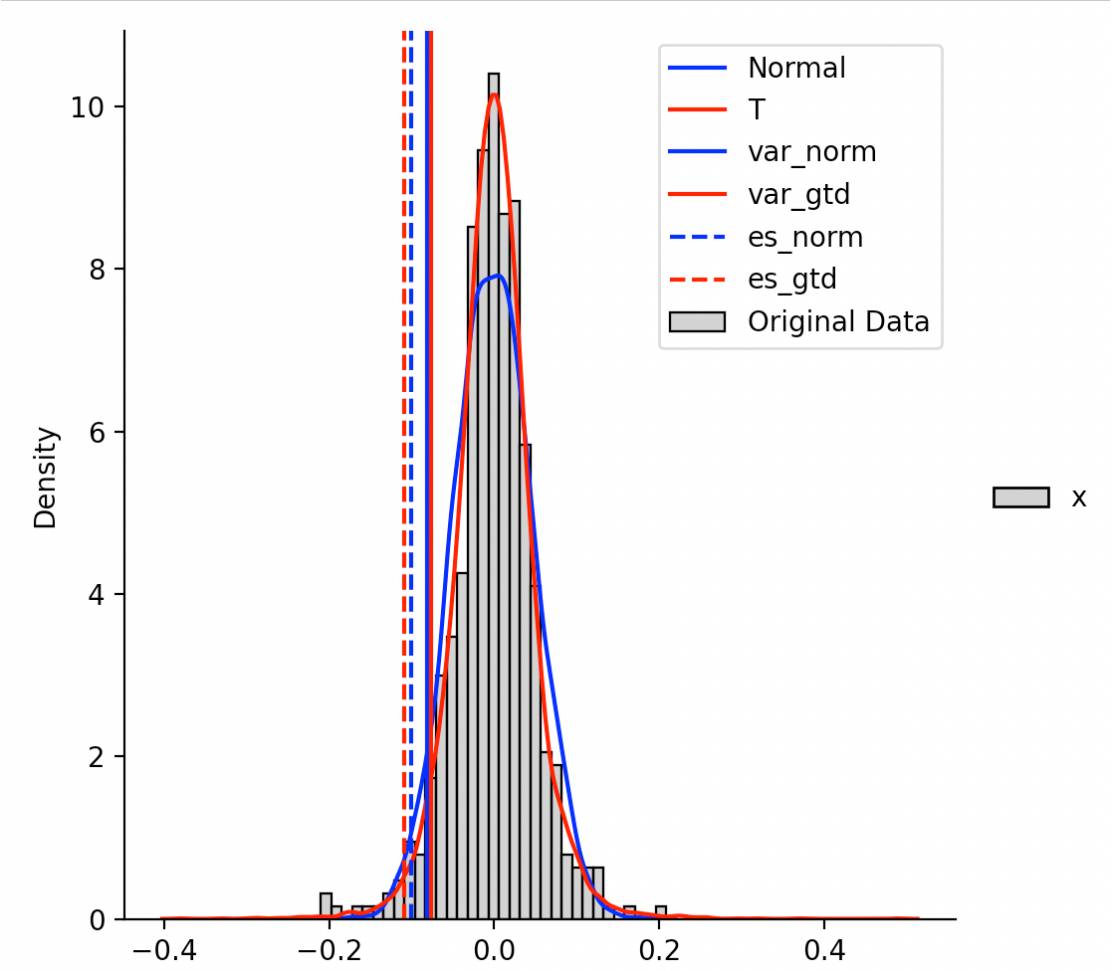
Problem 1

In problem 1, I fit a normal distribution and a generalized T distribution the data and calculated the VaR and ES.

	Normal	T
VaR	0.0813	0.0765
ES	0.1007	0.1086

And the graph shows below



Problem 2

In problem 2, I created a library and wrote test cases for those functions.

Covariance estimation techniques: I used DailyReturn.csv to check if it works, and the output is correct

```
Covariance matrix
[[ 4.43888968e-05 -3.85430825e-06  1.07660135e-04 ...  4.86913046e-05
  -1.01684320e-04  3.93335000e-05]
 [-3.85430825e-06  1.27232874e-04  9.44610196e-05 ...  1.47031014e-06
   6.00522152e-05 -3.40224754e-05]
 [ 1.07660135e-04  9.44610196e-05  4.85738625e-04 ...  1.34714394e-04
  -1.68544006e-04  3.91910029e-05]
```

Non PSD fixes for correlation matrices: I wrote near_psd() and Highams's method, and the output is correct.

```
near_psd() method is correct
Higham's method is correct
```

Simulation Methods: I wrote direct simulation and PCA simulation, and the output is correct.

```
Direct Simulation Matrix
[[-0.00811716 -0.00531047  0.01492209 ... -0.00304445  0.01075656
   0.01445133]
 [-0.01555851  0.00428843 -0.01114583 ...  0.01875819 -0.01504508
  -0.00394743]
 [-0.03996249  0.00128814  0.04358945 ...  0.02402729  0.01747918
   0.03920063]
 ...
```

```
PCA Simulation Matrix
[[ 0.00020103 -0.00379285 -0.00551887 ... -0.00811713  0.00317634
  -0.00352901]
 [-0.00709941  0.00556719  0.00792057 ...  0.01632394  0.00470059
   0.00167357]
 [ 0.0085854  -0.0109322  -0.02167361 ... -0.00053666  0.04413378
  -0.00450874]
 ...
```

VaR calculation methods (all discussed): I use historic method and VaR calculation for Normal Distribution, the answers are correct, using the previous problem data sets.

```
VaR For Historic method:
0.02803599095
VaR For Normal Distribution:
0.03097117565479961 4
```

ES calculation: Using the previous data set, I check that the ES calculation is correct.

```
ES calculation is 0.1167766978856219
```

Problem 3

In problem 3, I used the function that calculate VaR and ES in my library created in problem 2. After fitting a generalized T model to each stock and calculate the VaR and ES of each portfolio and total, the answers are:

	A	B	C	Total
VaR	1960.2054	1811.5893	1592.7413	3088.9572
ES	2468.8770	2320.6709	2044.9239	3890.4365

The results are all smaller than the VaR I calculated from problem 3 from Week 4.