Name: Linghao Shi
RIN: 661954958
Course: CSCI4390

Part 1(a)
Mean vector is:
[97.695   3.8019 21.6866 40.2597 20.3412 40.4204 22.2676 39.2425
  20.8553 39.0269 19.5921 50.9493   7.9109 54.6091 20.2671 35.3882
  22.0291 42.9362 19.4858 41.5524   7.4117 755.5226 79.7504   4.0398
  38.3308   3.7607 24.988]

Total Varance var(D) is:
12504.288

Part 1(b)
Inner product is:
[[10510.8206   160.504   9.1296   35.0971   26.9952   -25.2281
    17.4939   12.109   8.4363   7.5508   3.7368   6.4325
    73.4507 -265.6251   5.5812   -29.1737   7.936   -50.3671
     2.0676   -21.9028   54.0531   -26.4632 -232.6349   21.8936
     0.2785   6.6023   -16.5635]
 [160.504   62.9767   -0.2999   3.3778   -0.0978   1.6466
    -1.5505   3.3875   -0.1436   3.9596   -1.1527   10.1116
    -3.8195   38.0074   -2.2663   1.4233   -1.1093   0.5354
    -2.5196   -0.2888   -3.1405   -0.621   8.1051   1.1726
     1.8755   -1.2091   0.0599]
 [9.1296   -0.2999   2.5793   1.0481   2.9472   -0.0164
     2.8751   -0.1492   2.8773   0.6823   2.6225   -0.2142
     6.4043   -30.7683   2.842   1.1103   2.5931   -0.054
     2.7334   0.4784   5.8313   -1.7893   -8.2677   -0.3451
    -1.4436   3.8486   -0.1444]
 [35.0971   3.3778   1.0481   15.834   2.3546   12.9154
     2.0214   10.9388   0.8631   15.2078   1.5105   10.8868
     7.6614   30.3829   0.1796   16.3028   -0.2339   15.3042
     0.924   12.6207   7.2101   -8.655   16.2537   1.9988
    -0.9883   10.6673   -0.0403]
 [26.9952   -0.0978   2.9472   2.3546   4.8089   -1.478
     3.2344   0.8671   3.4139   2.2045   2.9146   0.5855
    10.7001   -39.6436   3.0707   2.5706   2.4802   0.7851
     2.9845   1.4324   9.238   -2.1585   -16.5109   0.2822
    -1.8033   5.3589   -0.3525]
 [-25.2281   1.6466   -0.0164   12.9154   -1.478   16.5625
     1.1211   8.9843   -0.3933   12.7459   0.8288   9.189
    -0.2397   49.4308   -0.4416   14.373   -0.3266   14.4528
     0.4472   11.4289   0.7287   -7.6982   35.4699   0.6902
    -0.2576   8.5208   0.3702]
 [17.4939   -1.5505   2.8751   2.0214   3.2344   1.1211

```
    4.0243   -0.0733    3.4947    1.0689    3.2865   -1.2009
    8.3918  -40.471     3.5867    1.771     3.1208    0.4656
    3.6427    1.121     7.4605   -2.8199   -8.421    -0.4955
   -2.4207    5.4348   -0.1511]
[  12.109     3.3875   -0.1492   10.9388    0.8671    8.9843
   -0.0733   10.5917   -0.9338   12.7012   -0.3005   11.0229
    1.5229   52.1988   -1.7173   13.859    -1.8031   14.0918
   -1.2803   11.2617    2.0456   -5.6174   17.2733    2.0995
    0.6541    5.6568   -0.0225]
[   8.4363   -0.1436    2.8773    0.8631    3.4139   -0.3933
    3.4947   -0.9338    4.1732   -0.4314    3.2851   -1.4097
    8.116   -44.7429    3.7834    0.4547    3.1818   -1.0159
    3.6606   -0.2167    7.2069   -1.1381  -11.8289   -0.9301
   -2.5243    4.4512   -0.0537]
[   7.5508    3.9596    0.6823   15.2078    2.2045   12.7459
    1.0689   12.7012   -0.4314   18.8461    0.7352   13.8094
    6.8489   53.032    -1.2018   19.8546   -1.4187   19.2154
   -0.3894   15.4375    6.7701   -8.0544   21.7874    3.1943
    0.135    11.2263   -0.1124]
[   3.7368   -1.1527    2.6225    1.5105    2.9146    0.8288
    3.2865   -0.3005    3.2851    0.7352    3.4025    0.5456
    7.0679  -36.3347    3.3884    1.4047    2.9767    0.1579
