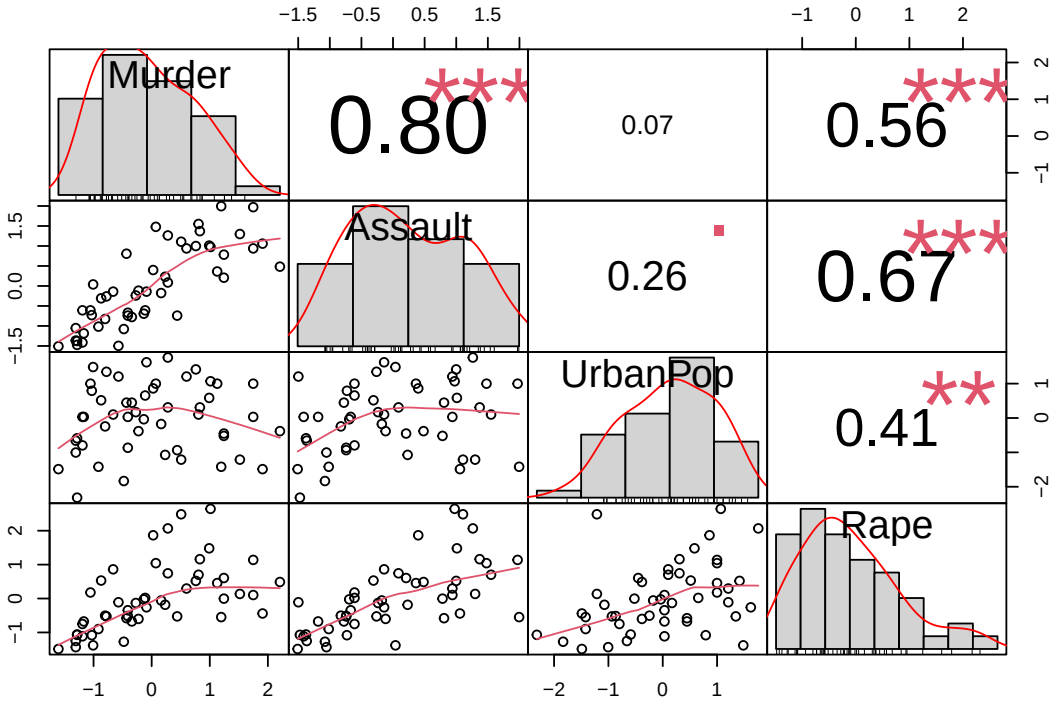
STAT 6390 Mini Project 3 | Brett Walker - 3/28/2023



Question 3.

a. The data seem to be fairly correlated with each other, with Assault having a higher correlation to other crimes than Urban Population.

b. The values are the same, which is consistent with what is expected.

From S:
Eigenvalues:
2.4802416, 0.9897652, 0.3565632, 0.1734301
Eigenvectors:
-0.5358995, -0.5831836, -0.2781909, -0.5434321, 0.4181809, 0.1879856, -0.8728062, -0.1673186, -0.3412327, -0.2681484, -0.3780158, 0.8177779, 0.6492278, -0.7434075, 0.1338777, 0.0890243

From D:
Eigenvalues (sdev squared):
2.4802416, 0.9897652, 0.3565632, 0.1734301
Eigenvectors:
-0.5358995, -0.5831836, -0.2781909, -0.5434321, 0.4181809, 0.1879856, -0.8728062, -0.1673186, -0.3412327, -0.2681484, -0.3780158, 0.8177779, 0.6492278, -0.7434075, 0.1338777, 0.0890243

Covariance of scores: 2.48, 0, 0, 0, 0, 0.99, 0, 0, 0, 0, 0.357, 0, 0, 0, 0, 0.173

c.

Singular values:
11.0241479, 6.9640859, 4.1799038, 2.9151457
Matrix:
-0.5358995, -0.5831836, -0.2781909, -0.5434321, 0.4181809, 0.1879856, -0.8728062, -0.1673186, -0.3412327, -0.2681484, -0.3780158, 0.8177779, 0.6492278, -0.7434075, 0.1338777, 0.0890243

Note the matrix is consistent with the eigenvectors obtained in (b). Singular values are not equal to the eigenvalues, which makes sense because D is neither square nor symmetric. This coincides with what was discussed in class.

d. Running the following code produces the same eigenvectors (as seen above) each time:

```
for (k in 1:4) {
    cat(svd(x.std, nu = k)$v, '\n')
    cat(prcomp(x.std, rank = k)$rotation, '\n')
}
```

Note that by setting the rank in the prcomp function, we are only given the first k eigenvectors.