83:
84: [eig(L_u) eig(L_n) eig(L_ns)]
85: %%
86: % *Example* $$$ *Using 'blkdiag' function*
87: %
88: % $$$ zero eigen values $\rightarrow$$$ components
89:
90: clearvars
91: rng(100)
92: %%
93: % Make a random adjacency matrix(square symmetric)
94:
95: A = rand(4);
96: A = A'*A;
97: %%
98: % Build the Laplacian matrix of a graph with 3 disconnected components using
99: % blkdiag function.
100:
101: W = blkdiag(A,A,A);
102: W = W-diag(diag(W));
103:
104: n = size(W,1);
105:
106: D = diag(sum(W));
107:
108: L_u = D - W;
109: L_n = eye(n) - pinv(D)*W;
110: L_ns = eye(n) - D^(-0.5)*W*D^(-0.5);
111:
112: subplot(1,2,1)
113: spy(W)
114: title("W")
115:
116: subplot(1,2,2)
117: plot(graph(W))
118: title("3 component Graph")
119:
120: [eig(L_u) eig(L_n) eig(L_ns)]
121: %%
122: cd("/media/user/DATA4LINUX/new1/Repos/MFC4_22MAT230/")
123: matlab.internal.liveeditor.openAndConvert('U1_EigValues_GraphLaplacian.mlx',
'U1_EigValues_GraphLaplacian.m');

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