    3.3857    0.5537    6.3882   -2.3339   -7.5297   -0.6556
   -1.8311    4.5522   -0.1468]
[   6.4325   10.1116   -0.2142   10.8868    0.5855    9.189
   -1.2009   11.0229   -1.4097   13.8094    0.5456   81.393
   -4.3042   74.1322   -2.7187   15.0322   -1.5352   16.96
   -2.5175   10.1946   -2.5485   -7.9657   24.9963    1.8143
   -1.3975    2.9583   -1.446 ]
[  73.4507   -3.8195    6.4043    7.6614   10.7001   -0.2397
    8.3918    1.5229    8.116     6.8489    7.0679   -4.3042
   37.0904 -127.5067    7.9552    7.9757    5.7521    2.3456
    8.186     4.6628   31.5667   -6.3828  -51.6465    2.5256
   -5.8407   19.523    -1.3319]
[-265.6251   38.0074  -30.7683   30.3829  -39.6436   49.4308
  -40.471    52.1988  -44.7429   53.032   -36.3347   74.1322
 -127.5067  970.2612  -49.553    56.9049  -40.572    79.6692
  -46.372    50.6829 -106.2622  -15.1688  333.5266    7.5066
   39.9367  -34.025     5.2701]
[   5.5812   -2.2663    2.842     0.1796    3.0707   -0.4416
    3.5867   -1.7173    3.7834   -1.2018    3.3884   -2.7187
    7.9552  -49.553     4.4518   -0.3663    3.6408   -2.3144
    4.0161   -0.6805    7.0826   -1.5257  -12.9284   -0.9614
   -2.7396    4.1297   -0.1193]
[ -29.1737    1.4233    1.1103   16.3028    2.5706   14.373
    1.771    13.859     0.4547   19.8546    1.4047   15.0322
    7.9757   56.9049   -0.3663   26.1538   -1.2415   23.6175
    0.2891   18.2304    8.0001  -10.0598   28.8444    2.6698
   -0.4333   13.7686    0.1349]
[   7.936    -1.1093    2.5931   -0.2339    2.4802   -0.3266
```

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    3.1208   -1.8031    3.1818   -1.4187    2.9767   -1.5352
    5.7521  -40.572     3.6408   -1.2415    3.8264   -2.1412
    3.426    -1.2735    5.2302   -2.3571   -8.757    -1.0495
   -1.3865    3.2148   -0.091 ]
[ -50.3671    0.5354   -0.054    15.3042    0.7851   14.4528
    0.4656   14.0918   -1.0159   19.2154    0.1579   16.96
    2.3456   79.6692   -2.3144   23.6175   -2.1412   27.2926
   -1.1895   18.5607    3.254    -8.7203   37.938     2.5916
    2.8453   10.9955    0.3393]
[   2.0676   -2.5196    2.7334    0.924     2.9845    0.4472
    3.6427   -1.2803    3.6606   -0.3894    3.3857   -2.5175
    8.186   -46.372     4.0161    0.2891    3.426    -1.1895
    4.0589   -0.0726    7.1583   -2.3378   -9.5718   -0.8778
   -2.4692    4.9139   -0.0358]
[ -21.9028   -0.2888    0.4784   12.6207    1.4324   11.4289
    1.121    11.2617   -0.2167   15.4375    0.5537   10.1946
    4.6628   50.6829   -0.6805   18.2304   -1.2735   18.5607
   -0.0726   17.2341    4.9285   -5.644    22.2306    2.4285
    0.4244    9.4088   -0.1778]
[   54.0531   -3.1405    5.8313    7.2101    9.238     0.7287
    7.4605    2.0456    7.2069    6.7701    6.3882   -2.5485
   31.5667 -106.2622    7.0826    8.0001    5.2302    3.254
    7.1583    4.9285   28.2734   -5.636   -45.4943    2.5146
   -4.852    17.6345   -1.1729]
[ -26.4632   -0.621    -1.7893   -8.655    -2.1585   -7.6982
   -2.8199   -5.6174   -1.1381   -8.0544   -2.3339   -7.9657
   -6.3828  -15.1688   -1.5257  -10.0598   -2.3571   -8.7203
   -2.3378   -5.644    -5.636    54.7489  -10.1452   -4.2627
    3.5183   -7.5759    0.075 ]
[ -232.6349    8.1051   -8.2677   16.2537  -16.5109   35.4699
   -8.421    17.2733  -11.8289   21.7874   -7.5297   24.9963
