mean vector
 [97.695   3.802   21.687   40.26   20.341   40.42   22.268   39.243   20.855
   39.027   19.592   50.949   7.911   54.609   20.267   35.388   22.029   42.936
   19.486   41.552   7.412 755.523   79.75   4.04   38.331   3.761   24.988]
----
total variance
 12504.288
----
inner product covariance
 [[1.051e+04   1.605e+02   9.130e+00   3.510e+01   2.700e+01 -2.523e+01
    1.749e+01   1.211e+01   8.436e+00   7.551e+00   3.737e+00   6.433e+00
    7.345e+01 -2.656e+02   5.581e+00 -2.917e+01   7.936e+00 -5.037e+01
    2.068e+00 -2.190e+01   5.405e+01 -2.646e+01 -2.326e+02   2.189e+01
    2.790e-01   6.602e+00 -1.656e+01]
  [1.605e+02   6.298e+01 -3.000e-01   3.378e+00 -9.800e-02   1.647e+00
   -1.550e+00   3.387e+00 -1.440e-01   3.960e+00 -1.153e+00   1.011e+01
   -3.819e+00   3.801e+01 -2.266e+00   1.423e+00 -1.109e+00   5.350e-01
   -2.520e+00 -2.890e-01 -3.140e+00 -6.210e-01   8.105e+00   1.173e+00
    1.875e+00 -1.209e+00   6.000e-02]
  [9.130e+00 -3.000e-01   2.579e+00   1.048e+00   2.947e+00 -1.600e-02
    2.875e+00 -1.490e-01   2.877e+00   6.820e-01   2.622e+00 -2.140e-01
    6.404e+00 -3.077e+01   2.842e+00   1.110e+00   2.593e+00 -5.400e-02
    2.733e+00   4.780e-01   5.831e+00 -1.789e+00 -8.268e+00 -3.450e-01
   -1.444e+00   3.849e+00 -1.440e-01]
  [3.510e+01   3.378e+00   1.048e+00   1.583e+01   2.355e+00   1.291e+01
    2.021e+00   1.094e+01   8.630e-01   1.521e+01   1.511e+00   1.089e+01
    7.661e+00   3.038e+01   1.800e-01   1.630e+01 -2.340e-01   1.530e+01
    9.240e-01   1.262e+01   7.210e+00 -8.655e+00   1.625e+01   1.999e+00
   -9.880e-01   1.067e+01 -4.000e-02]
  [2.700e+01 -9.800e-02   2.947e+00   2.355e+00   4.809e+00 -1.478e+00
    3.234e+00   8.670e-01   3.414e+00   2.204e+00   2.915e+00   5.860e-01
    1.070e+01 -3.964e+01   3.071e+00   2.571e+00   2.480e+00   7.850e-01
    2.985e+00   1.432e+00   9.238e+00 -2.159e+00 -1.651e+01   2.820e-01
   -1.803e+00   5.359e+00 -3.520e-01]
  [-2.523e+01   1.647e+00 -1.600e-02   1.291e+01 -1.478e+00   1.656e+01
    1.121e+00   8.984e+00 -3.930e-01   1.275e+01   8.290e-01   9.189e+00
   -2.400e-01   4.943e+01 -4.420e-01   1.437e+01 -3.270e-01   1.445e+01
    4.470e-01   1.143e+01   7.290e-01 -7.698e+00   3.547e+01   6.900e-01
   -2.580e-01   8.521e+00   3.700e-01]
  [1.749e+01 -1.550e+00   2.875e+00   2.021e+00   3.234e+00   1.121e+00
    4.024e+00 -7.300e-02   3.495e+00   1.069e+00   3.287e+00 -1.201e+00
    8.392e+00 -4.047e+01   3.587e+00   1.771e+00   3.121e+00   4.660e-01
    3.643e+00   1.121e+00   7.461e+00 -2.820e+00 -8.421e+00 -4.960e-01
   -2.421e+00   5.435e+00 -1.510e-01]
  [1.211e+01   3.387e+00 -1.490e-01   1.094e+01   8.670e-01   8.984e+00
   -7.300e-02   1.059e+01 -9.340e-01   1.270e+01 -3.010e-01   1.102e+01
    1.523e+00   5.220e+01 -1.717e+00   1.386e+01 -1.803e+00   1.409e+01
   -1.280e+00   1.126e+01   2.046e+00 -5.617e+00   1.727e+01   2.100e+00
    6.540e-01   5.657e+00 -2.300e-02]
  [8.436e+00 -1.440e-01   2.877e+00   8.630e-01   3.414e+00 -3.930e-01
    3.495e+00 -9.340e-01   4.173e+00 -4.310e-01   3.285e+00 -1.410e+00
    8.116e+00 -4.474e+01   3.783e+00   4.550e-01   3.182e+00 -1.016e+00
    3.661e+00 -2.170e-01   7.207e+00 -1.138e+00 -1.183e+01 -9.300e-01
   -2.524e+00   4.451e+00 -5.400e-02]
  [7.551e+00   3.960e+00   6.820e-01   1.521e+01   2.204e+00   1.275e+01
    1.069e+00   1.270e+01 -4.310e-01   1.885e+01   7.350e-01   1.381e+01
    6.849e+00   5.303e+01 -1.202e+00   1.986e+01 -1.419e+00   1.921e+01
   -3.890e-01   1.544e+01   6.770e+00 -8.054e+00   2.179e+01   3.194e+00
    1.350e-01   1.123e+01 -1.120e-01]
  [3.737e+00 -1.153e+00   2.622e+00   1.511e+00   2.915e+00   8.290e-01
    3.287e+00 -3.010e-01   3.285e+00   7.350e-01   3.402e+00   5.460e-01

```
   7.068e+00  -3.634e+01   3.388e+00   1.405e+00   2.977e+00   1.580e-01
   3.386e+00   5.540e-01   6.388e+00  -2.334e+00  -7.530e+00  -6.560e-01
  -1.831e+00   4.552e+00  -1.470e-01]
[ 6.433e+00   1.011e+01  -2.140e-01   1.089e+01   5.860e-01   9.189e+00
