Prob1:

After testing all cases in data, we can have these results:

1.1Arrays are approximately equal: True

1.2Arrays are approximately equal: True

1.3Arrays are approximately equal: True

1.4Arrays are approximately equal: True

2.1Arrays are approximately equal: True

2.2Arrays are approximately equal: True

2.3Arrays are approximately equal: True

3.1Arrays are approximately equal: True

3.2Arrays are approximately equal: True

3.3Arrays are approximately equal: True

3.4Arrays are approximately equal: True

4.1Arrays are approximately equal: True

5.1Arrays are approximately equal: True

5.2Arrays are approximately equal: True

5.3Arrays are approximately equal: True

5.4Arrays are approximately equal: True

5.5Arrays are approximately equal: True

7.1mu is approximately equal: True

7.1sigma is approximately equal: True

7.2mu is approximately equal: True

7.2sigma is approximately equal: True

7.2nu is approximately equal: True

	mu	sigma	nu	Alpha	B1	B2	B3
0	2.257214e-08	0.048548	4.598387	0.042634	0.974887	2.041193	3.154802

	mu	sigma	nu	Alpha	B1	B2	B3

0 0.0 0.048548 4.598293 0.042634 0.974889 2.041192 3.154801

8.1VaR_absolute is approximately equal: True

8.1VaR_diff_from_mean is approximately equal: True

8.2VaR_absolute is approximately equal: True

8.2VaR_diff_from_mean is approximately equal: True

8.4ES_absolute is approximately equal: True

8.4ES_diff_from_mean is approximately equal: True

8.5ES_absolute is approximately equal: True

8.5ES_diff_from_mean is approximately equal: True

Stock VaR95 ES95 VaR95_Pct ES95_Pct

0 A 94.314357 117.854494 0.047157 0.058927

1 B 108.31591 152.252229 0.036105 0.050751

2 Total 152.856258 200.801152 0.030571 0.04016

Stock VaR95 ES95 VaR95_Pct ES95_Pct

0 A 94.460376 118.289371 0.047230 0.059145

1 B 107.880427 151.218174 0.035960 0.050406

2 Total 152.565684 199.704532 0.030513 0.039941

Prob2:

a. Using a normal distribution with an exponentially weighted variance (lambda=0.97);

b. Using a MLE fitted T distribution

c. Using a Historic Simulation

I have set the alpha as 0.05

For a:

VaR absolute: 0.09116934

VaR relative: 0.09028951

ES absolute: 0.1141065222243895

ES relative: 0.11322669273469874

For b:

VaR absolute: 0.07647602684516216

VaR relative: 0.07638230431847998

ES absolute: 0.11321790139118343

ES relative: 0.11312417886418621

For c:

VaR absolute: 0.078245

VaR relative: 0.077067

ES absolute: 0.116337

ES relative: 0.115159

For method a, it is more affected by the recent observations rather than the older ones because it is calculated by assuming a normal distribution with an exponentially weighed variance. The difference between VaR and ES can be due to different tail sensitivity because ES is more sensitive to tail risk while VaR will ignore some tail events.

For method b, which uses MLE fitted T distribution, it has larger tails than normal distribution, which means that it will perform better in capturing extreme events. The difference between VaR and ES can be the difference of the shape of fails and the degree of freedom.

For method c, the difference between VaR and ES can be due to that VaR gives a cutoff point and ignores the losses beyond the threshold, which provides no insight into the extreme losses beyond this point, while ES captures the average of the tail losses and thus accounts for the severity of losses beyond VaR.

Prob3:

For last assignment's data:

Delta Normal VaR method:

A: 19466.5044

B: 11504.0442

C: 26815.5607

Total: 52931.1706

Historical VaR method:

A: 17404.9077

B: 11485.4864

C: 21225.4686

Total: 46410.0203

Then using problem 1's management library fit generalized T models to stocks in portfolios A and B and fit a normal distributions to stocks in portfolio C. Calculate the VaR and ES of each portfolio as well as total VaR and ES, using a copula:

For portfolio a:

VaR_95: 4882.921791

ES_95: 6680.561868

VaR_95_Pct: 0.0129

ES_95_Pct: 0.017649

For portfolio b:

VaR_95: 4026.901598

ES_95: 5689.493577

VaR_95_Pct: 0.010543

ES_95_Pct: 0.014896

For portfolio c:

VaR_95: 3575.631472

ES_95: 4542.796752

VaR_95_Pct: 0.011749

ES_95_Pct: 0.014927

Total:

VaR_95: 11894.829191

ES_95: 15997.311604

VaR_95_Pct: 0.011171

ES_95_Pct: 0.015024

After comparing the results between the last assignment and this assignment, we can find that the data are greatly different. This can be due to different distribution assumptions. For this assignment, we have used generalized T models for portfolio A and B, and normal distribution for portfolio C, while last assignment we have used only Delta Normal VaR method or historical VaR method. The different method will have different tail sensitivity which means they have different performance on capturing the extreme event. Moreover, for this assignment, we have used copula modeling for dependency between stocks in portfolio A and B while last week's assignment does not have dependency between stocks. Therefore, based on these differences, the results can be various greatly. Therefore, we should pick suitable method when we facing different cases of portfolios.