  -51.6465  333.5266  -12.9284   28.8444   -8.757    37.938
   -9.5718   22.2306  -45.4943  -10.1452  222.0312   -6.445
   14.6088    2.2817    4.4153]
[   21.8936    1.1726   -0.3451    1.9988    0.2822    0.6902
   -0.4955    2.0995   -0.9301    3.1943   -0.6556    1.8143
    2.5256    7.5066   -0.9614    2.6698   -1.0495    2.5916
   -0.8778    2.4285    2.5146   -4.2627   -6.445     6.0082
   -0.2173    1.2952   -0.403 ]
[   0.2785    1.8755   -1.4436   -0.9883   -1.8033   -0.2576
   -2.4207    0.6541   -2.5243    0.135    -1.8311   -1.3975
   -5.8407   39.9367   -2.7396   -0.4333   -1.3865    2.8453
   -2.4692    0.4244   -4.852     3.5183   14.6088   -0.2173
  139.1083   -2.0872   -1.0068]
[   6.6023   -1.2091    3.8486   10.6673    5.3589    8.5208
    5.4348    5.6568    4.4512   11.2263    4.5522    2.9583
   19.523   -34.025     4.1297   13.7686    3.2148   10.9955
    4.9139    9.4088   17.6345   -7.5759    2.2817    1.2952
   -2.0872   17.5942   -0.2397]
[ -16.5635    0.0599   -0.1444   -0.0403   -0.3525    0.3702
```

```
    -0.1511    -0.0225    -0.0537    -0.1124    -0.1468    -1.446
    -1.3319     5.2701    -0.1193     0.1349    -0.091      0.3393
    -0.0358    -0.1778    -1.1729     0.075      4.4153    -0.403
    -1.0068    -0.2397   210.1417]]


Outer product is:
[[10510.8206   160.504      9.1296    35.0971    26.9952   -25.2281
    17.4939    12.109      8.4363     7.5508     3.7368     6.4325
    73.4507  -265.6251     5.5812   -29.1737     7.936    -50.3671
     2.0676   -21.9028    54.0531   -26.4632  -232.6349    21.8936
     0.2785     6.6023   -16.5635]
 [  160.504     62.9767    -0.2999     3.3778    -0.0978     1.6466
    -1.5505     3.3875    -0.1436     3.9596    -1.1527    10.1116
    -3.8195    38.0074    -2.2663     1.4233    -1.1093     0.5354
    -2.5196    -0.2888    -3.1405    -0.621      8.1051     1.1726
     1.8755    -1.2091     0.0599]
 [    9.1296    -0.2999     2.5793     1.0481     2.9472    -0.0164
     2.8751    -0.1492     2.8773     0.6823     2.6225    -0.2142
     6.4043   -30.7683     2.842      1.1103     2.5931    -0.054
     2.7334     0.4784     5.8313    -1.7893    -8.2677    -0.3451
    -1.4436     3.8486    -0.1444]
 [   35.0971     3.3778     1.0481    15.834      2.3546    12.9154
     2.0214    10.9388     0.8631    15.2078     1.5105    10.8868
     7.6614    30.3829     0.1796    16.3028    -0.2339    15.3042
     0.924     12.6207     7.2101    -8.655     16.2537     1.9988
    -0.9883    10.6673    -0.0403]
 [   26.9952    -0.0978     2.9472     2.3546     4.8089    -1.478
     3.2344     0.8671     3.4139     2.2045     2.9146     0.5855
    10.7001   -39.6436     3.0707     2.5706     2.4802     0.7851
     2.9845     1.4324     9.238     -2.1585   -16.5109     0.2822
    -1.8033     5.3589    -0.3525]
 [  -25.2281     1.6466    -0.0164    12.9154    -1.478     16.5625
     1.1211     8.9843    -0.3933    12.7459     0.8288     9.189
    -0.2397    49.4308    -0.4416    14.373     -0.3266    14.4528
     0.4472    11.4289     0.7287    -7.6982    35.4699     0.6902
    -0.2576     8.5208     0.3702]
 [   17.4939    -1.5505     2.8751     2.0214     3.2344     1.1211
     4.0243    -0.0733     3.4947     1.0689     3.2865    -1.2009
