Assignment 1

Part 1

(a) Mean Vector and Total Variance

```
Enter the threshold epsilon:0.001
(1503, 6)
The mean of each attribute is:
[2.88638057e+03 6.78230206e+00 1.36548237e-01 5.08607452e+01
 1.11398804e-02 1.24835943e+02]
------------------------------------------------------------
The variance of each attribute is:
[9.93210480e+06 3.50009376e+01 8.74404626e-03 2.42350262e+02
 1.72813606e-04 4.75597989e+01]
Tht total variance is: 9932429.717196094
```

(b) Covariance Matrix

Inner product method:

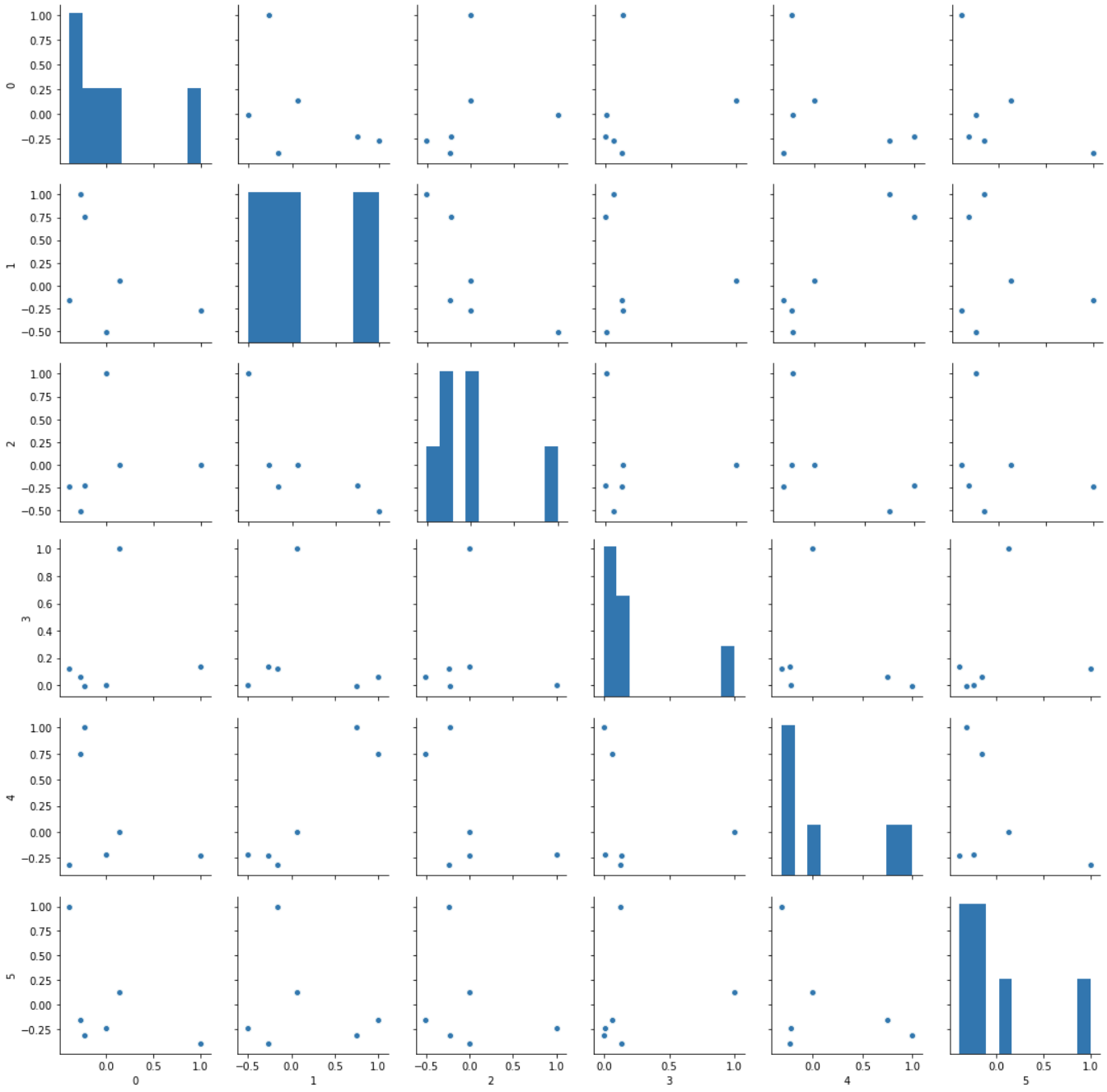
```
The covariance matrix through inner product is:
[[ 9.93210480e+06 -5.08567251e+03 -1.07878216e+00  6.55777176e+03
  -9.53323084e+00 -8.49174115e+03]
 [-5.08567251e+03  3.50009376e+01 -2.79301994e-01  5.41178032e+00
   5.85936885e-02 -6.36918252e+00]
 [-1.07878216e+00 -2.79301994e-01  8.74404626e-03  5.51227277e-03
  -2.71473666e-04 -1.52294896e-01]
 [ 6.55777176e+03  5.41178032e+00  5.51227277e-03  2.42350262e+02
  -8.13279857e-04  1.34310135e+01]
 [-9.53323084e+00  5.85936885e-02 -2.71473666e-04 -8.13279857e-04
   1.72813606e-04 -2.83461772e-02]
 [-8.49174115e+03 -6.36918252e+00 -1.52294896e-01  1.34310135e+01
  -2.83461772e-02  4.75597989e+01]]
```