  -1.201e+00   1.102e+01  -1.410e+00   1.381e+01   5.460e-01   8.139e+01
  -4.304e+00   7.413e+01  -2.719e+00   1.503e+01  -1.535e+00   1.696e+01
  -2.518e+00   1.020e+01  -2.549e+00  -7.966e+00   2.500e+01   1.814e+00
  -1.397e+00   2.958e+00  -1.446e+00]
[ 7.345e+01  -3.819e+00   6.404e+00   7.661e+00   1.070e+01  -2.400e-01
   8.392e+00   1.523e+00   8.116e+00   6.849e+00   7.068e+00  -4.304e+00
   3.709e+01  -1.275e+02   7.955e+00   7.976e+00   5.752e+00   2.346e+00
   8.186e+00   4.663e+00   3.157e+01  -6.383e+00  -5.165e+01   2.526e+00
  -5.841e+00   1.952e+01  -1.332e+00]
[-2.656e+02   3.801e+01  -3.077e+01   3.038e+01  -3.964e+01   4.943e+01
  -4.047e+01   5.220e+01  -4.474e+01   5.303e+01  -3.634e+01   7.413e+01
  -1.275e+02   9.703e+02  -4.955e+01   5.691e+01  -4.057e+01   7.967e+01
  -4.637e+01   5.068e+01  -1.063e+02  -1.517e+01   3.335e+02   7.507e+00
   3.994e+01  -3.402e+01   5.270e+00]
[ 5.581e+00  -2.266e+00   2.842e+00   1.800e-01   3.071e+00  -4.420e-01
   3.587e+00  -1.717e+00   3.783e+00  -1.202e+00   3.388e+00  -2.719e+00
   7.955e+00  -4.955e+01   4.452e+00  -3.660e-01   3.641e+00  -2.314e+00
   4.016e+00  -6.800e-01   7.083e+00  -1.526e+00  -1.293e+01  -9.610e-01
  -2.740e+00   4.130e+00  -1.190e-01]
[-2.917e+01   1.423e+00   1.110e+00   1.630e+01   2.571e+00   1.437e+01
   1.771e+00   1.386e+01   4.550e-01   1.986e+01   1.405e+00   1.503e+01
   7.976e+00   5.691e+01  -3.660e-01   2.615e+01  -1.241e+00   2.362e+01
   2.890e-01   1.823e+01   8.000e+00  -1.006e+01   2.884e+01   2.670e+00
  -4.330e-01   1.377e+01   1.350e-01]
[ 7.936e+00  -1.109e+00   2.593e+00  -2.340e-01   2.480e+00  -3.270e-01
   3.121e+00  -1.803e+00   3.182e+00  -1.419e+00   2.977e+00  -1.535e+00
   5.752e+00  -4.057e+01   3.641e+00  -1.241e+00   3.826e+00  -2.141e+00
   3.426e+00  -1.273e+00   5.230e+00  -2.357e+00  -8.757e+00  -1.049e+00
  -1.387e+00   3.215e+00  -9.100e-02]
[-5.037e+01   5.350e-01  -5.400e-02   1.530e+01   7.850e-01   1.445e+01
   4.660e-01   1.409e+01  -1.016e+00   1.921e+01   1.580e-01   1.696e+01
   2.346e+00   7.967e+01  -2.314e+00   2.362e+01  -2.141e+00   2.729e+01
  -1.189e+00   1.856e+01   3.254e+00  -8.720e+00   3.794e+01   2.592e+00
   2.845e+00   1.100e+01   3.390e-01]
[ 2.068e+00  -2.520e+00   2.733e+00   9.240e-01   2.985e+00   4.470e-01
   3.643e+00  -1.280e+00   3.661e+00  -3.890e-01   3.386e+00  -2.518e+00
   8.186e+00  -4.637e+01   4.016e+00   2.890e-01   3.426e+00  -1.189e+00
   4.059e+00  -7.300e-02   7.158e+00  -2.338e+00  -9.572e+00  -8.780e-01
  -2.469e+00   4.914e+00  -3.600e-02]
[-2.190e+01  -2.890e-01   4.780e-01   1.262e+01   1.432e+00   1.143e+01
   1.121e+00   1.126e+01  -2.170e-01   1.544e+01   5.540e-01   1.020e+01
   4.663e+00   5.068e+01  -6.800e-01   1.823e+01  -1.273e+00   1.856e+01
  -7.300e-02   1.723e+01   4.928e+00  -5.644e+00   2.223e+01   2.428e+00
   4.240e-01   9.409e+00  -1.780e-01]
[ 5.405e+01  -3.140e+00   5.831e+00   7.210e+00   9.238e+00   7.290e-01
   7.461e+00   2.046e+00   7.207e+00   6.770e+00   6.388e+00  -2.549e+00
   3.157e+01  -1.063e+02   7.083e+00   8.000e+00   5.230e+00   3.254e+00
   7.158e+00   4.928e+00   2.827e+01  -5.636e+00  -4.549e+01   2.515e+00
  -4.852e+00   1.764e+01  -1.173e+00]
[-2.646e+01  -6.210e-01  -1.789e+00  -8.655e+00  -2.159e+00  -7.698e+00
  -2.820e+00  -5.617e+00  -1.138e+00  -8.054e+00  -2.334e+00  -7.966e+00
  -6.383e+00  -1.517e+01  -1.526e+00  -1.006e+01  -2.357e+00  -8.720e+00
  -2.338e+00  -5.644e+00  -5.636e+00   5.475e+01  -1.014e+01  -4.263e+00
   3.518e+00  -7.576e+00   7.500e-02]
[-2.326e+02   8.105e+00  -8.268e+00   1.625e+01  -1.651e+01   3.547e+01
  -8.421e+00   1.727e+01  -1.183e+01   2.179e+01  -7.530e+00   2.500e+01
  -5.165e+01   3.335e+02  -1.293e+01   2.884e+01  -8.757e+00   3.794e+01
```

```
 -9.572e+00  2.223e+01 -4.549e+01 -1.014e+01  2.220e+02 -6.445e+00
  1.461e+01  2.282e+00  4.415e+00]
[ 2.189e+01  1.173e+00 -3.450e-01  1.999e+00  2.820e-01  6.900e-01
