

All numbers are in 3 precision

Part I

a)

Mean vector:

```
[[97.695]
 [ 3.802]
 [21.687]
 ...
 [38.331]
 [ 3.761]
 [24.988]]
```

Total variance:

12504.288

b)

Covariance matrix inner product form:

```
[[ 1.051e+04  1.605e+02  9.130e+00 ...  2.785e-01  6.602e+00 -1.656e+01]
 [ 1.605e+02  6.298e+01 -2.999e-01 ...  1.875e+00 -1.209e+00  5.995e-02]
 [ 9.130e+00 -2.999e-01  2.579e+00 ... -1.444e+00  3.849e+00 -1.444e-01]
 ...
 [ 2.785e-01  1.875e+00 -1.444e+00 ...  1.391e+02 -2.087e+00 -1.007e+00]
 [ 6.602e+00 -1.209e+00  3.849e+00 ... -2.087e+00  1.759e+01 -2.397e-01]
 [-1.656e+01  5.995e-02 -1.444e-01 ... -1.007e+00 -2.397e-01  2.101e+02]]
```

Outer product form:

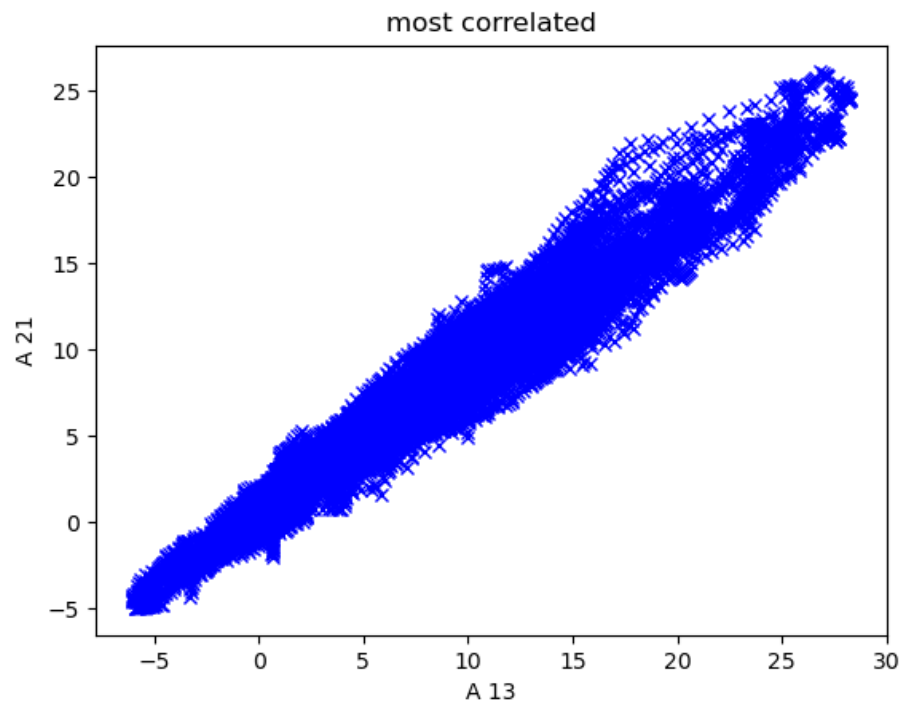
```
[[ 1.051e+04  1.605e+02  9.130e+00 ...  2.785e-01  6.602e+00 -1.656e+01]
 [ 1.605e+02  6.298e+01 -2.999e-01 ...  1.875e+00 -1.209e+00  5.995e-02]
 [ 9.130e+00 -2.999e-01  2.579e+00 ... -1.444e+00  3.849e+00 -1.444e-01]
 ...
 [ 2.785e-01  1.875e+00 -1.444e+00 ...  1.391e+02 -2.087e+00 -1.007e+00]
 [ 6.602e+00 -1.209e+00  3.849e+00 ... -2.087e+00  1.759e+01 -2.397e-01]
 [-1.656e+01  5.995e-02 -1.444e-01 ... -1.007e+00 -2.397e-01  2.101e+02]]
```

c)

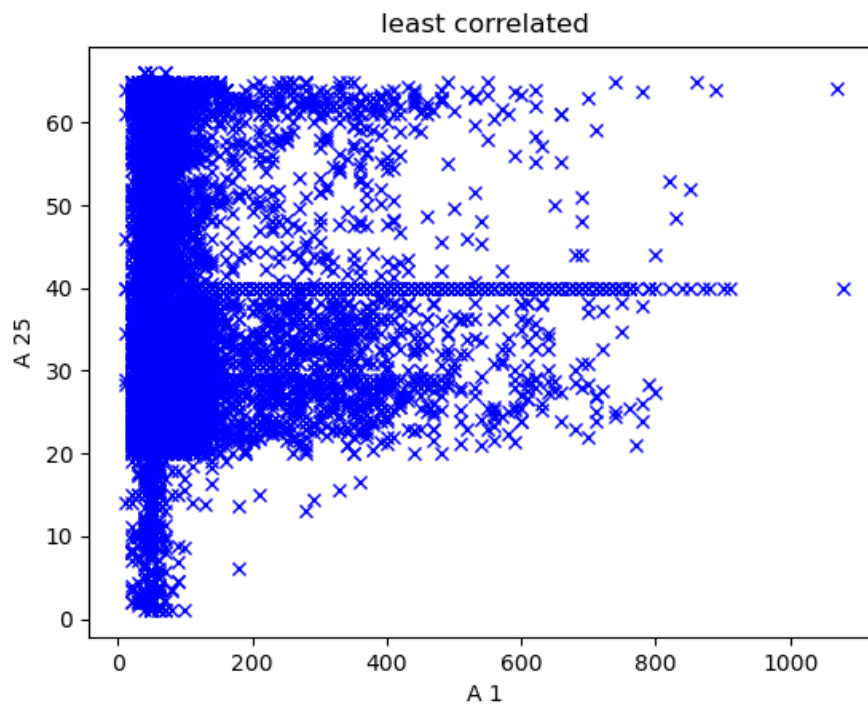
Correlation matrix:

```
[[ 1.000e+00  1.973e-01  5.545e-02 ...  2.304e-04  1.535e-02 -1.114e-02]
 [ 1.973e-01  1.000e+00 -2.353e-02 ...  2.004e-02 -3.632e-02  5.211e-04]
 [ 5.545e-02 -2.353e-02  1.000e+00 ... -7.621e-02  5.713e-01 -6.203e-03]
 ...
 [ 2.304e-04  2.004e-02 -7.621e-02 ...  1.000e+00 -4.219e-02 -5.889e-03]
 [ 1.535e-02 -3.632e-02  5.713e-01 ... -4.219e-02  1.000e+00 -3.943e-03]
```

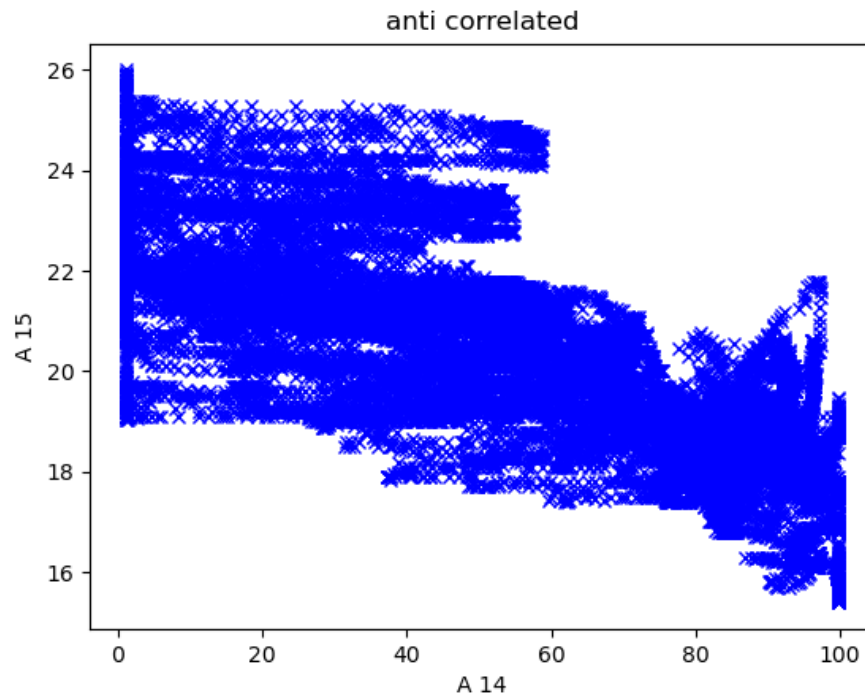
`[-1.114e-02 5.211e-04 -6.203e-03 ... -5.889e-03 -3.943e-03 1.000e+00]`



