

PROJECT----WEEK02

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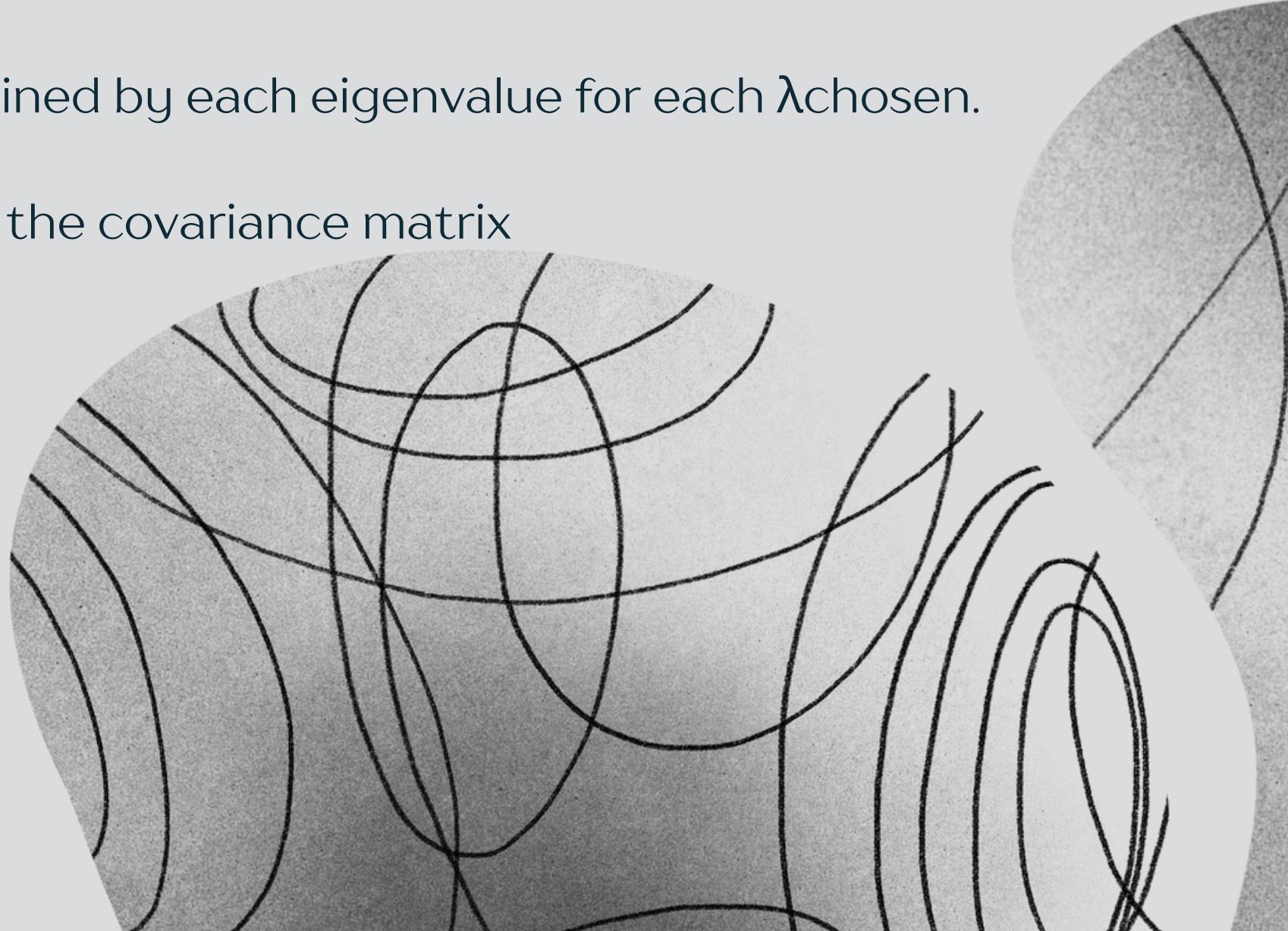
Problem 1

