Problem 4

```
A=[-5 -5 4; 2 0 -2; 0 -2 -1];
B=[-1; 2; -2];
C=[-1 1 2];
D=0;

%Transfer function used to build inverted Pccf matrix
sys=ss(A,B,C,D);
[num, den]=ss2tf(A,B,C,D)
roots(den)

P=ctrb(sys)
Pc1=[11 6 1; 6 1 0; 1 0 0];
T=P*Pc1;
T1=inv(T);

Ac1=T1*A;
Ac=Ac1*T
Bc=T1*B
Cc=C*T
Dc=D


num =

         0   -1.0000    5.0000  -18.0000


den =

    1.0000    6.0000   11.0000    6.0000


ans =

   -3.0000
   -2.0000
   -1.0000


P =

    -1   -13    47
     2     2   -22
    -2    -2    -2


Ac =

    0.0000    1.0000    0.0000
    0.0000         0    1.0000
```

```
   -6.0000  -11.0000   -6.0000


Bc =

     0
     0
     1


Cc =

   -18     5    -1


Dc =

     0
```

CME 3.4

```
A=[0 1 0 0; 0 0 1 0; 0 0 0 1; -680 -176 -86 -6];
B=[0;0;0;1];
C=[100 20 10 0];
D=0;

sys1=ss(A,B,C,D);
P=ctrb(sys1);
if rank(P)==4
    disp('controllable');
else
    disp('not controllable');
end

%Transfer function used to build inverted Pccf matrix
[num, den]=ss2tf(A,B,C,D)
roots(den)

Pc1=[176 86 6 1; 86 6 1 0; 6 1 0 0; 1 0 0 0];

T=P*Pc1;
T1=inv(T);

Ac1=T1*A;
Ac=Ac1*T
Bc=T1*B
Cc=C*T
Dc=D

controllable

num =
```

```
         0         0   10.0000   20.0000  100.0000

den =

    1.0000    6.0000   86.0000  176.0000  680.0000

ans =

  -2.0000 + 8.0000i
  -2.0000 - 8.0000i
  -1.0000 + 3.0000i
  -1.0000 - 3.0000i

Ac =

     0     1     0     0
     0     0     1     0
     0     0     0     1
  -680  -176   -86    -6

Bc =

     0
     0
     0
     1

Cc =

   100    20    10     0

Dc =

     0
```

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