In the above most correlated graph, the selected attribute pair is the most correlated. From the graph, we can see that the points are closed with each other since they have a small angle between their centered attribute vector; from the shape, we could tell it is close to a line.



In the above least correlated graph, we can see that the points still have positive relation; however, it is more scattered than the previous graph, since the angle between their centered attribute vector is close to 90 degrees.



From the anti correlated graph, we can tell that the points have an inverse relationship, since the shape is like an arc down curve.

Part II

eigenvalue:

10528.132

dominant eigenvector:

[[9.991e-01]

[1.520e-02]

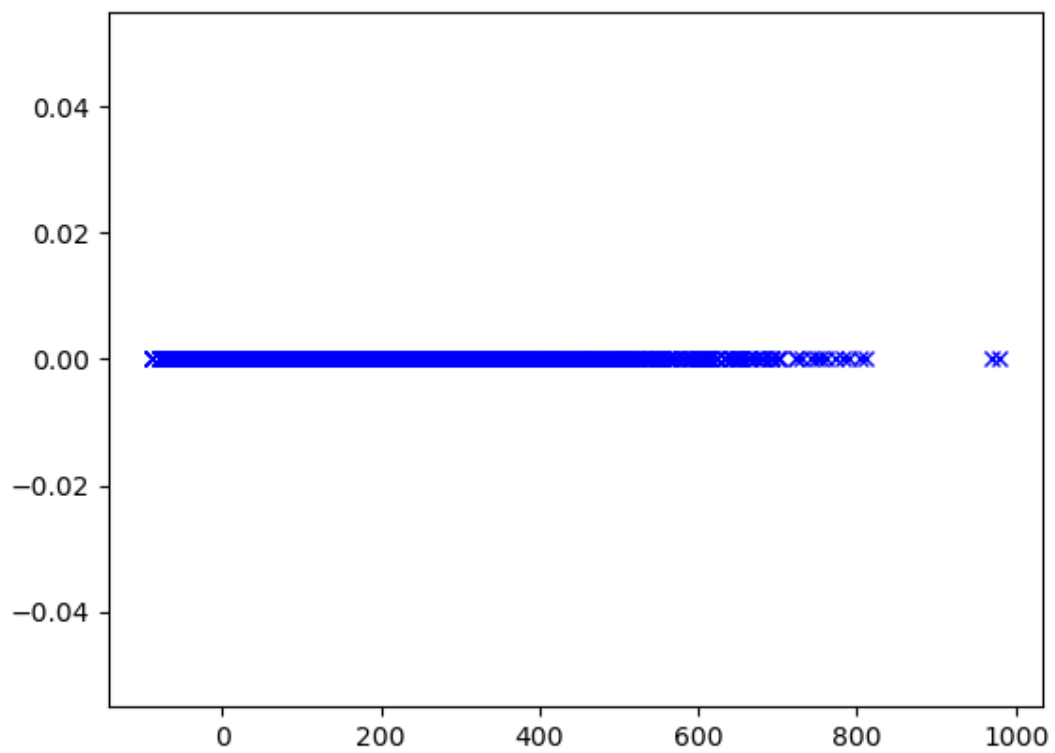
[9.793e-04]

...

[-1.254e-04]

[7.344e-04]

[-1.631e-03]]



The above graph is the projected data by the **eigenvector**