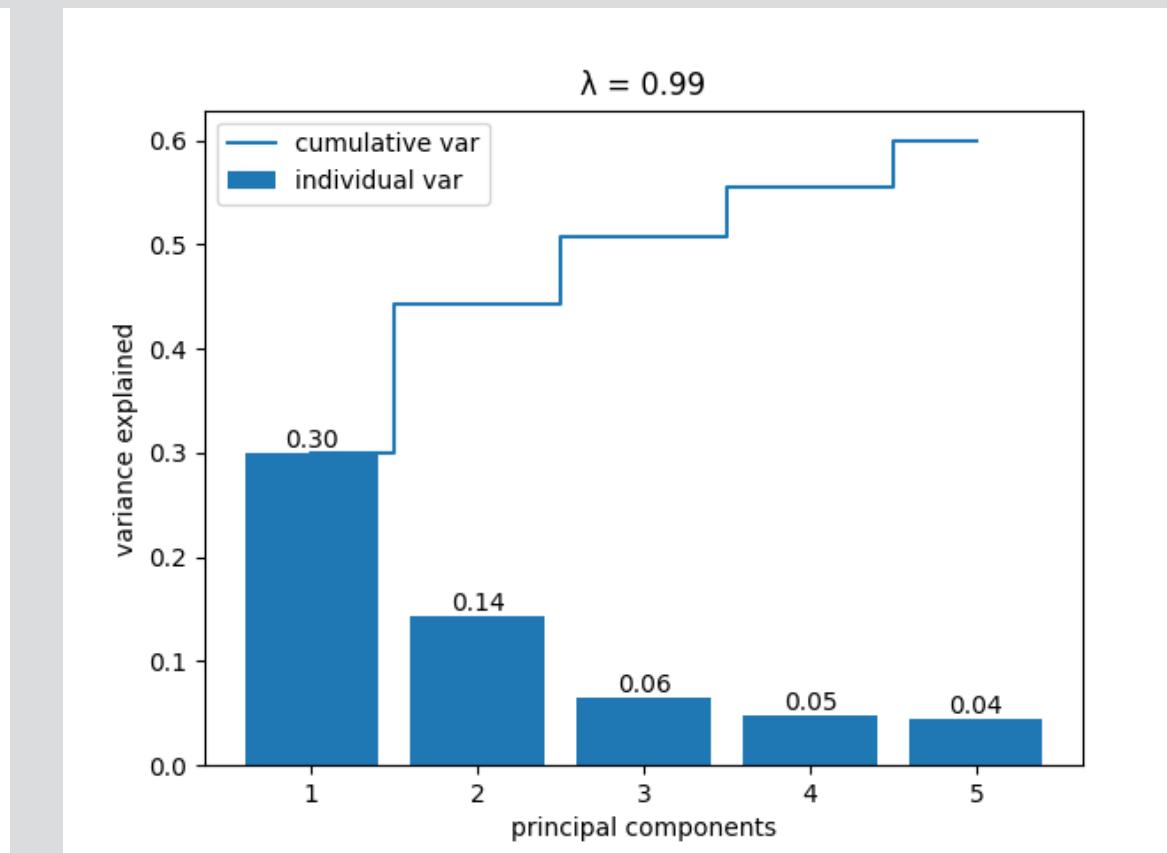
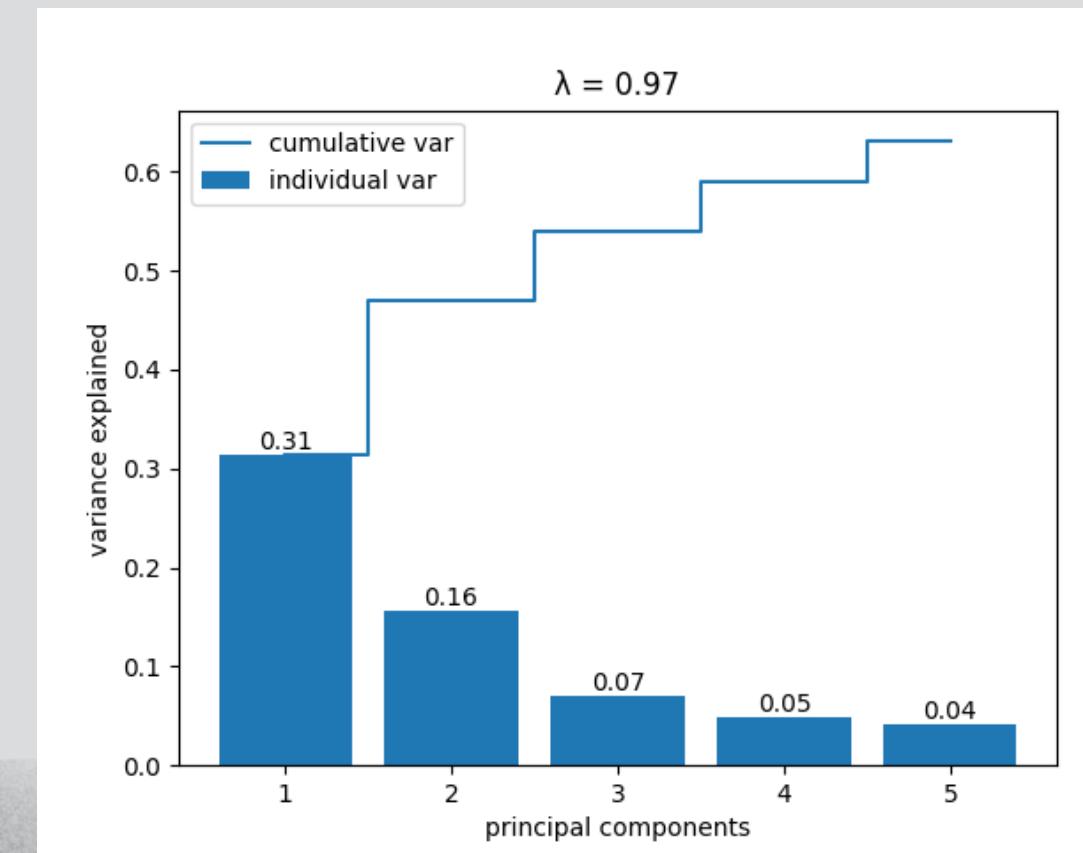
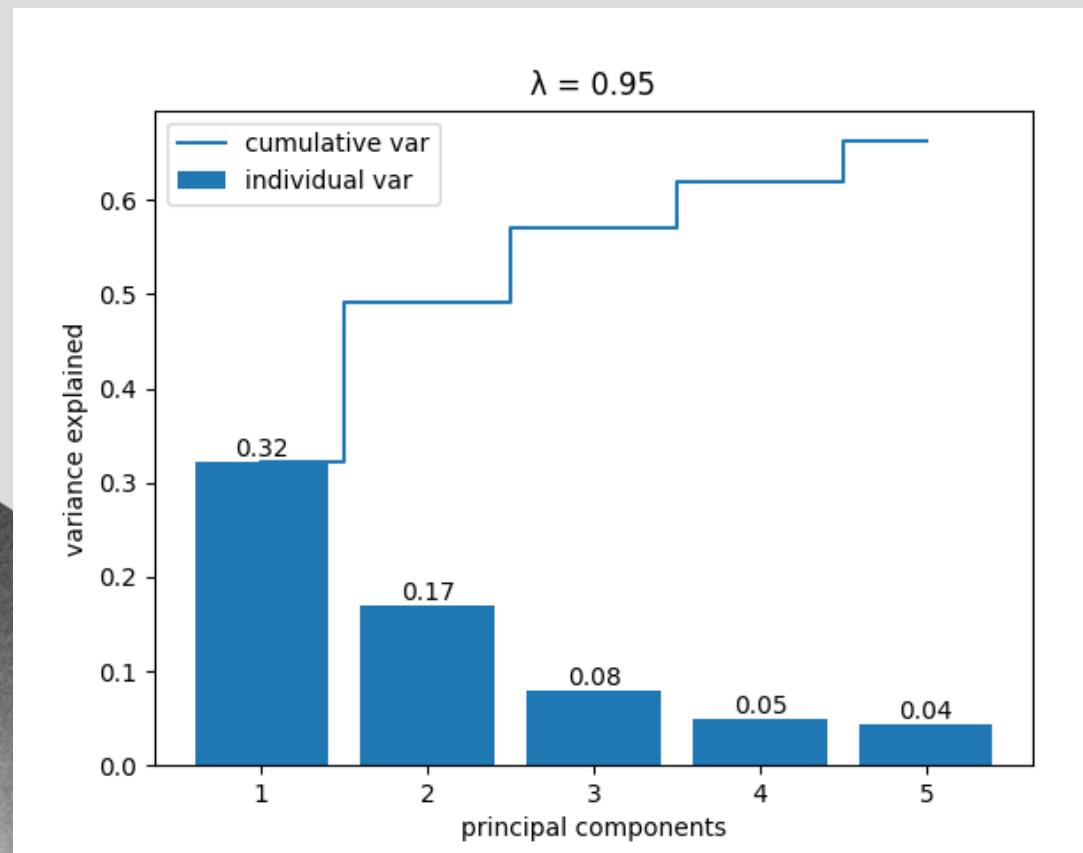