     8.3918   -40.471      3.5867     1.771      3.1208     0.4656
     3.6427     1.121      7.4605    -2.8199    -8.421     -0.4955
    -2.4207     5.4348    -0.1511]
 [   12.109      3.3875    -0.1492    10.9388     0.8671     8.9843
    -0.0733    10.5917    -0.9338    12.7012    -0.3005    11.0229
     1.5229    52.1988    -1.7173    13.859     -1.8031    14.0918
    -1.2803    11.2617     2.0456    -5.6174    17.2733     2.0995
     0.6541     5.6568    -0.0225]
 [    8.4363    -0.1436     2.8773     0.8631     3.4139    -0.3933
     3.4947    -0.9338     4.1732    -0.4314     3.2851    -1.4097
     8.116    -44.7429     3.7834     0.4547     3.1818    -1.0159
```

```
    3.6606   -0.2167    7.2069   -1.1381  -11.8289   -0.9301
   -2.5243    4.4512   -0.0537]
[   7.5508    3.9596    0.6823   15.2078    2.2045   12.7459
    1.0689   12.7012   -0.4314   18.8461    0.7352   13.8094
    6.8489   53.032    -1.2018   19.8546   -1.4187   19.2154
   -0.3894   15.4375    6.7701   -8.0544   21.7874    3.1943
    0.135    11.2263   -0.1124]
[   3.7368   -1.1527    2.6225    1.5105    2.9146    0.8288
    3.2865   -0.3005    3.2851    0.7352    3.4025    0.5456
    7.0679  -36.3347    3.3884    1.4047    2.9767    0.1579
    3.3857    0.5537    6.3882   -2.3339   -7.5297   -0.6556
   -1.8311    4.5522   -0.1468]
[   6.4325   10.1116   -0.2142   10.8868    0.5855    9.189
   -1.2009   11.0229   -1.4097   13.8094    0.5456   81.393
   -4.3042   74.1322   -2.7187   15.0322   -1.5352   16.96
   -2.5175   10.1946   -2.5485   -7.9657   24.9963    1.8143
   -1.3975    2.9583   -1.446 ]
[  73.4507   -3.8195    6.4043    7.6614   10.7001   -0.2397
    8.3918    1.5229    8.116     6.8489    7.0679   -4.3042
   37.0904 -127.5067    7.9552    7.9757    5.7521    2.3456
    8.186     4.6628   31.5667   -6.3828  -51.6465    2.5256
   -5.8407   19.523    -1.3319]
[-265.6251   38.0074  -30.7683   30.3829  -39.6436   49.4308
  -40.471    52.1988  -44.7429   53.032   -36.3347   74.1322
 -127.5067  970.2612  -49.553    56.9049  -40.572    79.6692
  -46.372    50.6829 -106.2622  -15.1688  333.5266    7.5066
   39.9367  -34.025     5.2701]
[   5.5812   -2.2663    2.842     0.1796    3.0707   -0.4416
    3.5867   -1.7173    3.7834   -1.2018    3.3884   -2.7187
    7.9552  -49.553     4.4518   -0.3663    3.6408   -2.3144
    4.0161   -0.6805    7.0826   -1.5257  -12.9284   -0.9614
   -2.7396    4.1297   -0.1193]
[ -29.1737    1.4233    1.1103   16.3028    2.5706   14.373
    1.771    13.859     0.4547   19.8546    1.4047   15.0322
    7.9757   56.9049   -0.3663   26.1538   -1.2415   23.6175
    0.2891   18.2304    8.0001  -10.0598   28.8444    2.6698
   -0.4333   13.7686    0.1349]
[   7.936    -1.1093    2.5931   -0.2339    2.4802   -0.3266
    3.1208   -1.8031    3.1818   -1.4187    2.9767   -1.5352
    5.7521  -40.572     3.6408   -1.2415    3.8264   -2.1412
    3.426    -1.2735    5.2302   -2.3571   -8.757    -1.0495
   -1.3865    3.2148   -0.091 ]
[ -50.3671    0.5354   -0.054    15.3042    0.7851   14.4528
    0.4656   14.0918   -1.0159   19.2154    0.1579   16.96
    2.3456   79.6692   -2.3144   23.6175   -2.1412   27.2926
   -1.1895   18.5607    3.254    -8.7203   37.938     2.5916
    2.8453   10.9955    0.3393]