Outer Product Method:

```
The covraince matrix through outer product is:
[[ 9.93210480e+06 -5.08567251e+03 -1.07878216e+00  6.55777176e+03
  -9.53323084e+00 -8.49174115e+03]
 [-5.08567251e+03  3.50009376e+01 -2.79301994e-01  5.41178032e+00
   5.85936885e-02 -6.36918252e+00]
 [-1.07878216e+00 -2.79301994e-01  8.74404626e-03  5.51227277e-03
  -2.71473666e-04 -1.52294896e-01]
 [ 6.55777176e+03  5.41178032e+00  5.51227277e-03  2.42350262e+02
  -8.13279857e-04  1.34310135e+01]
 [-9.53323084e+00  5.85936885e-02 -2.71473666e-04 -8.13279857e-04
   1.72813606e-04 -2.83461772e-02]
 [-8.49174115e+03 -6.36918252e+00 -1.52294896e-01  1.34310135e+01
  -2.83461772e-02  4.75597989e+01]]
```

c. Correlation matrix as pair-wise cosines

```
The correlation matrix is:
[[ 1.         -0.27276454 -0.00366064  0.13366383 -0.23010735 -0.39071141]
 [-0.27276454  1.         -0.50486815  0.05875957  0.75339378 -0.15610753]
 [-0.00366064 -0.50486815  1.          0.00378663 -0.22084243 -0.23616151]
 [ 0.13366383  0.05875957  0.00378663  1.         -0.00397401  0.1251028 ]
 [-0.23010735  0.75339378 -0.22084243 -0.00397401  1.         -0.31266951]
 [-0.39071141 -0.15610753 -0.23616151  0.1251028  -0.31266951  1.        ]]
```



Part 2

The Eigen vectors and Eigen values are:

```
The eigen values are:
The eigen vectors u1 and u2 are:
[[ 1.00000000e+00  1.00000000e+00]
 [-5.12043919e-04 -5.12043919e-04]
 [-1.08587778e-07 -1.08587778e-07]
 [ 6.60274411e-04  6.60274411e-04]
 [-9.59839186e-07 -9.59839186e-07]
 [-8.54980596e-04 -8.54980596e-04]]
```

The new points projected along the Eigen vectors are:

```
The new projected points in 2D are:
[[-2086.36477094 -2086.36477094]
 [-1886.36391596 -1886.36391596]
 [-1636.3645572  -1636.3645572 ]
 ...
 [ 1113.6230655   1113.6230655 ]
 [ 2113.62339039  2113.62339039]
 [ 3413.62511746  3413.62511746]]
```

Projection of plots on to new dimensions