Week05 - Project Report

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Problem1

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

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----------------------------------------------------------------------
Ran 29 tests in 0.820s

OK
```

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:

```
Portfolio A:
Stock               Total
VaR95         8005.002384
ES95         10634.445194
VaR95_Pct        0.026688
ES95_Pct         0.035454
Name: 35, dtype: object
Portfolio B:
Stock               Total
VaR95        6873.195227
ES95         9071.337269
VaR95_Pct       0.023348
ES95_Pct        0.030814
Name: 32, dtype: object
Portfolio C:
Stock               Total
VaR95        5912.689935
ES95         7425.745754
VaR95_Pct       0.021895
ES95_Pct        0.027498
Name: 32, dtype: object
```

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.