Q4

```
A = [-4 -2.5;
     4, 0];
B = [2;0];
C = [0 1.25];
D = 0;
r = 1; % Unit circle

P = sdpvar(size(A,1));
W = sdpvar(size(B,2), size(A,1),'full');
eps = 1e-14;
cond1 = A'*P + P*A;
cond3 = A'*P + P*A + 2*1*P
```

```
Linear matrix variable 2x2 (symmetric, real, 3 variables)
Coeffiecient range: 2 to 8
```

```
cond2 = [-r*P, A*P+B*W;
         P*A'+W'*B', -r*P];

F = [P>=eps*eye(size(P)),cond1<=0;cond2<=0;cond3>=0];
optimize(F);
```

```
 Solver for LMI feasibility problems L(x) < R(x)
    This solver minimizes  t  subject to  L(x) < R(x) + t*I
    The best value of t should be negative for feasibility

  Iteration   :    Best value of t so far

     1                        0.210834
     2                        0.045529
***              new lower bound:     -0.034764
     3                    9.335716e-03
***              new lower bound: -9.682349e-03
     4                    2.796643e-03
***              new lower bound: -3.089180e-04
     5                    5.617223e-04
     6                    1.246016e-04
***              new lower bound: -9.182905e-05
     7                    1.637163e-05
***              new lower bound: -3.772028e-05
     8                    1.637163e-05
***              new lower bound: -1.067373e-05
     9                    7.919902e-06
    10                    7.919902e-06
***              new lower bound: -1.376297e-06
    11                    9.475432e-07
***              new lower bound: -2.143754e-07
    12                    1.124138e-07
    13                    1.124138e-07
***              new lower bound: -5.098027e-08
    14                    3.071670e-08
***              new lower bound: -1.013178e-08
    15                    2.633370e-09
    16                    2.633370e-09
***              new lower bound: -3.749200e-09
    17                    2.633370e-09
***              new lower bound: -5.579148e-10
    18                    2.399063e-10
```

```
***                    new lower bound: -1.590043e-10
    19                     4.045102e-11
***                    new lower bound: -5.927662e-11

 Result:  best value of t: 4.045102e-11
          f-radius saturation:  0.000% of R =  1.00e+09

 Marginal infeasibility: these LMI constraints may be
          feasible but are not strictly feasible

################################################################
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https://yalmip.github.io/solver/lmilab/

Install a better SDP solver
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To get rid of this message, edit calllmilab.m
(but don't expect support when things do not work,
YALMIP + LMILAB => No support)
################################################################
```

```
K = value(W)*inv(value(P))
```

```
K = 1×2
    2.2541    1.2499
```

```
% poles of the closed loop system
```

```
eig(A+B*K)
```

```
ans = 2×1
    0.5071
    0.0011
```