[   2.0676   -2.5196    2.7334    0.924     2.9845    0.4472
    3.6427   -1.2803    3.6606   -0.3894    3.3857   -2.5175
    8.186   -46.372     4.0161    0.2891    3.426    -1.1895
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    4.0589   -0.0726    7.1583   -2.3378   -9.5718   -0.8778
   -2.4692    4.9139   -0.0358]
[ -21.9028   -0.2888    0.4784   12.6207    1.4324   11.4289
    1.121   11.2617   -0.2167   15.4375    0.5537   10.1946
    4.6628   50.6829   -0.6805   18.2304   -1.2735   18.5607
   -0.0726   17.2341    4.9285   -5.644    22.2306    2.4285
    0.4244    9.4088   -0.1778]
[  54.0531   -3.1405    5.8313    7.2101    9.238     0.7287
    7.4605    2.0456    7.2069    6.7701    6.3882   -2.5485
   31.5667 -106.2622    7.0826    8.0001    5.2302    3.254
    7.1583    4.9285   28.2734   -5.636   -45.4943    2.5146
   -4.852   17.6345   -1.1729]
[ -26.4632   -0.621    -1.7893   -8.655    -2.1585   -7.6982
   -2.8199   -5.6174   -1.1381   -8.0544   -2.3339   -7.9657
   -6.3828  -15.1688   -1.5257  -10.0598   -2.3571   -8.7203
   -2.3378   -5.644    -5.636    54.7489  -10.1452   -4.2627
    3.5183   -7.5759    0.075 ]
[ -232.6349    8.1051   -8.2677   16.2537  -16.5109   35.4699
   -8.421    17.2733  -11.8289   21.7874   -7.5297   24.9963
  -51.6465  333.5266  -12.9284   28.8444   -8.757    37.938
   -9.5718   22.2306  -45.4943  -10.1452  222.0312   -6.445
   14.6088    2.2817    4.4153]
[  21.8936    1.1726   -0.3451    1.9988    0.2822    0.6902
   -0.4955    2.0995   -0.9301    3.1943   -0.6556    1.8143
    2.5256    7.5066   -0.9614    2.6698   -1.0495    2.5916
   -0.8778    2.4285    2.5146   -4.2627   -6.445     6.0082
   -0.2173    1.2952   -0.403 ]
[   0.2785    1.8755   -1.4436   -0.9883   -1.8033   -0.2576
   -2.4207    0.6541   -2.5243    0.135    -1.8311   -1.3975
   -5.8407   39.9367   -2.7396   -0.4333   -1.3865    2.8453
   -2.4692    0.4244   -4.852     3.5183   14.6088   -0.2173
  139.1083   -2.0872   -1.0068]
[   6.6023   -1.2091    3.8486   10.6673    5.3589    8.5208
    5.4348    5.6568    4.4512   11.2263    4.5522    2.9583
   19.523   -34.025     4.1297   13.7686    3.2148   10.9955
    4.9139    9.4088   17.6345   -7.5759    2.2817    1.2952
   -2.0872   17.5942   -0.2397]
[ -16.5635    0.0599   -0.1444   -0.0403   -0.3525    0.3702
   -0.1511   -0.0225   -0.0537   -0.1124   -0.1468   -1.446
   -1.3319    5.2701   -0.1193    0.1349   -0.091     0.3393
   -0.0358   -0.1778   -1.1729    0.075     4.4153   -0.403
   -1.0068   -0.2397  210.1417]]

---------------------------------------------------------------------------
Part 1(c)
Correlation matrix is:
[[ 1.      0.1973  0.0554  0.086   0.1201 -0.0605  0.0851  0.0363  0.0403
   0.017   0.0198  0.007   0.1176 -0.0832  0.0258 -0.0556  0.0396 -0.094
   0.01   -0.0515  0.0992 -0.0349 -0.1523  0.0871  0.0002  0.0154 -0.0111]
 [ 0.1973  1.     -0.0235  0.107  -0.0056  0.051  -0.0974  0.1312 -0.0089
```

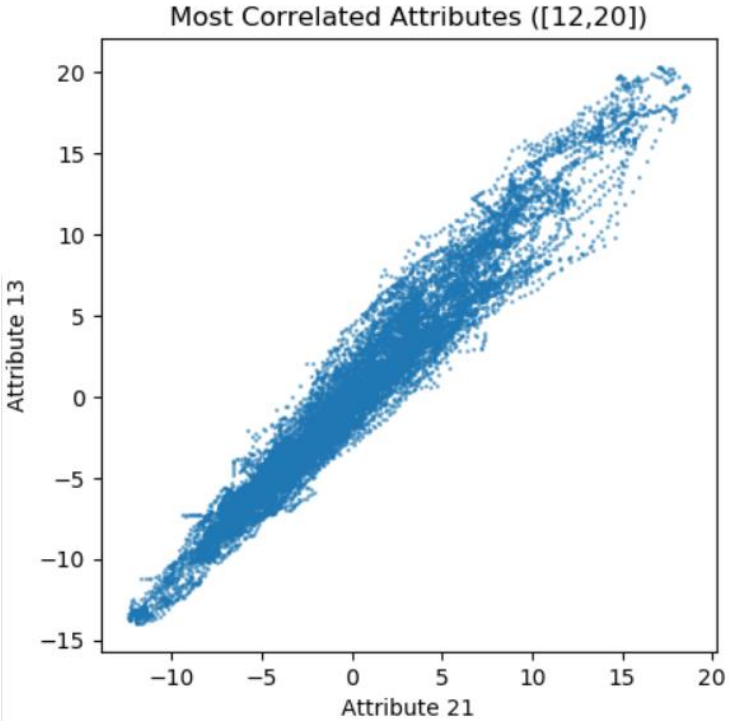
```
  0.1149 -0.0787  0.1412 -0.079   0.1538 -0.1353  0.0351 -0.0715  0.0129
 -0.1576 -0.0088 -0.0744 -0.0106  0.0685  0.0603  0.02   -0.0363  0.0005]
[ 0.0554 -0.0235  1.      0.164   0.8368 -0.0025  0.8924 -0.0286  0.877
  0.0979  0.8852 -0.0148  0.6548 -0.615   0.8387  0.1352  0.8254 -0.0064