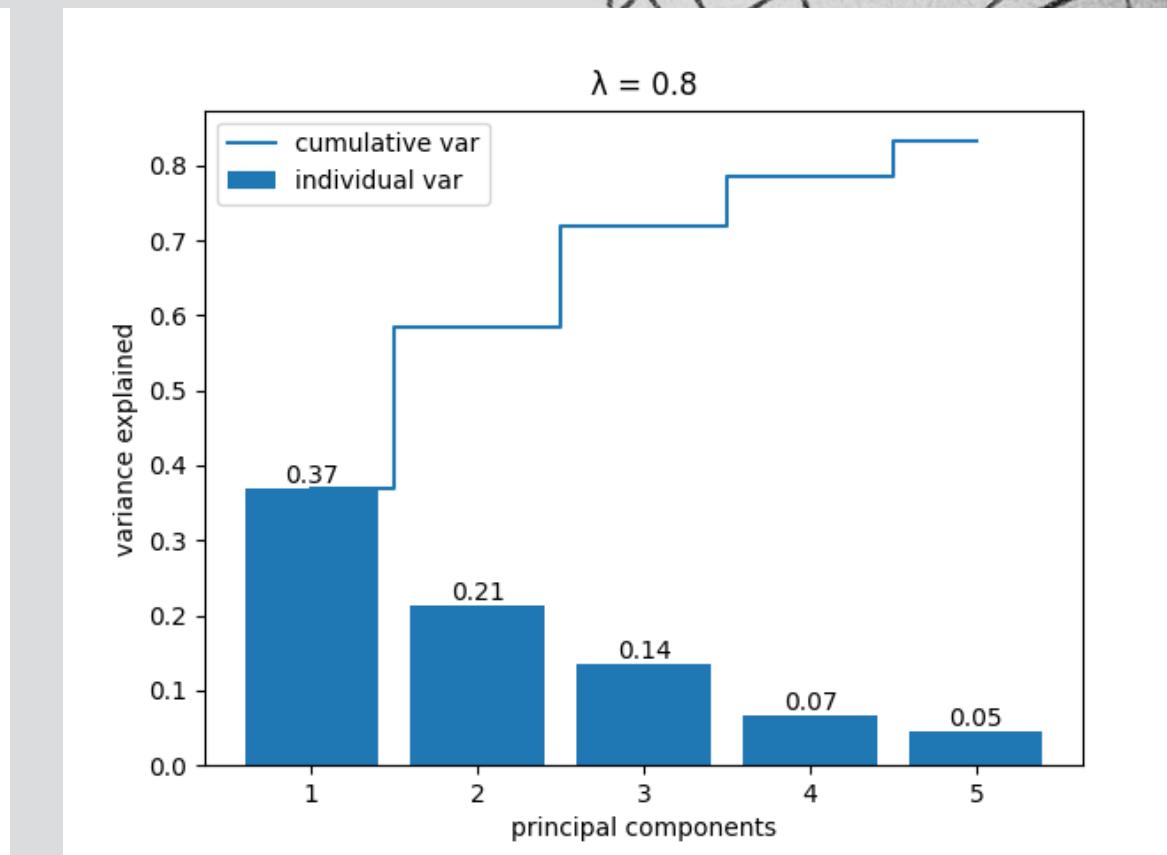
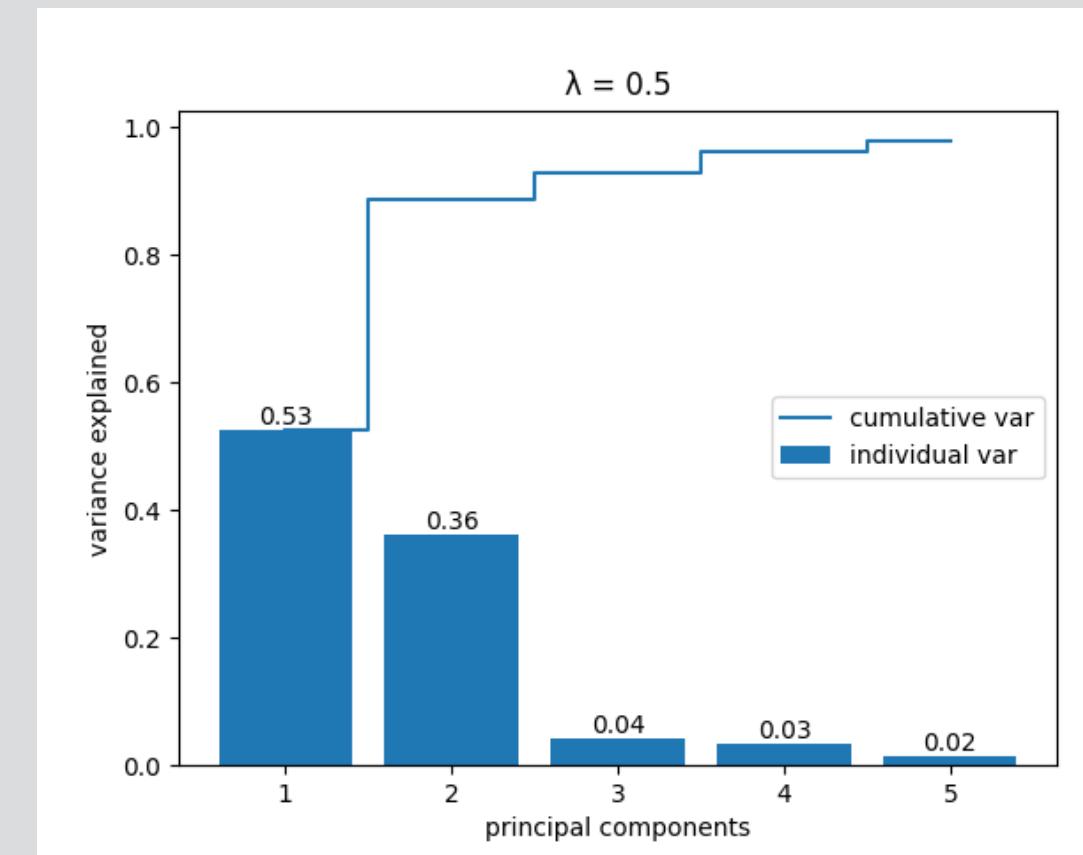
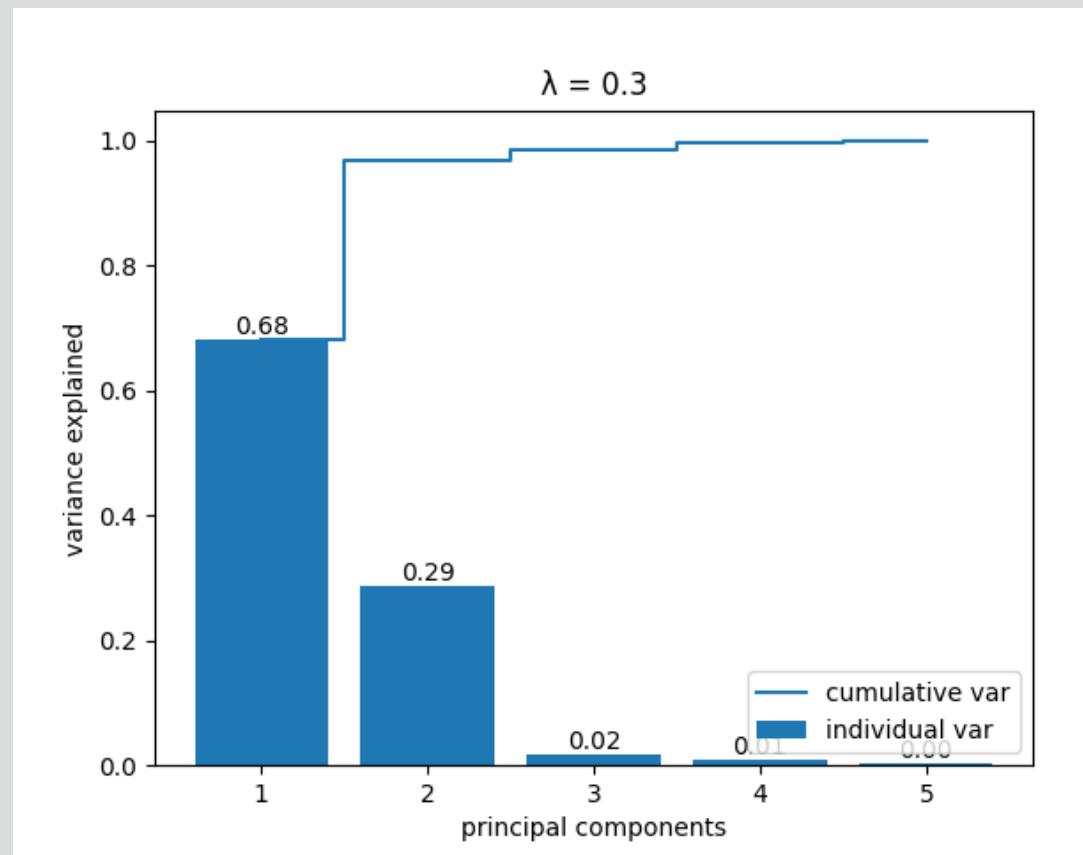
Use the stock returns in DailyReturn.csv for this problem. DailyReturn.csv contains returns for 100 large US stocks and as well as the ETF, SPY which tracks the S&P500.

