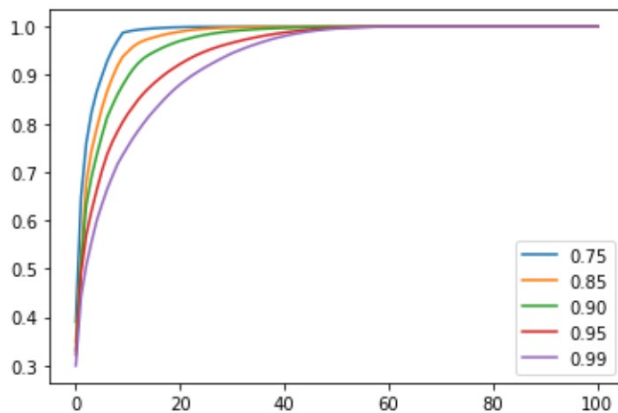


Problem 1:

Answer:

For this problem, I first clean the data to drop the first column (date). Then, I try to write exponentially weighted covariance matrix function by using the data input and the lambda.

After that, I write the PCA function by using the exponentially weighted covariance matrix output. Then, I choose different lambda to test the result. The result show the number of eigenvalue that included.



This plot show the result for the calculation. In this plot, the x-axis shows how many number of eigenvalue included. The y-axis shows the percentage of explained. In this plot, I find when the Lambda increase, the number of eigenvalue that included increase. When lambda increases, we included more about recent data.

Problem 2:

Answer:

In this question, I first build the `near_psd` function, `chol_psd` function, and `higham_nearestPSD` function. Then, I build a data frame for calculation. I calculate the running time for these two functions and get the result.

Here is the result:

Name	Norm	Time
Near_PSD	0.627523	0.114829
Higham2002_psd	0.089648	3.136185

When I see the Norm, I find that Higham's method is more accurate; however, it needs more running time than Near_PSD. I think when we don't care about running time, Higham's method is better because it has better performance than other methods.

Problem 3:

Answer:

For this problem, I first write the `simulateNormal` function and `simulate_pca` function. Then, I calculate the Pearson correlation and Exponentially weighted correlation. After that, I set a simulation for 25,000 and using Direct simulation, PCA with 100% explained, 75% explained, 50% explained.

Here is the result:

	Matrix	Simulation	Norm	Runtimes
0	PEARSON	Full	0.000188	0.178729
1	EWMA_COR_PEARSON_STD	Full	0.000182	0.147698
2	EWMA	Full	0.000178	0.162535
3	PEARSON_COR_EWMA_STD	Full	0.000184	0.144133
4	PEARSON	PCA=1	0.016376	0.081993
5	EWMA_COR_PEARSON_STD	PCA=1	0.017701	0.087832
6	EWMA	PCA=1	0.017424	0.156085
7	PEARSON_COR_EWMA_STD	PCA=1	0.016366	0.117849
8	PEARSON	PCA=0.75	0.016449	0.026298
9	EWMA_COR_PEARSON_STD	PCA=0.75	0.017758	0.028116
10	EWMA	PCA=0.75	0.017480	0.030046
11	PEARSON_COR_EWMA_STD	PCA=0.75	0.016437	0.027812
12	PEARSON	PCA=0.5	0.016304	0.014241
13	EWMA_COR_PEARSON_STD	PCA=0.5	0.017637	0.010069
14	EWMA	PCA=0.5	0.017371	0.015150
15	PEARSON_COR_EWMA_STD	PCA=0.5	0.016307	0.016954

In the plot, I find when PCA explained the percentage decrease, the running time decreased; however, the accuracy also decrease.