 -4.960e-01  2.100e+00 -9.300e-01  3.194e+00 -6.560e-01  1.814e+00
  2.526e+00  7.507e+00 -9.610e-01  2.670e+00 -1.049e+00  2.592e+00
 -8.780e-01  2.428e+00  2.515e+00 -4.263e+00 -6.445e+00  6.008e+00
 -2.170e-01  1.295e+00 -4.030e-01]
[ 2.790e-01  1.875e+00 -1.444e+00 -9.880e-01 -1.803e+00 -2.580e-01
 -2.421e+00  6.540e-01 -2.524e+00  1.350e-01 -1.831e+00 -1.397e+00
 -5.841e+00  3.994e+01 -2.740e+00 -4.330e-01 -1.387e+00  2.845e+00
 -2.469e+00  4.240e-01 -4.852e+00  3.518e+00  1.461e+01 -2.170e-01
  1.391e+02 -2.087e+00 -1.007e+00]
[ 6.602e+00 -1.209e+00  3.849e+00  1.067e+01  5.359e+00  8.521e+00
  5.435e+00  5.657e+00  4.451e+00  1.123e+01  4.552e+00  2.958e+00
  1.952e+01 -3.402e+01  4.130e+00  1.377e+01  3.215e+00  1.100e+01
  4.914e+00  9.409e+00  1.764e+01 -7.576e+00  2.282e+00  1.295e+00
 -2.087e+00  1.759e+01 -2.400e-01]
[-1.656e+01  6.000e-02 -1.440e-01 -4.000e-02 -3.520e-01  3.700e-01
 -1.510e-01 -2.300e-02 -5.400e-02 -1.120e-01 -1.470e-01 -1.446e+00
 -1.332e+00  5.270e+00 -1.190e-01  1.350e-01 -9.100e-02  3.390e-01
 -3.600e-02 -1.780e-01 -1.173e+00  7.500e-02  4.415e+00 -4.030e-01
 -1.007e+00 -2.400e-01  2.101e+02]]
--------------------------------------------------------------------
```

outer product covariance

```
[[ 1.051e+04  1.605e+02  9.130e+00  3.510e+01  2.700e+01 -2.523e+01
   1.749e+01  1.211e+01  8.436e+00  7.551e+00  3.737e+00  6.433e+00
   7.345e+01 -2.656e+02  5.581e+00 -2.917e+01  7.936e+00 -5.037e+01
   2.068e+00 -2.190e+01  5.405e+01 -2.646e+01 -2.326e+02  2.189e+01
   2.790e-01  6.602e+00 -1.656e+01]
 [ 1.605e+02  6.298e+01 -3.000e-01  3.378e+00 -9.800e-02  1.647e+00
  -1.550e+00  3.387e+00 -1.440e-01  3.960e+00 -1.153e+00  1.011e+01
  -3.819e+00  3.801e+01 -2.266e+00  1.423e+00 -1.109e+00  5.350e-01
  -2.520e+00 -2.890e-01 -3.140e+00 -6.210e-01  8.105e+00  1.173e+00
   1.875e+00 -1.209e+00  6.000e-02]
 [ 9.130e+00 -3.000e-01  2.579e+00  1.048e+00  2.947e+00 -1.600e-02
   2.875e+00 -1.490e-01  2.877e+00  6.820e-01  2.622e+00 -2.140e-01
   6.404e+00 -3.077e+01  2.842e+00  1.110e+00  2.593e+00 -5.400e-02
   2.733e+00  4.780e-01  5.831e+00 -1.789e+00 -8.268e+00 -3.450e-01
  -1.444e+00  3.849e+00 -1.440e-01]
 [ 3.510e+01  3.378e+00  1.048e+00  1.583e+01  2.355e+00  1.291e+01
   2.021e+00  1.094e+01  8.630e-01  1.521e+01  1.511e+00  1.089e+01
   7.661e+00  3.038e+01  1.800e-01  1.630e+01 -2.340e-01  1.530e+01
   9.240e-01  1.262e+01  7.210e+00 -8.655e+00  1.625e+01  1.999e+00
  -9.880e-01  1.067e+01 -4.000e-02]
 [ 2.700e+01 -9.800e-02  2.947e+00  2.355e+00  4.809e+00 -1.478e+00
   3.234e+00  8.670e-01  3.414e+00  2.204e+00  2.915e+00  5.860e-01
   1.070e+01 -3.964e+01  3.071e+00  2.571e+00  2.480e+00  7.850e-01
   2.985e+00  1.432e+00  9.238e+00 -2.159e+00 -1.651e+01  2.820e-01
  -1.803e+00  5.359e+00 -3.520e-01]
 [-2.523e+01  1.647e+00 -1.600e-02  1.291e+01 -1.478e+00  1.656e+01
   1.121e+00  8.984e+00 -3.930e-01  1.275e+01  8.290e-01  9.189e+00
  -2.400e-01  4.943e+01 -4.420e-01  1.437e+01 -3.270e-01  1.445e+01
   4.470e-01  1.143e+01  7.290e-01 -7.698e+00  3.547e+01  6.900e-01
  -2.580e-01  8.521e+00  3.700e-01]
 [ 1.749e+01 -1.550e+00  2.875e+00  2.021e+00  3.234e+00  1.121e+00
   4.024e+00 -7.300e-02  3.495e+00  1.069e+00  3.287e+00 -1.201e+00
   8.392e+00 -4.047e+01  3.587e+00  1.771e+00  3.121e+00  4.660e-01
   3.643e+00  1.121e+00  7.461e+00 -2.820e+00 -8.421e+00 -4.960e-01
  -2.421e+00  5.435e+00 -1.510e-01]
 [ 1.211e+01  3.387e+00 -1.490e-01  1.094e+01  8.670e-01  8.984e+00
  -7.300e-02  1.059e+01 -9.340e-01  1.270e+01 -3.010e-01  1.102e+01
```

```
    1.523e+00   5.220e+01  -1.717e+00   1.386e+01  -1.803e+00   1.409e+01
   -1.280e+00   1.126e+01   2.046e+00  -5.617e+00   1.727e+01   2.100e+00
    6.540e-01   5.657e+00  -2.300e-02]
 [ 8.436e+00  -1.440e-01   2.877e+00   8.630e-01   3.414e+00  -3.930e-01
    3.495e+00  -9.340e-01   4.173e+00  -4.310e-01   3.285e+00  -1.410e+00
    8.116e+00  -4.474e+01   3.783e+00   4.550e-01   3.182e+00  -1.016e+00
    3.661e+00  -2.170e-01   7.207e+00  -1.138e+00  -1.183e+01  -9.300e-01
   -2.524e+00   4.451e+00  -5.400e-02]
 [ 7.551e+00   3.960e+00   6.820e-01   1.521e+01   2.204e+00   1.275e+01
    1.069e+00   1.270e+01  -4.310e-01   1.885e+01   7.350e-01   1.381e+01
    6.849e+00   5.303e+01  -1.202e+00   1.986e+01  -1.419e+00   1.921e+01
   -3.890e-01   1.544e+01   6.770e+00  -8.054e+00   2.179e+01   3.194e+00
    1.350e-01   1.123e+01  -1.120e-01]
 [ 3.737e+00  -1.153e+00   2.622e+00   1.511e+00   2.915e+00   8.290e-01
    3.287e+00  -3.010e-01   3.285e+00   7.350e-01   3.402e+00   5.460e-01
    7.068e+00  -3.634e+01   3.388e+00   1.405e+00   2.977e+00   1.580e-01
    3.386e+00   5.540e-01   6.388e+00  -2.334e+00  -7.530e+00  -6.560e-01
   -1.831e+00   4.552e+00  -1.470e-01]
 [ 6.433e+00   1.011e+01  -2.140e-01   1.089e+01   5.860e-01   9.189e+00
   -1.201e+00   1.102e+01  -1.410e+00   1.381e+01   5.460e-01   8.139e+01
   -4.304e+00   7.413e+01  -2.719e+00   1.503e+01  -1.535e+00   1.696e+01
   -2.518e+00   1.020e+01  -2.549e+00  -7.966e+00   2.500e+01   1.814e+00
   -1.397e+00   2.958e+00  -1.446e+00]
 [ 7.345e+01  -3.819e+00   6.404e+00   7.661e+00   1.070e+01  -2.400e-01
    8.392e+00   1.523e+00   8.116e+00   6.849e+00   7.068e+00  -4.304e+00
    3.709e+01  -1.275e+02   7.955e+00   7.976e+00   5.752e+00   2.346e+00
    8.186e+00   4.663e+00   3.157e+01  -6.383e+00  -5.165e+01   2.526e+00
   -5.841e+00   1.952e+01  -1.332e+00]
 [-2.656e+02   3.801e+01  -3.077e+01   3.038e+01  -3.964e+01   4.943e+01
   -4.047e+01   5.220e+01  -4.474e+01   5.303e+01  -3.634e+01   7.413e+01
   -1.275e+02   9.703e+02  -4.955e+01   5.691e+01  -4.057e+01   7.967e+01
   -4.637e+01   5.068e+01  -1.063e+02  -1.517e+01   3.335e+02   7.507e+00
    3.994e+01  -3.402e+01   5.270e+00]
 [ 5.581e+00  -2.266e+00   2.842e+00   1.800e-01   3.071e+00  -4.420e-01
    3.587e+00  -1.717e+00   3.783e+00  -1.202e+00   3.388e+00  -2.719e+00
    7.955e+00  -4.955e+01   4.452e+00  -3.660e-01   3.641e+00  -2.314e+00
    4.016e+00  -6.800e-01   7.083e+00  -1.526e+00  -1.293e+01  -9.610e-01
   -2.740e+00   4.130e+00  -1.190e-01]
 [-2.917e+01   1.423e+00   1.110e+00   1.630e+01   2.571e+00   1.437e+01
    1.771e+00   1.386e+01   4.550e-01   1.986e+01   1.405e+00   1.503e+01
    7.976e+00   5.691e+01  -3.660e-01   2.615e+01  -1.241e+00   2.362e+01
    2.890e-01   1.823e+01   8.000e+00  -1.006e+01   2.884e+01   2.670e+00
   -4.330e-01   1.377e+01   1.350e-01]
 [ 7.936e+00  -1.109e+00   2.593e+00  -2.340e-01   2.480e+00  -3.270e-01
    3.121e+00  -1.803e+00   3.182e+00  -1.419e+00   2.977e+00  -1.535e+00
    5.752e+00  -4.057e+01   3.641e+00  -1.241e+00   3.826e+00  -2.141e+00
    3.426e+00  -1.273e+00   5.230e+00  -2.357e+00  -8.757e+00  -1.049e+00
   -1.387e+00   3.215e+00  -9.100e-02]
 [-5.037e+01   5.350e-01  -5.400e-02   1.530e+01   7.850e-01   1.445e+01
    4.660e-01   1.409e+01  -1.016e+00   1.921e+01   1.580e-01   1.696e+01
    2.346e+00   7.967e+01  -2.314e+00   2.362e+01  -2.141e+00   2.729e+01
   -1.189e+00   1.856e+01   3.254e+00  -8.720e+00   3.794e+01   2.592e+00
    2.845e+00   1.100e+01   3.390e-01]
 [ 2.068e+00  -2.520e+00   2.733e+00   9.240e-01   2.985e+00   4.470e-01
    3.643e+00  -1.280e+00   3.661e+00  -3.890e-01   3.386e+00  -2.518e+00
    8.186e+00  -4.637e+01   4.016e+00   2.890e-01   3.426e+00  -1.189e+00
    4.059e+00  -7.300e-02   7.158e+00  -2.338e+00  -9.572e+00  -8.780e-01
   -2.469e+00   4.914e+00  -3.600e-02]
 [-2.190e+01  -2.890e-01   4.780e-01   1.262e+01   1.432e+00   1.143e+01
    1.121e+00   1.126e+01  -2.170e-01   1.544e+01   5.540e-01   1.020e+01
    4.663e+00   5.068e+01  -6.800e-01   1.823e+01  -1.273e+00   1.856e+01
```

```
  -7.300e-02  1.723e+01  4.928e+00 -5.644e+00  2.223e+01  2.428e+00
   4.240e-01  9.409e+00 -1.780e-01]
 [ 5.405e+01 -3.140e+00  5.831e+00  7.210e+00  9.238e+00  7.290e-01
   7.461e+00  2.046e+00  7.207e+00  6.770e+00  6.388e+00 -2.549e+00
   3.157e+01 -1.063e+02  7.083e+00  8.000e+00  5.230e+00  3.254e+00
   7.158e+00  4.928e+00  2.827e+01 -5.636e+00 -4.549e+01  2.515e+00
  -4.852e+00  1.764e+01 -1.173e+00]
 [-2.646e+01 -6.210e-01 -1.789e+00 -8.655e+00 -2.159e+00 -7.698e+00
  -2.820e+00 -5.617e+00 -1.138e+00 -8.054e+00 -2.334e+00 -7.966e+00
  -6.383e+00 -1.517e+01 -1.526e+00 -1.006e+01 -2.357e+00 -8.720e+00
  -2.338e+00 -5.644e+00 -5.636e+00  5.475e+01 -1.014e+01 -4.263e+00
   3.518e+00 -7.576e+00  7.500e-02]
 [-2.326e+02  8.105e+00 -8.268e+00  1.625e+01 -1.651e+01  3.547e+01
  -8.421e+00  1.727e+01 -1.183e+01  2.179e+01 -7.530e+00  2.500e+01
  -5.165e+01  3.335e+02 -1.293e+01  2.884e+01 -8.757e+00  3.794e+01
  -9.572e+00  2.223e+01 -4.549e+01 -1.014e+01  2.220e+02 -6.445e+00
   1.461e+01  2.282e+00  4.415e+00]
 [ 2.189e+01  1.173e+00 -3.450e-01  1.999e+00  2.820e-01  6.900e-01
  -4.960e-01  2.100e+00 -9.300e-01  3.194e+00 -6.560e-01  1.814e+00
   2.526e+00  7.507e+00 -9.610e-01  2.670e+00 -1.049e+00  2.592e+00
  -8.780e-01  2.428e+00  2.515e+00 -4.263e+00 -6.445e+00  6.008e+00
  -2.170e-01  1.295e+00 -4.030e-01]
 [ 2.790e-01  1.875e+00 -1.444e+00 -9.880e-01 -1.803e+00 -2.580e-01
  -2.421e+00  6.540e-01 -2.524e+00  1.350e-01 -1.831e+00 -1.397e+00
  -5.841e+00  3.994e+01 -2.740e+00 -4.330e-01 -1.387e+00  2.845e+00
  -2.469e+00  4.240e-01 -4.852e+00  3.518e+00  1.461e+01 -2.170e-01
   1.391e+02 -2.087e+00 -1.007e+00]
 [ 6.602e+00 -1.209e+00  3.849e+00  1.067e+01  5.359e+00  8.521e+00
   5.435e+00  5.657e+00  4.451e+00  1.123e+01  4.552e+00  2.958e+00
   1.952e+01 -3.402e+01  4.130e+00  1.377e+01  3.215e+00  1.100e+01
   4.914e+00  9.409e+00  1.764e+01 -7.576e+00  2.282e+00  1.295e+00
  -2.087e+00  1.759e+01 -2.400e-01]
 [-1.656e+01  6.000e-02 -1.440e-01 -4.000e-02 -3.520e-01  3.700e-01
  -1.510e-01 -2.300e-02 -5.400e-02 -1.120e-01 -1.470e-01 -1.446e+00
  -1.332e+00  5.270e+00 -1.190e-01  1.350e-01 -9.100e-02  3.390e-01
  -3.600e-02 -1.780e-01 -1.173e+00  7.500e-02  4.415e+00 -4.030e-01
  -1.007e+00 -2.400e-01  2.101e+02]]
----------------------------------------------------------------------
```

correlation matrix
```
[[ 1.      0.197  0.055  0.086  0.12  -0.06   0.085  0.036  0.04   0.017
   0.02   0.007  0.118 -0.083  0.026 -0.056  0.04  -0.094  0.01  -0.051
   0.099 -0.035 -0.152  0.087  0.     0.015 -0.011]
 [ 0.197  1.     -0.024  0.107 -0.006  0.051 -0.097  0.131 -0.009  0.115
  -0.079  0.141 -0.079  0.154 -0.135  0.035 -0.071  0.013 -0.158 -0.009
  -0.074 -0.011  0.069  0.06   0.02  -0.036  0.001]
 [ 0.055 -0.024  1.      0.164  0.837 -0.003  0.892 -0.029  0.877  0.098
   0.885 -0.015  0.655 -0.615  0.839  0.135  0.825 -0.006  0.845  0.072
   0.683 -0.151 -0.345 -0.088 -0.076  0.571 -0.006]
 [ 0.086  0.107  0.164  1.      0.27   0.798  0.253  0.845  0.106  0.88
   0.206  0.303  0.316  0.245  0.021  0.801 -0.03   0.736  0.115  0.764
   0.341 -0.294  0.274  0.205 -0.021  0.639 -0.001]
 [ 0.12  -0.006  0.837  0.27   1.     -0.166  0.735  0.121  0.762  0.232
   0.721  0.03   0.801 -0.58   0.664  0.229  0.578  0.069  0.676  0.157
   0.792 -0.133 -0.505  0.052 -0.07   0.583 -0.011]
 [-0.06   0.051 -0.003  0.798 -0.166  1.      0.137  0.678 -0.047  0.721
   0.11   0.25  -0.01   0.39  -0.051  0.691 -0.041  0.68   0.055  0.676
   0.034 -0.256  0.585  0.069 -0.005  0.499  0.006]
 [ 0.085 -0.097  0.892  0.253  0.735  0.137  1.     -0.011  0.853  0.123
   0.888 -0.066  0.687 -0.648  0.847  0.173  0.795  0.044  0.901  0.135
   0.699 -0.19  -0.282 -0.101 -0.102  0.646 -0.005]
 [ 0.036  0.131 -0.029  0.845  0.121  0.678 -0.011  1.     -0.14   0.899
```

```
  -0.05    0.375   0.077   0.515  -0.25    0.833  -0.283   0.829  -0.195   0.834
   0.118  -0.233   0.356   0.263   0.017   0.414  -0.    ]
 [ 0.04   -0.009   0.877   0.106   0.762  -0.047   0.853  -0.14    1.      -0.049
   0.872  -0.076   0.652  -0.703   0.878   0.044   0.796  -0.095   0.889  -0.026
   0.663  -0.075  -0.389  -0.186  -0.105   0.519  -0.002]
 [ 0.017   0.115   0.098   0.88    0.232   0.721   0.123   0.899  -0.049   1.
   0.092   0.353   0.259   0.392  -0.131   0.894  -0.167   0.847  -0.045   0.857
   0.293  -0.251   0.337   0.3     0.003   0.617  -0.002]
 [ 0.02   -0.079   0.885   0.206   0.721   0.11    0.888  -0.05    0.872   0.092
   1.      0.033   0.629  -0.632   0.871   0.149   0.825   0.016   0.911   0.072
   0.651  -0.171  -0.274  -0.145  -0.084   0.588  -0.005]
 [ 0.007   0.141  -0.015   0.303   0.03    0.25   -0.066   0.375  -0.076   0.353
   0.033   1.     -0.078   0.264  -0.143   0.326  -0.087   0.36   -0.139   0.272
  -0.053  -0.119   0.186   0.082  -0.013   0.078  -0.011]
 [ 0.118  -0.079   0.655   0.316   0.801  -0.01    0.687   0.077   0.652   0.259
   0.629  -0.078   1.     -0.672   0.619   0.256   0.483   0.074   0.667   0.184
   0.975  -0.142  -0.569   0.169  -0.081   0.764  -0.015]
 [-0.083   0.154  -0.615   0.245  -0.58    0.39   -0.648   0.515  -0.703   0.392
  -0.632   0.264  -0.672   1.     -0.754   0.357  -0.666   0.49   -0.739   0.392
  -0.642  -0.066   0.719   0.098   0.109  -0.26    0.012]
 [ 0.026  -0.135   0.839   0.021   0.664  -0.051   0.847  -0.25    0.878  -0.131
   0.871  -0.143   0.619  -0.754   1.     -0.034   0.882  -0.21    0.945  -0.078
   0.631  -0.098  -0.411  -0.186  -0.11    0.467  -0.004]
 [-0.056   0.035   0.135   0.801   0.229   0.691   0.173   0.833   0.044   0.894
   0.149   0.326   0.256   0.357  -0.034   1.     -0.124   0.884   0.028   0.859
   0.294  -0.266   0.379   0.213  -0.007   0.642   0.002]
 [ 0.04   -0.071   0.825  -0.03    0.578  -0.041   0.795  -0.283   0.796  -0.167
   0.825  -0.087   0.483  -0.666   0.882  -0.124   1.     -0.21    0.869  -0.157
   0.503  -0.163  -0.3    -0.219  -0.06    0.392  -0.003]
 [-0.094   0.013  -0.006   0.736   0.069   0.68    0.044   0.829  -0.095   0.847
   0.016   0.36    0.074   0.49   -0.21    0.884  -0.21    1.     -0.113   0.856
   0.117  -0.226   0.487   0.202   0.046   0.502   0.004]
 [ 0.01   -0.158   0.845   0.115   0.676   0.055   0.901  -0.195   0.889  -0.045
   0.911  -0.139   0.667  -0.739   0.945   0.028   0.869  -0.113   1.      -0.009
   0.668  -0.157  -0.319  -0.178  -0.104   0.581  -0.001]
 [-0.051  -0.009   0.072   0.764   0.157   0.676   0.135   0.834  -0.026   0.857
   0.072   0.272   0.184   0.392  -0.078   0.859  -0.157   0.856  -0.009   1.