  0.8448  0.0718  0.6828 -0.1506 -0.3455 -0.0877 -0.0762  0.5713 -0.0062]
[ 0.086   0.107   0.164   1.      0.2698  0.7975  0.2532  0.8447  0.1062
  0.8804  0.2058  0.3033  0.3161  0.2451  0.0214  0.8011 -0.0301  0.7362
  0.1153  0.764   0.3408 -0.294   0.2741  0.2049 -0.0211  0.6391 -0.0007]
[ 0.1201 -0.0056  0.8368  0.2698  1.     -0.1656  0.7352  0.1215  0.7621
  0.2316  0.7206  0.0296  0.8012 -0.5804  0.6637  0.2292  0.5782  0.0685
  0.6755  0.1573  0.7923 -0.133  -0.5053  0.0525 -0.0697  0.5826 -0.0111]
[-0.0605  0.051  -0.0025  0.7975 -0.1656  1.      0.1373  0.6783 -0.0473
  0.7214  0.1104  0.2503 -0.0097  0.3899 -0.0514  0.6906 -0.041   0.6798
  0.0545  0.6765  0.0337 -0.2556  0.5849  0.0692 -0.0054  0.4992  0.0063]
[ 0.0851 -0.0974  0.8924  0.2532  0.7352  0.1373  1.     -0.0112  0.8528
  0.1227  0.8882 -0.0664  0.6869 -0.6477  0.8474  0.1726  0.7953  0.0444
  0.9013  0.1346  0.6994 -0.19   -0.2817 -0.1008 -0.1023  0.6459 -0.0052]
[ 0.0363  0.1312 -0.0286  0.8447  0.1215  0.6783 -0.0112  1.     -0.1405
  0.899  -0.0501  0.3754  0.0768  0.5149 -0.2501  0.8327 -0.2832  0.8288
 -0.1953  0.8335  0.1182 -0.2333  0.3562  0.2632  0.017   0.4144 -0.0005]
[ 0.0403 -0.0089  0.877   0.1062  0.7621 -0.0473  0.8528 -0.1405  1.
 -0.0487  0.8718 -0.0765  0.6523 -0.7031  0.8778  0.0435  0.7963 -0.0952
  0.8894 -0.0255  0.6635 -0.0753 -0.3886 -0.1857 -0.1048  0.5195 -0.0018]
[ 0.017   0.1149  0.0979  0.8804  0.2316  0.7214  0.1227  0.899  -0.0487
  1.      0.0918  0.3526  0.259   0.3922 -0.1312  0.8943 -0.1671  0.8473
 -0.0445  0.8566  0.2933 -0.2507  0.3368  0.3002  0.0026  0.6165 -0.0018]
[ 0.0198 -0.0787  0.8852  0.2058  0.7206  0.1104  0.8882 -0.0501  0.8718
  0.0918  1.      0.0328  0.6292 -0.6324  0.8706  0.1489  0.825   0.0164
  0.9111  0.0723  0.6513 -0.171  -0.274  -0.145  -0.0842  0.5884 -0.0055]
[ 0.007   0.1412 -0.0148  0.3033  0.0296  0.2503 -0.0664  0.3754 -0.0765
  0.3526  0.0328  1.     -0.0783  0.2638 -0.1428  0.3258 -0.087   0.3598
 -0.1385  0.2722 -0.0531 -0.1193  0.1859  0.082  -0.0131  0.0782 -0.0111]
[ 0.1176 -0.079   0.6548  0.3161  0.8012 -0.0097  0.6869  0.0768  0.6523
  0.259   0.6292 -0.0783  1.     -0.6721  0.6191  0.2561  0.4828  0.0737
  0.6672  0.1844  0.9748 -0.1416 -0.5691  0.1692 -0.0813  0.7642 -0.0151]
[-0.0832  0.1538 -0.615   0.2451 -0.5804  0.3899 -0.6477  0.5149 -0.7031
  0.3922 -0.6324  0.2638 -0.6721  1.     -0.754   0.3572 -0.6659  0.4896
 -0.7389  0.3919 -0.6416 -0.0658  0.7186  0.0983  0.1087 -0.2604  0.0117]
[ 0.0258 -0.1353  0.8387  0.0214  0.6637 -0.0514  0.8474 -0.2501  0.8778
 -0.1312  0.8706 -0.1428  0.6191 -0.754   1.     -0.0339  0.8821 -0.21
  0.9448 -0.0777  0.6313 -0.0977 -0.4112 -0.1859 -0.1101  0.4666 -0.0039]
[-0.0556  0.0351  0.1352  0.8011  0.2292  0.6906  0.1726  0.8327  0.0435
  0.8943  0.1489  0.3258  0.2561  0.3572 -0.0339  1.     -0.1241  0.884
  0.0281  0.8587  0.2942 -0.2658  0.3785  0.213  -0.0072  0.6419  0.0018]
[ 0.0396 -0.0715  0.8254 -0.0301  0.5782 -0.041   0.7953 -0.2832  0.7963
 -0.1671  0.825  -0.087   0.4828 -0.6659  0.8821 -0.1241  1.     -0.2095
  0.8693 -0.1568  0.5028 -0.1629 -0.3004 -0.2189 -0.0601  0.3918 -0.0032]
[-0.094   0.0129 -0.0064  0.7362  0.0685  0.6798  0.0444  0.8288 -0.0952
  0.8473  0.0164  0.3598  0.0737  0.4896 -0.21    0.884  -0.2095  1.