Create a routine for calculating an exponentially weighted covariance matrix.

Vary $\lambda \in (0, 1)$. Use PCA and plot the cumulative variance explained by each eigenvalue for each λ chosen.

What does this tell us about values of λ and the effect it has on the covariance matrix





Problem 2

Implement chol_psd() in python

testing

```
>>> sigma
array([[1. , 1. , 0.9, 0.9, 0.9],
       [1. , 1. , 0.9, 0.9, 0.9],
       [0.9, 0.9, 1. , 0.9, 0.9],
       [0.9, 0.9, 0.9, 1. , 0.9],
       [0.9, 0.9, 0.9, 0.9, 1. ]])
```

```
chol_psd(root, sigma)
np.matmul(root, np.transpose(root))
```

```
>>> np.matmul(root, np.transpose(root))
array([[1. , 1. , 0.9, 0.9, 0.9],
       [1. , 1. , 0.9, 0.9, 0.9],
       [0.9, 0.9, 1. , 0.9, 0.9],
       [0.9, 0.9, 0.9, 1. , 0.9],
       [0.9, 0.9, 0.9, 0.9, 1. ]])
```

Implement near_psd() in python

not PSD

```
n=500
sigma = np.zeros([n, n]) + 0.9
for i in range(n):
    sigma[i, i] = 1.0

#make the matrix non-definite
sigma[0,1] = 0.7357
sigma[1,0] = 0.7357
```

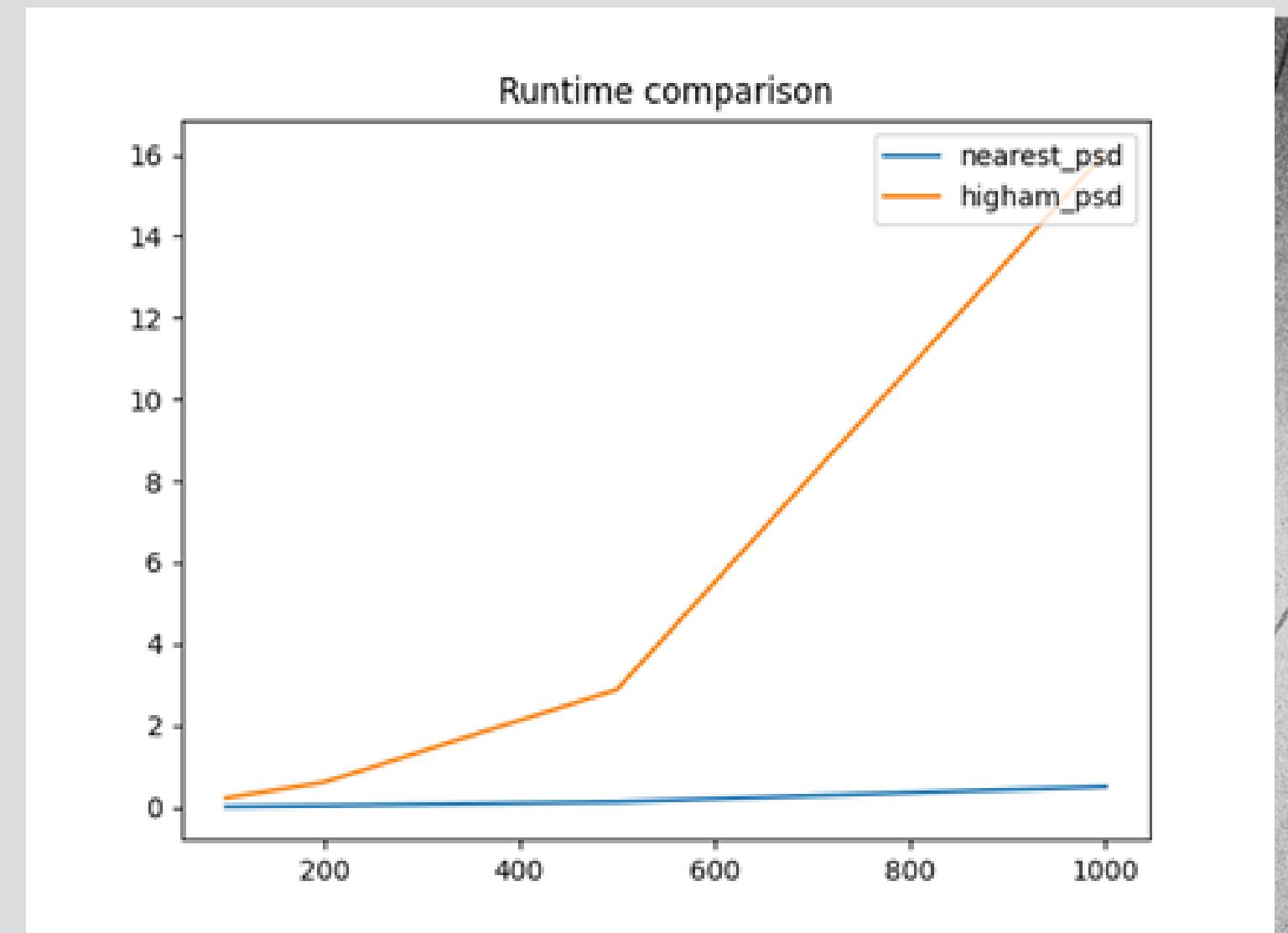
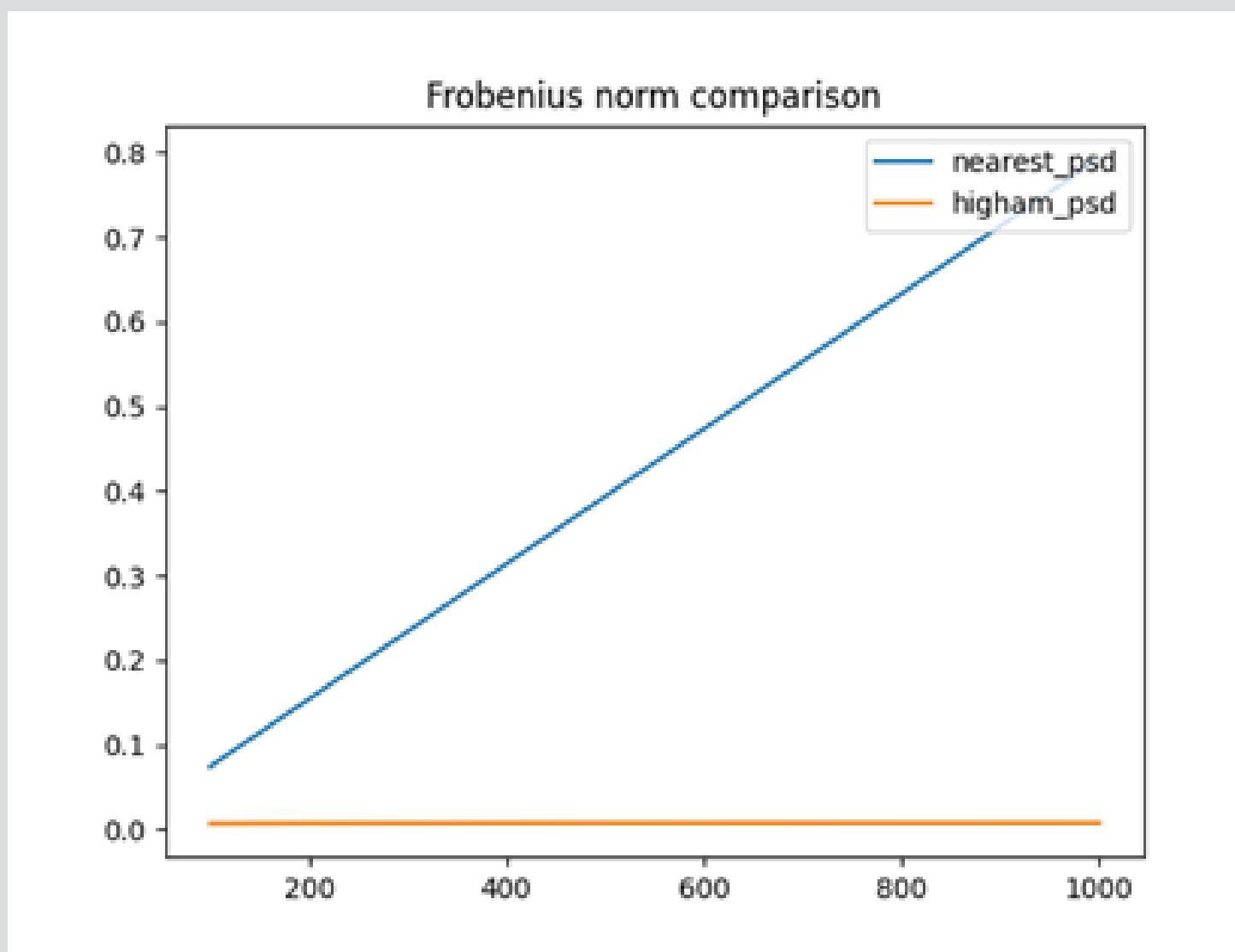
```
>>> sum(eigh(sigma)[0]>-1e-8)
499
```

```
a = near_psd(sigma)
```

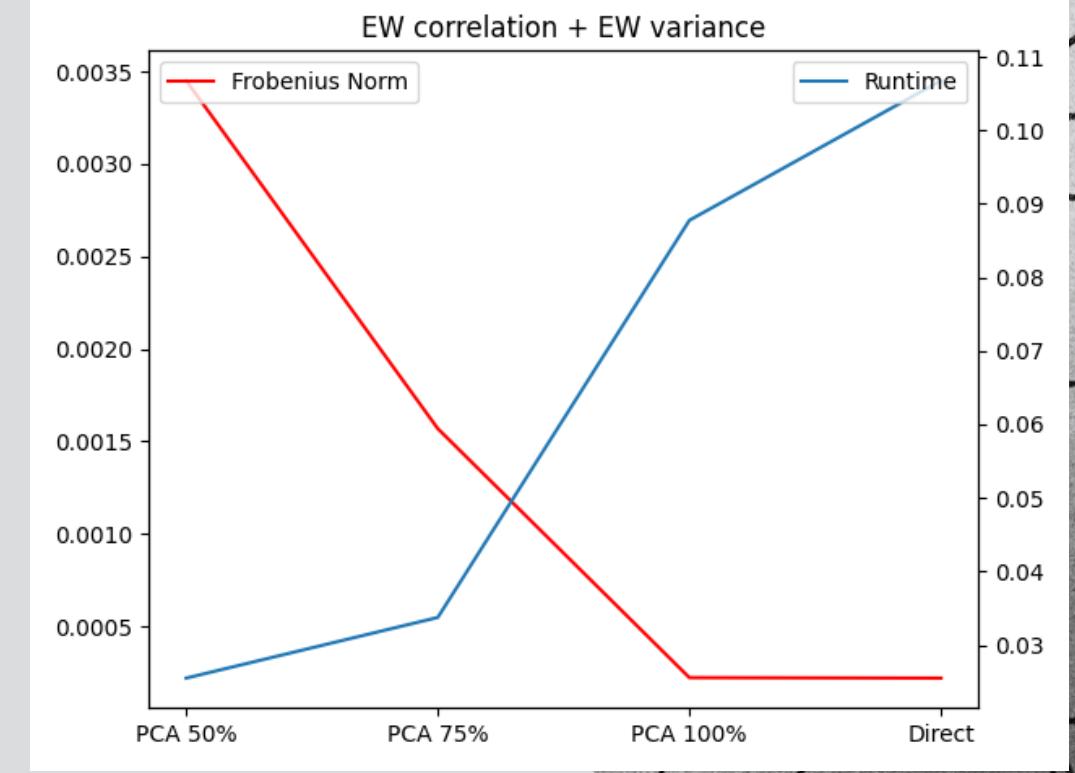
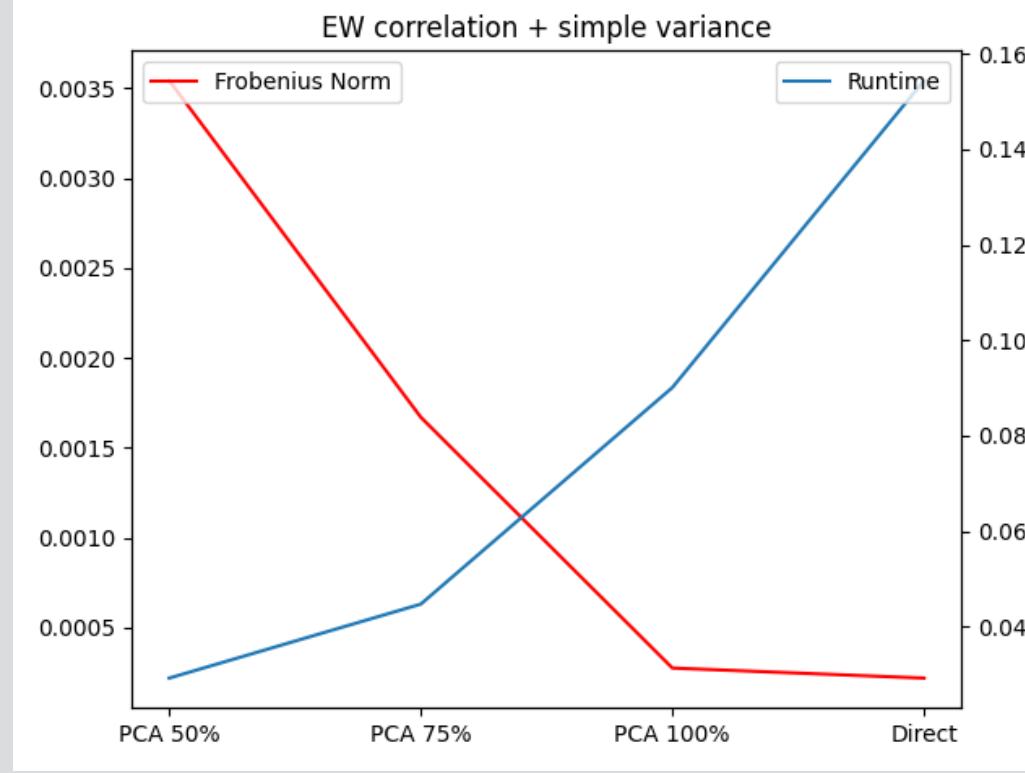
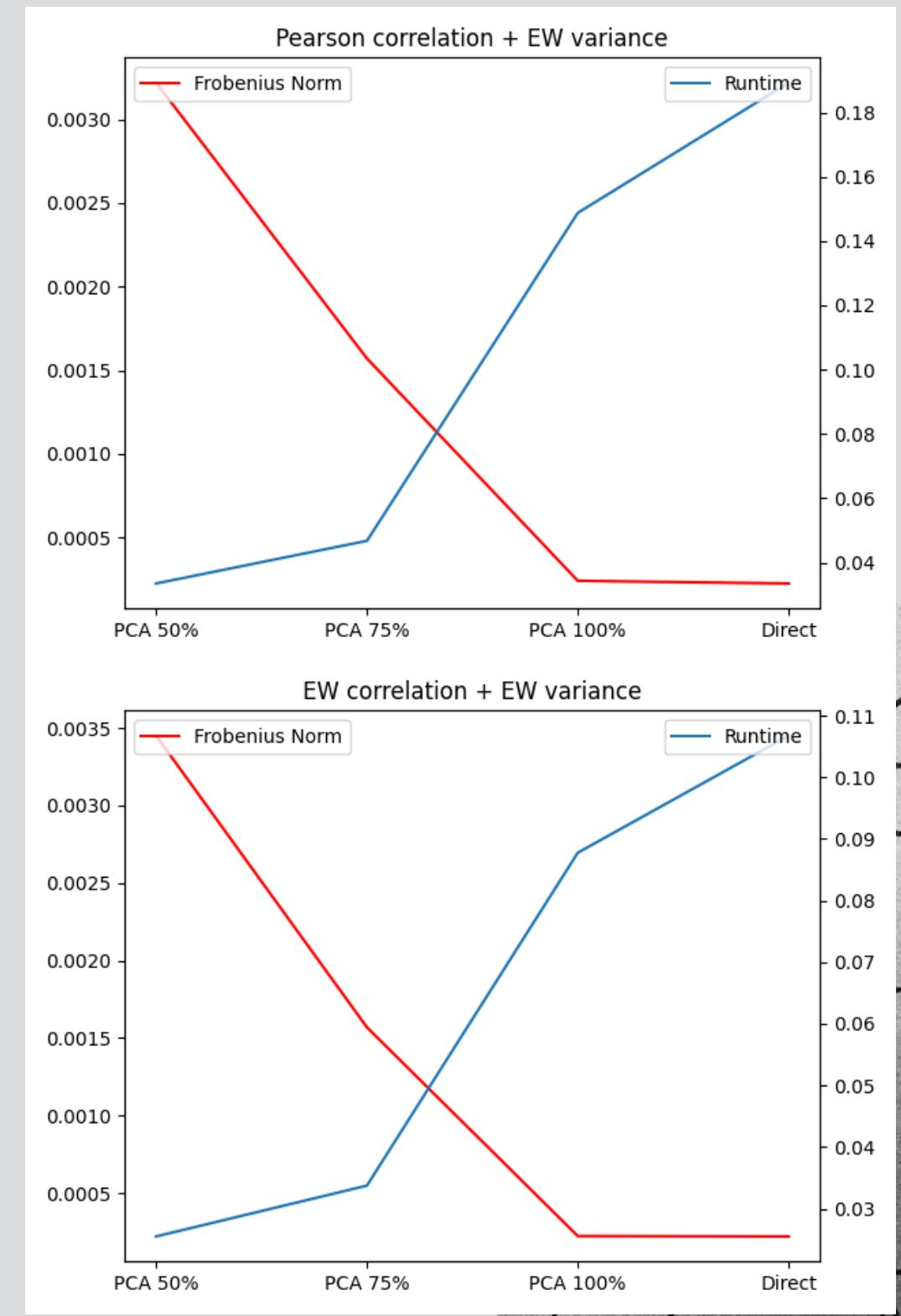
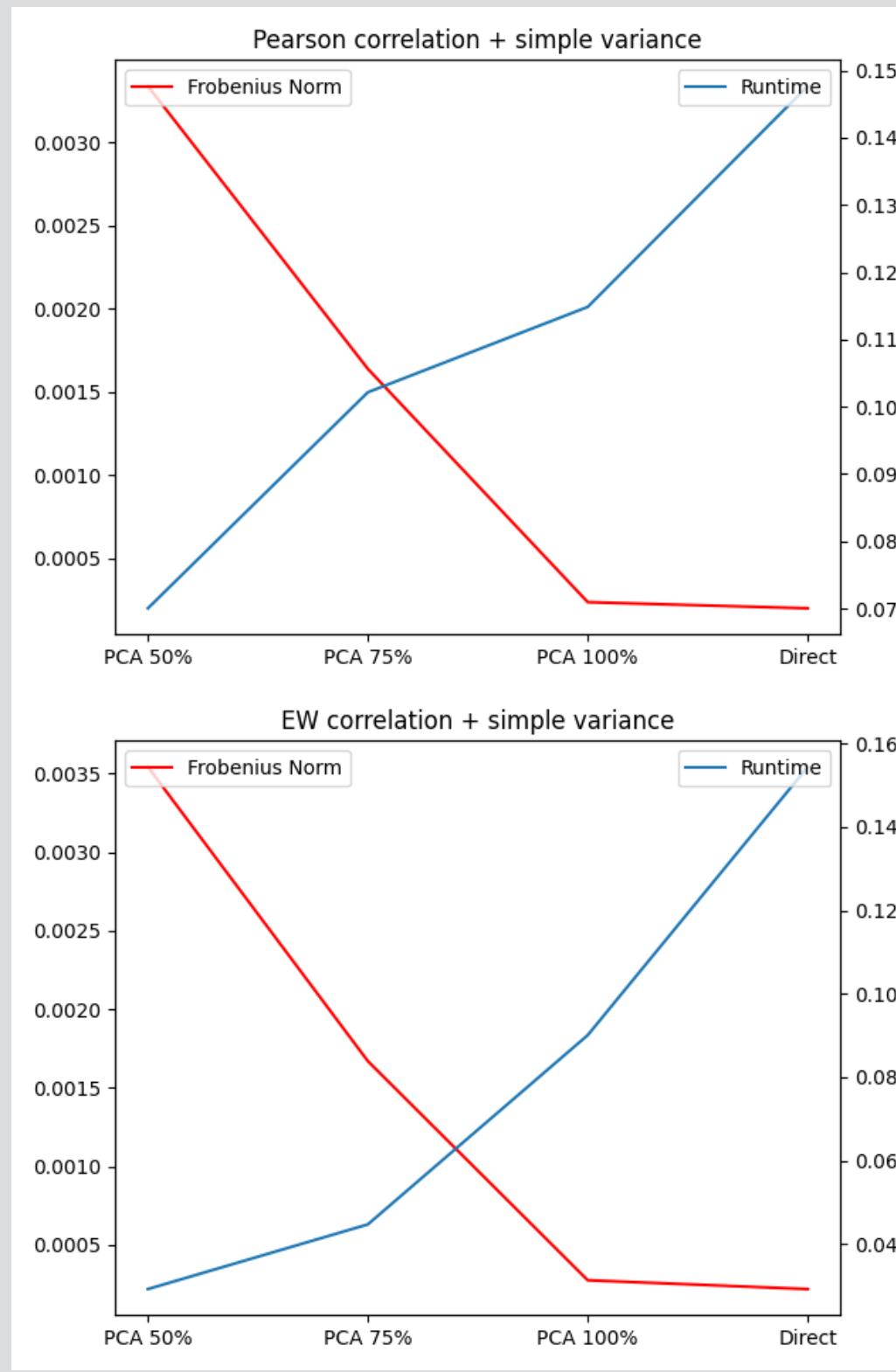
```
>>> sum(eigh(a)[0]>-1e-8)
500
```

Get PSD matrix

Implement Higham's method



Problem 3



The background features a dark teal color with abstract white shapes. On the left, there is a large circle containing a complex network of black lines that intersect and form various shapes, resembling a spider's web or a circuit board. To its right is a smaller, irregular white shape. The overall composition is minimalist and modern.

THANKS FOR LISTENING