   0.223  -0.184   0.359   0.239   0.009   0.54   -0.003]
 [ 0.099  -0.074   0.683   0.341   0.792   0.034   0.699   0.118   0.663   0.293
   0.651  -0.053   0.975  -0.642   0.631   0.294   0.503   0.117   0.668   0.223
   1.     -0.143  -0.574   0.193  -0.077   0.791  -0.015]
 [-0.035  -0.011  -0.151  -0.294  -0.133  -0.256  -0.19   -0.233  -0.075  -0.251
  -0.171  -0.119  -0.142  -0.066  -0.098  -0.266  -0.163  -0.226  -0.157  -0.184
  -0.143   1.     -0.092  -0.235   0.04   -0.244   0.001]
 [-0.152   0.069  -0.345   0.274  -0.505   0.585  -0.282   0.356  -0.389   0.337
  -0.274   0.186  -0.569   0.719  -0.411   0.379  -0.3     0.487  -0.319   0.359
  -0.574  -0.092   1.     -0.176   0.083   0.037   0.02 ]
 [ 0.087   0.06   -0.088   0.205   0.052   0.069  -0.101   0.263  -0.186   0.3
  -0.145   0.082   0.169   0.098  -0.186   0.213  -0.219   0.202  -0.178   0.239
   0.193  -0.235  -0.176   1.     -0.008   0.126  -0.011]
 [ 0.       0.02   -0.076  -0.021  -0.07   -0.005  -0.102   0.017  -0.105   0.003
  -0.084  -0.013  -0.081   0.109  -0.11   -0.007  -0.06    0.046  -0.104   0.009
  -0.077   0.04    0.083  -0.008   1.     -0.042  -0.006]
 [ 0.015  -0.036   0.571   0.639   0.583   0.499   0.646   0.414   0.519   0.617
   0.588   0.078   0.764  -0.26    0.467   0.642   0.392   0.502   0.581   0.54
   0.791  -0.244   0.037   0.126  -0.042   1.     -0.004]
