**Week05 - Project Report**

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**Problem1**

There are 29 tests in total and all the tests are passed.

A white line on a black surface

Description automatically generated

**Problem2**

The alpha is set to 0.05.

The result is as below:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Normal distribution | MLE fitted T distribution | Historic Simulation |
| VaR | 0.081335 | 0.076475 | 0.075862 |
| ES | 0.101774 | 0.112017 | 0.115348 |

The historic simulation method for VaR, which is based on actual historical returns, gives the smallest VaR. This suggests that the worst-case scenario in the historical data over the specified period is less extreme than what the normal distribution or the MLE fitted T distribution predict.

For ES, the normal distribution gives the smallest estimate, which suggests that when losses exceed the VaR threshold, they are, on average, less severe under the normal distribution assumption than under the historic simulation or the T distribution.

The differences can be attributed to how these distributions model tail risk:

1. A normal distribution assumes that returns are symmetrically distributed around the mean and has thinner tails, implying a lower likelihood of extreme outcomes compared to the T distribution.
2. An MLE fitted T distribution can better accommodate the heavier tails often observed in financial return data, which can result in higher ES values as it accounts for the possibility of more severe losses.
3. The historic simulation does not assume a particular distribution and instead uses actual historical return data. If the historical data has experienced some extreme losses (heavier tails), this can lead to a higher ES when compared to the normal distribution assumption.

**Problem3**

The result is as below:

**A screen shot of a computer

Description automatically generated**

Compared to the Week04 assignment’s result, the result is smaller.

The potential reason may be copulas allow for more sophisticated modeling of the joint distribution of asset returns, particularly tail dependence. If assets are less correlated in the tails of their distributions, a copula model may show a smaller VaR since it can capture that lower extreme co-movement compared to models that assume a constant correlation.