# **CODE:**

% Clear workspace

clear

clc

% Add parser and solver to path

addpath(genpath('C:\Users\tsamak\Downloads\MathWorks\Toolboxes\archives\required\YALMIP'))

addpath(genpath('C:\Users\tsamak\Downloads\MathWorks\Toolboxes\archives\required\SeDuMi'))

% Define the A matrices for the two systems

A1 = [-7 5; 3, -4]; % System matrix for case (i)

A2 = [-6, 4, -2; 3, -8, 1; -1, 5, -7]; % System matrix for case (ii)

% Initialize the YALMIP optimization environment

yalmip('clear');

% Define the variables: X (symmetric matrices)

n1 = size(A1, 1);

P1 = sdpvar(n1, n1, 'symmetric');

n2 = size(A2, 1);

P2 = sdpvar(n2, n2, 'symmetric');

% Define the constraint for eigenvalues to the left of s = -2 using Schur complement

lambda\_min = -2; % Desired minimum eigenvalue

% Define the LMI constraints for both systems

Constraint1 = [P1 >= 0, A1'\*P1 + P1\*A1 - lambda\_min\*eye(n1) <= 0];

Constraint2 = [P2 >= 0, A2'\*P2 + P2\*A2 - lambda\_min\*eye(n2) <= 0];

% Check the feasibility of the LMIs for both systems

options = sdpsettings('verbose', 0);

result1 = optimize(Constraint1, [], options);

result2 = optimize(Constraint2, [], options);

% Check the results for both systems

if result1.problem == 0 && all(eig(value(P1)) >= 0)

disp('System (i) has eigenvalues to the left of s = -2.');

else

disp('System (i) does not have eigenvalues to the left of s = -2.');

end

if result2.problem == 0 && all(eig(value(P2)) >= 0)

disp('System (ii) has eigenvalues to the left of s = -2.');

else

disp('System (ii) does not have eigenvalues to the left of s = -2.');

end

% Find and display the eigenvalues of A for both cases

eigenvalues\_A1 = eig(A1);

eigenvalues\_A2 = eig(A2);

disp('Eigenvalues of A for system (i):');

disp(eigenvalues\_A1);

disp('Eigenvalues of A for system (ii):');

disp(eigenvalues\_A2);

% Cleanup YALMIP environment

yalmip('clear');

# **OUTPUT:**

System (i) has eigenvalues to the left of s = -2.

System (ii) has eigenvalues to the left of s = -2.

Eigenvalues of A for system (i):

-9.6533

-1.3467

Eigenvalues of A for system (ii):

-12.2064 + 0.0000i

-4.3968 + 0.5744i

-4.3968 - 0.5744i

# **SCREENSHOT:**

A screenshot of a computer

Description automatically generated