In [26]:
```
# ISMET OKAN CELIK CWID:10472265
# Homework-6
```

In [41]:
```
import numpy as np

def matrix_factor(R, P, Q, K, steps, alpha, beta):
    for step in range(steps):
        for i in range(len(R)):
            for j in range(len(R[i])):
                if R[i][j] > 0:

                    error = R[i][j] - np.dot(P[i,:],Q[:,j])

                    for k in range(K):

                        Gradient1=(2 * error * Q[k][j] - beta * P[i][k])
                        Gradient2=(2 * error * P[i][k] - beta * Q[k][j])

                        P[i][k] = P[i][k] + alpha * Gradient1
                        Q[k][j] = Q[k][j] + alpha * Gradient2

    return P,Q
```

In [61]:
```
R=np.array([[5,3,0,1],
            [4,0,0,1],
            [1,1,0,5],
            [1,0,0,4],
            [0,1,5,4]])

nRow, nCol =np.shape(R)

K=2
P=np.random.rand(nRow,K)
Q=np.random.rand(K,nCol)

steps=5000
alpha=0.0002
beta=0.02
nP,nQ=matrix_factor(R,P,Q,K,steps,alpha,beta)
```

In [62]:
```
np.dot(nP,nQ)
```

Out[62]:
```
array([[5.01251503, 2.88358879, 5.72358085, 0.99841092],
       [3.9491545 , 2.27711736, 4.65029273, 0.99747176],
       [1.09429696, 0.74789197, 4.42288605, 4.96644042],
       [0.95405708, 0.64318265, 3.61845706, 3.97441095],
       [2.17053854, 1.33833387, 4.8824778 , 4.02962678]])
```

In [63]:
```
R
```

Out[63]:
```
array([[5, 3, 0, 1],
       [4, 0, 0, 1],
       [1, 1, 0, 5],
       [1, 0, 0, 4],
       [0, 1, 5, 4]])
```

In [58]:
```
R=np.array([[4,3,0,1,2],
            [5,0,0,1,0],
            [1,2,1,5,4],
            [1,0,0,4,0],
            [0,1,5,4,0],
            [5,5,0,0,1]])

nRow, nCol =np.shape(R)

K=3
P=np.random.rand(nRow,K)
Q=np.random.rand(K,nCol)

steps=10000
alpha=0.0002
beta=0.02

nP,nQ=matrix_factor(R, P, Q, K, steps, alpha, beta)
```

In [59]:
```
np.dot(nP,nQ)
```

Out[59]:
```
array([[4.00393279, 2.96801337, 3.3495112 , 1.03261157, 1.96057978],
       [4.97648818, 3.50768434, 4.27513264, 0.99350213, 2.29336459],
       [1.00426565, 1.98493593, 1.01274581, 4.96844592, 3.98101392],
       [0.99672298, 1.43692215, 1.30237308, 3.98485439, 3.44315635],
       [2.96626042, 1.01373931, 4.97555751, 3.98072785, 5.2177704 ],
       [4.97163129, 4.987712  , 2.43726713, 0.70521586, 1.01734922]])
```

In [60]:
```
R
```

Out[60]:
```
array([[4, 3, 0, 1, 2],
       [5, 0, 0, 1, 0],
       [1, 2, 1, 5, 4],
       [1, 0, 0, 4, 0],
       [0, 1, 5, 4, 0],
       [5, 5, 0, 0, 1]])
```

In [ ]: