1)

```
>> A = [7 3 3 2; 0 1 2 −4; −8 −4 −5 0; 2 1 1 3]
A =

    7    3    3    2
    0    1    2   −4
   −8   −4   −5    0
    2    1    1    3

>> eigs(A)
ans =

    3.0000
    3.0000
   −1.0000
    1.0000
```

Lambda = 3

```
>> rref(A − 3*eye(4))
ans =

    1    0    0   −1
    0    1    0    2
    0    0    1    0
    0    0    0    0
>> rref([(A−3*eye(4)) w1])
ans =

    1    0    0   −1    1
    0    1    0    2    0
    0    0    1    0   −1
    0    0    0    0    0
```

Lambda = −1

```
>> rref(A+eye(4))
ans =

    1    0    0    0
    0    1    1    0
    0    0    0    1
    0    0    0    0
```

Lambda = 1

```
>> rref(A−eye(4))
ans =

    1.0000    0.5000         0         0
         0         0    1.0000         0
         0         0         0    1.0000
         0         0         0         0
```

Verify Factorizations

```
>> [1 2 −1/2 0;−2 −2 1 −1; 0 −1 0 1; 1 1 0 0]*[3 1 0 0;0 3 0 0; 0 0 1 0;0 0 0
−1]*inv([1 2 −1/2 0;−2 −2 1 −1; 0 −1 0 1; 1 1 0 0])
```

```
ans =

     7     3     3     2
     0     1     2    -4
    -8    -4    -5     0
     2     1     1     3

>> [0 -1/2 1 2; -1 1 -2 -2; 1 0 0 -1; 0 0 1 1]*[-1 0 0 0; 0 1 0 0; 0 0 3 1; 0
0 0 3]*inv([0 -1/2 1 2; -1 1 -2 -2; 1 0 0 -1; 0 0 1 1])
ans =

     7     3     3     2
     0     1     2    -4
    -8    -4    -5     0
     2     1     1     3

2)

>> A = [1 1 0 0; 0 1 1 0; 0 0 1 1; -1 0 2 1]
A =

     1     1     0     0
     0     1     1     0
     0     0     1     1
    -1     0     2     1

>> format bank
>> eigs(A)
ans =

          2.00
          2.00
         -0.00
          0.00
```

Lambda = 2

```
>> rref(A-2*eye(4))
ans =

          1.00             0             0         -1.00
             0          1.00             0         -1.00
             0             0          1.00         -1.00
             0             0             0             0

>> rref([A-2*eye(4) [1;1;1;1]])
ans =

          1.00             0             0         -1.00         -3.00
             0          1.00             0         -1.00         -2.00
             0             0          1.00         -1.00         -1.00
             0             0             0             0             0
```

Lambda = 0

```
>> rref(A)
ans =

          1.00             0             0          1.00
```

```
                0              1.00                 0             -1.00
                0                 0              1.00              1.00
                0                 0                 0                 0
>> rref([A [-1;1;-1;1]])
ans =

             1.00                 0                 0              1.00             -3.00
                0              1.00                 0             -1.00              2.00
                0                 0              1.00              1.00             -1.00
                0                 0                 0                 0                 0

>> w1 = [1;1;1;1]
w1 =

             1.00
             1.00
             1.00
             1.00

>> w2 = [-2;-1;0;1]
w2 =

            -2.00
            -1.00
                0
             1.00

>> w3 = [-1;1;-1;1]
w3 =

            -1.00
             1.00
            -1.00
             1.00

>> w4=[-4;3;-2;1]
w4 =

            -4.00
             3.00
            -2.00
             1.00
```

Verify Factorization

```
>> [w1 w2 w3 w4]*[2 1 0 0;0 2 0 0;0 0 0 1;0 0 0 0]*inv([w1 w2 w3 w4])
ans =

             1.00              1.00                 0             -0.00
             0.00              1.00              1.00             -0.00
            -0.00              0.00              1.00              1.00
            -1.00              0.00              2.00              1.00
>> inv([w1 w2 w3 w4])
ans =

                0              0.25              0.50              0.25
            -0.25             -0.25              0.25              0.25
             0.50             -0.25             -1.00              0.75
            -0.25              0.25              0.25             -0.25
```

```
>> [w3 w4 w1 w2]*[0 1 0 0;0 0 0 0;0 0 2 1;0 0 0 2]*inv([w3 w4 w1 w2])
ans =

        1.00          1.00         -0.00            0
       -0.00          1.00          1.00            0
       -0.00         -0.00          1.00         1.00
       -1.00         -0.00          2.00         1.00

>> inv([w3 w4 w1 w2])
ans =

        0.50         -0.25         -1.00         0.75
       -0.25          0.25          0.25        -0.25
       -0.00          0.25          0.50         0.25
       -0.25         -0.25          0.25         0.25
```

5)

A)

```
>> A = [1 1 -2;-1 2 1;0 1 -1]
A =

    1     1    -2
   -1     2     1
    0     1    -1

>> Xo = [5;2;3]
Xo =

    5
    2
    3

>> eigs(A)
ans =

    2.0000
    1.0000
   -1.0000

>> rref(A+eye(3))
ans =

    1     0    -1
    0     1     0
    0     0     0

>> rref(A-eye(3))
ans =

    1     0    -3
    0     1    -2
    0     0     0

>> rref(A-2*eye(3))
ans =

    1     0    -1
```

```
     0      1     -3
     0      0      0
>> format rat
>> inv([1 3 1; 0 2 3; 1 1 1])
ans =

     -1/6              -1/3               7/6
      1/2               0                -1/2
     -1/3               1/3               1/3

>> ans*[5;2;3]
ans =

      2
      1
      1/9007199254740992
```

B)

```
>> A = [4 6 6;1 3 2;-1 -5 -2]
A =

      4                 6                 6
      1                 3                 2
     -1                -5                -2

>> eigs(A)
ans =

         2.00
         2.00
         1.00

>> rref(A-2*eye(3))
ans =

         1.00              0            1.50
            0           1.00            0.50
            0              0               0
>> rref([A-2*eye(3) [-3;-1;2]])
ans =

      1                 0               3/2            -3/4
      0                 1               1/2            -1/4
      0                 0               0               0

>> rref(A-eye(3))
ans =

      1                 0               4/3
      0                 1               1/3
      0                 0               0
>> inv([-3 -15 -4;-1 -5 -1;2 8 3])
ans =

      7/2              -13/2              5/2
     -1/2               1/2              -1/2
     -1                 3                 0

>> ans*Xo
```

```
ans =

    12
    -3
     1
```