 -0.113   0.8558  0.1171 -0.2256  0.4874  0.2024  0.0462  0.5018  0.0045]
```

```
 [ 0.01   -0.1576  0.8448  0.1153  0.6755  0.0545  0.9013 -0.1953  0.8894
  -0.0445  0.9111 -0.1385  0.6672 -0.7389  0.9448  0.0281  0.8693 -0.113
   1.     -0.0087  0.6682 -0.1568 -0.3188 -0.1778 -0.1039  0.5815 -0.0012]
 [-0.0515 -0.0088  0.0718  0.764   0.1573  0.6765  0.1346  0.8335 -0.0255
   0.8566  0.0723  0.2722  0.1844  0.3919 -0.0777  0.8587 -0.1568  0.8558
  -0.0087  1.      0.2233 -0.1837  0.3594  0.2387  0.0087  0.5403 -0.003 ]
 [ 0.0992 -0.0744  0.6828  0.3408  0.7923  0.0337  0.6994  0.1182  0.6635
   0.2933  0.6513 -0.0531  0.9748 -0.6416  0.6313  0.2942  0.5028  0.1171
   0.6682  0.2233  1.     -0.1432 -0.5742  0.1929 -0.0774  0.7907 -0.0152]
 [-0.0349 -0.0106 -0.1506 -0.294  -0.133  -0.2556 -0.19   -0.2333 -0.0753
  -0.2507 -0.171  -0.1193 -0.1416 -0.0658 -0.0977 -0.2658 -0.1629 -0.2256
  -0.1568 -0.1837 -0.1432  1.     -0.092  -0.235   0.0403 -0.2441  0.0007]
 [-0.1523  0.0685 -0.3455  0.2741 -0.5053  0.5849 -0.2817  0.3562 -0.3886
   0.3368 -0.274   0.1859 -0.5691  0.7186 -0.4112  0.3785 -0.3004  0.4874
  -0.3188  0.3594 -0.5742 -0.092   1.     -0.1765  0.0831  0.0365  0.0204]
 [ 0.0871  0.0603 -0.0877  0.2049  0.0525  0.0692 -0.1008  0.2632 -0.1857
   0.3002 -0.145   0.082   0.1692  0.0983 -0.1859  0.213  -0.2189  0.2024
  -0.1778  0.2387  0.1929 -0.235  -0.1765  1.     -0.0075  0.126  -0.0113]
 [ 0.0002  0.02   -0.0762 -0.0211 -0.0697 -0.0054 -0.1023  0.017  -0.1048
