```
% Computational Experiment
% To demonstrate that the no: zero eigen values of the (unnormalized) graph
% Laplacian is equal to the no: disconnected components or disconnected subgraphs
% (or the clusters)
%
% *Toy examples*
%
% These are toy examples.
%
% Understand the concept using toy examples !
%
% Demonstrate your understanding using toy examples !
%%
% *Example* $1$
%
% $2$ zero eigen values $\Rightarrow$$2$ components

clearvars
rng(100)
N = 4;  %no: nodes
%%
% Make a random adjacency matrix(square symmetric)

A = rand(N);
A = A'*A;
Z =  zeros(size(A));
%%
% Build the Laplacian matrix of a graph with $2$ disconnected components.

W = [A Z ;Z A];
W = W-diag(diag(W));

n = size(W,1);

D = diag(sum(W));

L_u = D - W;
L_n = eye(n) - pinv(D)*W;
L_ns = eye(n) - D^(-0.5)*W*D^(-0.5);

subplot(1,2,1)
spy(W)
title("W")

subplot(1,2,2)
plot(graph(W))
title("2 component Graph")

[eig(L_u) eig(L_n) eig(L_ns)]
%%
% *Example* $2$
%
% $3$ zero eigen values $\Rightarrow$$3$ components

clearvars
rng(100)
N = 4;  %no: nodes
%%
% Make a random adjacency matrix(square symmetric)

A = rand(N);
A = A'*A;
Z =  zeros(size(A));
%%
% Build the Laplacian matrix of a graph with $3$ disconnected components.

W = [A Z Z;Z A Z;Z Z A];
W = W-diag(diag(W));

n = size(W,1);

D = diag(sum(W));
L_u = D - W;
L_n = eye(n) - pinv(D)*W;
L_ns = eye(n) - D^(-0.5)*W*D^(-0.5);

```

```
subplot(1,2,1)
spy(W)
title("W")
subplot(1,2,2)
plot(graph(W))
title("3 component Graph")

[eig(L_u) eig(L_n) eig(L_ns)]
%%
% *Example* $3$ *Using 'blkdiag' function*
%
% $3$ zero eigen values $\Rightarrow$$3$ components

clearvars
rng(100)
%%
% Make a random adjacency matrix(square symmetric)

A = rand(4);
A = A'*A;
%%
% Build the Laplacian matrix of a graph with 3 disconnected components using
% blkdiag function.

W = blkdiag(A,A,A);
W = W-diag(diag(W));

n = size(W,1);

D = diag(sum(W));

L_u = D - W;
L_n = eye(n) - pinv(D)*W;
L_ns = eye(n) - D^(-0.5)*W*D^(-0.5);

subplot(1,2,1)
spy(W)
title("W")

subplot(1,2,2)
plot(graph(W))
title("3 component Graph")

[eig(L_u) eig(L_n) eig(L_ns)]
%%
cd("/media/user/DATA4LINUX/new1/Repos/MFC4_22MAT230/")
matlab.internal.liveeditor.openAndConvert('U1_EigValues_GraphLaplacian.mlx',
'U1_EigValues_GraphLaplacian.m');
```