 [-0.011   0.001  -0.006  -0.001  -0.011   0.006  -0.005  -0.      -0.002  -0.002
  -0.005  -0.011  -0.015   0.012  -0.004   0.002  -0.003   0.004  -0.001  -0.003
  -0.015   0.001   0.02   -0.011  -0.006  -0.004   1.    ]]
 ----------------------------------------------------------------------
```
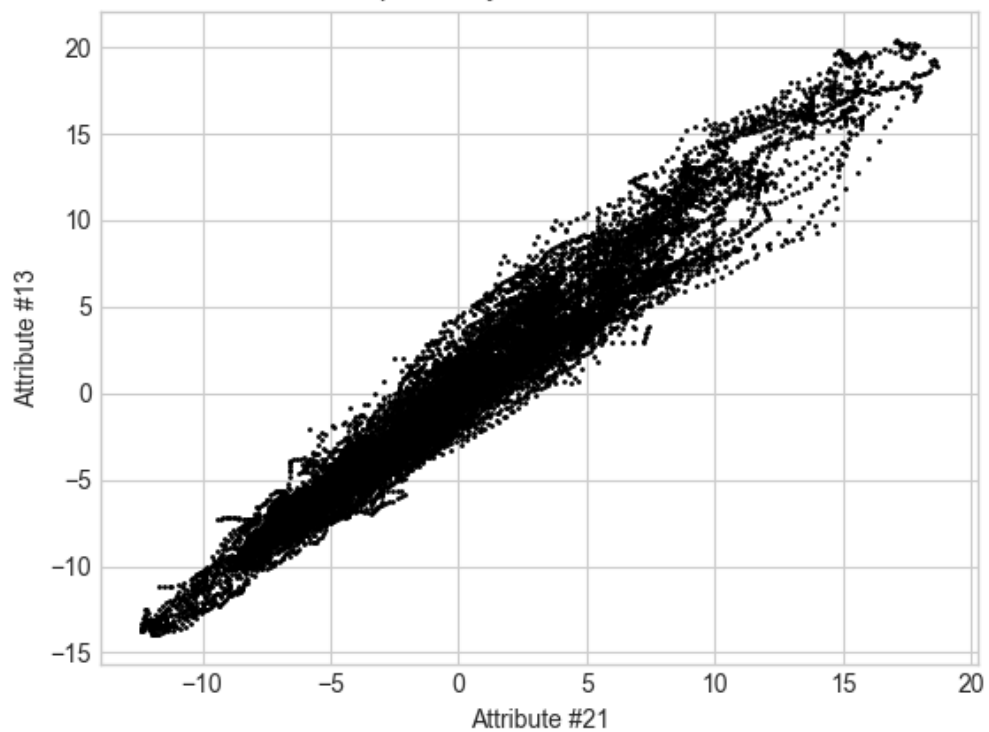**eigenvalue** 10528.115

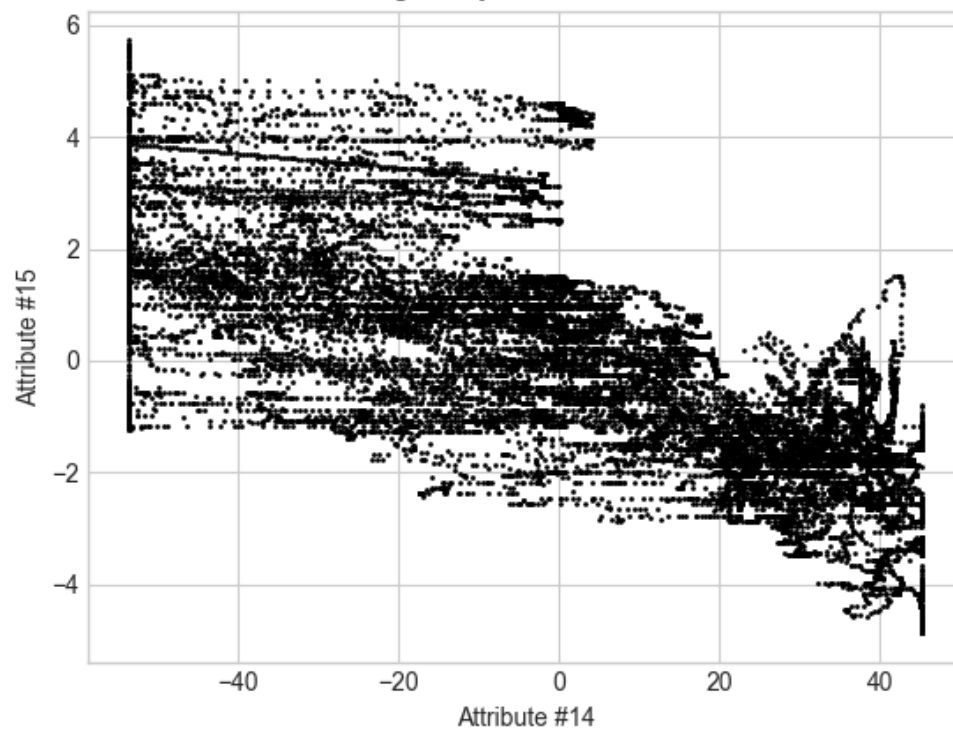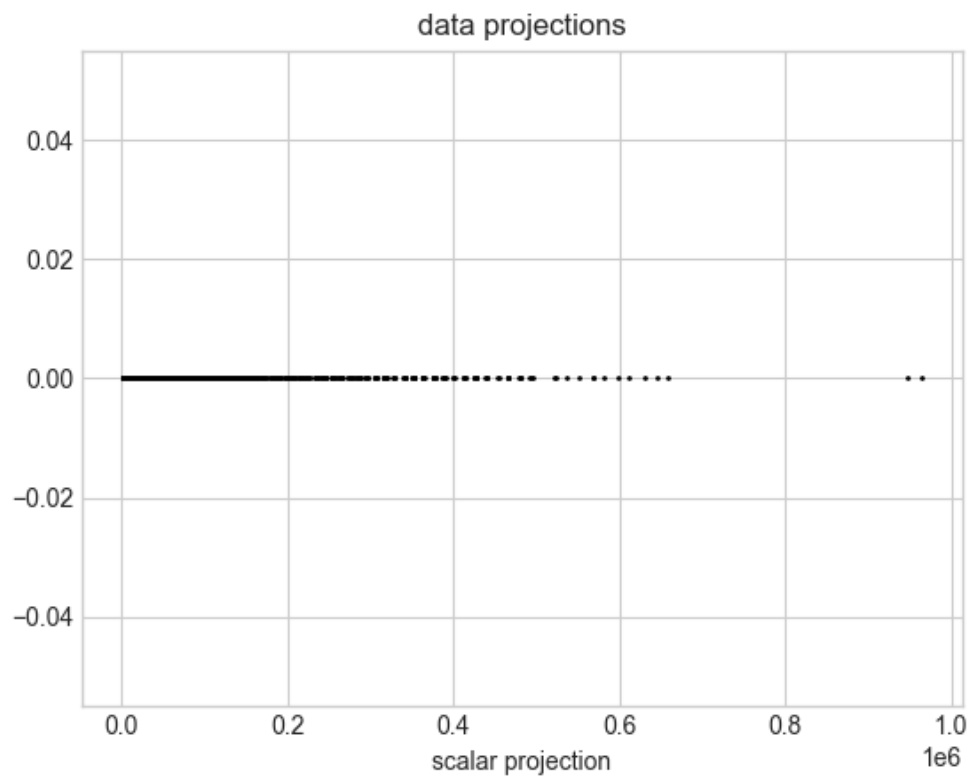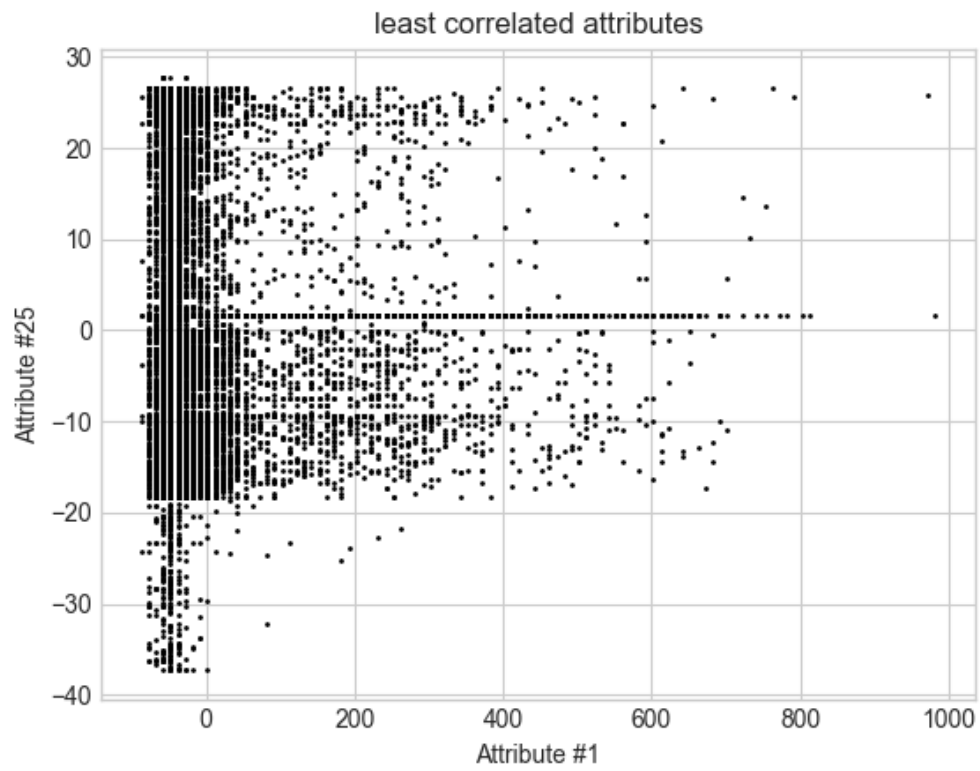
eigenvector without normalization
```
[[ 1.000e+00]
 [ 1.521e-02]
 [ 9.800e-04]
 [ 3.222e-03]
 [ 2.726e-03]
 [-2.618e-03]
 [ 1.802e-03]
 [ 9.676e-04]
 [ 9.635e-04]
 [ 5.273e-04]
 [ 4.810e-04]
 [ 3.554e-04]
 [ 7.488e-03]
 [-2.881e-02]
 [ 7.053e-04]
 [-2.993e-03]
 [ 8.941e-04]
 [-5.100e-03]
 [ 3.546e-04]
 [-2.275e-03]
 [ 5.567e-03]
 [-2.467e-03]
 [-2.360e-02]
 [ 2.079e-03]
 [-1.252e-04]
 [ 7.349e-04]
 [-1.632e-03]]
```

most positively correlated attributes

most negatively correlated attributes

least correlated attributes

data projections

observations

One easily noticeable fact is that the covariance matrices from the inner product and the outer product are the same – which shows that one could compute a covariance matrix by either methods.
Furthermore, on the correlation matrix, all the diagonal entries are 1, because a correlation between the two identical data columns is always 1.