   0.0026 -0.0842 -0.0131 -0.0813  0.1087 -0.1101 -0.0072 -0.0601  0.0462
  -0.1039  0.0087 -0.0774  0.0403  0.0831 -0.0075  1.     -0.0422 -0.0059]
 [ 0.0154 -0.0363  0.5713  0.6391  0.5826  0.4992  0.6459  0.4144  0.5195
   0.6165  0.5884  0.0782  0.7642 -0.2604  0.4666  0.6419  0.3918  0.5018
   0.5815  0.5403  0.7907 -0.2441  0.0365  0.126  -0.0422  1.     -0.0039]
 [-0.0111  0.0005 -0.0062 -0.0007 -0.0111  0.0063 -0.0052 -0.0005 -0.0018
  -0.0018 -0.0055 -0.0111 -0.0151  0.0117 -0.0039  0.0018 -0.0032  0.0045
  -0.0012 -0.003  -0.0152  0.0007  0.0204 -0.0113 -0.0059 -0.0039  1.    ]]

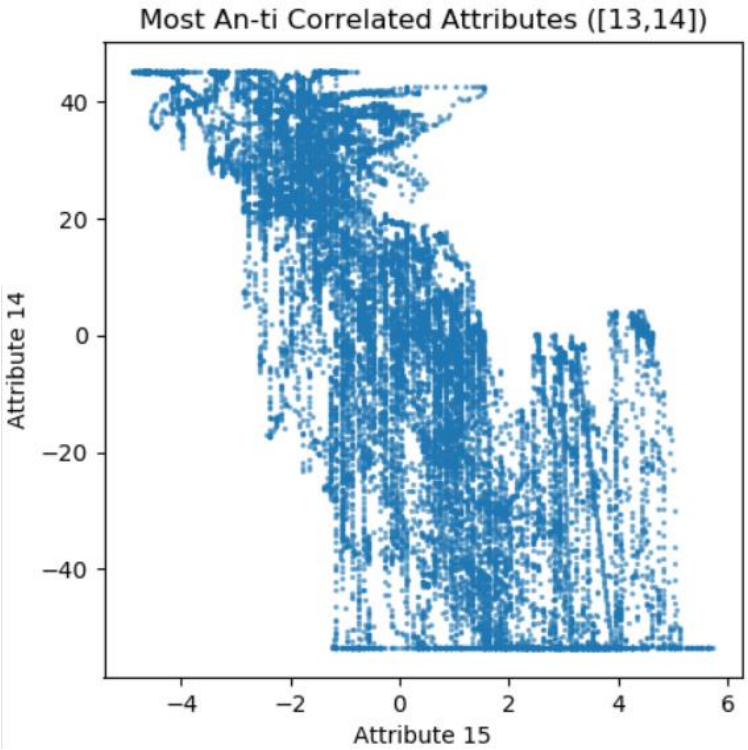
--------------------------------------------------------------------------------
Part2 results:
Dominant eigenvalue: 10528.126; Error: 0.00; input epsilon: 0.001
Dominant eigenvector [ 0.9991  0.0152  0.001   0.0032  0.0027 -0.0026  0.0018  0.001   0.001
  0.0005  0.0005  0.0004  0.0075 -0.0288  0.0007 -0.003   0.0009 -0.0051
  0.0004 -0.0023  0.0056 -0.0025 -0.0236  0.0021 -0.0001  0.0007 -0.0016];
```

Part1

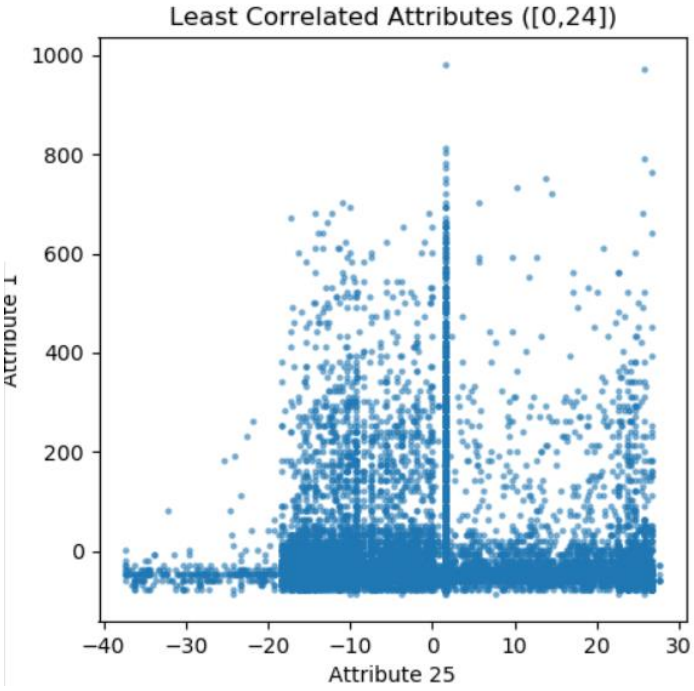
1. The Most correlated attribute pairs (Attribute 21 and 13. Correlation is 0.9748)



2. The most anti-correlated attribute pairs (Attribute 14 and 15. Correlation is -0.754)



3. The least correlated attribute pairs. (Attribute 1 and 25. Correlation is 0.0002)



Part2:

In the output.pdf data set, we can see our dominant eigenvalue result and dominant eigenvector when the input epsilon is 0.001 and graph below.