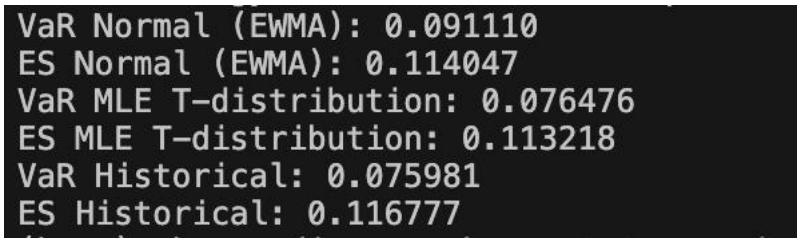
Week 05
Problem 2



Explanation of Differences:

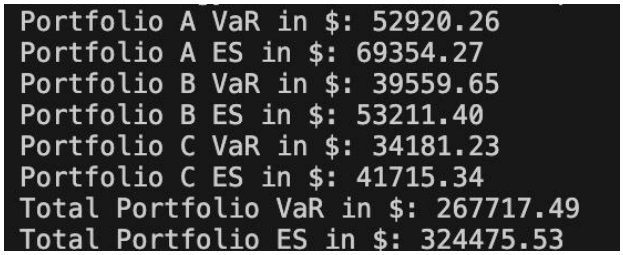
・Normal Distribution with Exponentially Weighted Variance (EWMA):
This method uses exponentially weighted variance to give more weight to recent observations. It results in a slightly higher VaR compared to the other methods, which suggests that recent volatility has been higher. The ES is relatively small, indicating that extreme losses beyond VaR are expected to be less significant.

・MLE-Fitted T-Distribution:
The T-distribution is used to account for heavier tails in financial data. The VaR here is closer to the historical VaR but is slightly larger, while the ES is quite small. This indicates that while the tails are considered, the losses beyond VaR aren't as significant as in the historical simulation.

・Historical Simulation:
This method directly uses historical data without making distributional assumptions. It has the smallest VaR, but the highest ES, suggesting that while the threshold for significant losses is relatively low, the average loss in the worst-case scenarios is much larger.

Conclusion:
The Normal (EWMA) method emphasizes recent volatility, leading to a higher VaR. The MLE T-distribution captures heavier tails but still suggests relatively lower expected losses compared to historical data. The historical simulation shows the most conservative approach with a higher ES, reflecting past extreme events.

Problem3



1.Model Differences Analysis:

・In Week 4, I used an Exponentially Weighted (EW) Covariance approach with λ=0.97 to calculate VaR, which provides a more recent-weighted view of volatility, emphasizing recent price movements. This method helps to capture changes in volatility more responsively compared to equally weighted methods.

・For the new calculations, I chose Generalized T distributions for portfolios A and B and Normal distributions for portfolio C, using a copula to estimate joint risks. The choice of a Generalized T distribution is beneficial for modeling financial returns with heavier tails, capturing extreme events better than the normal distribution. The copula model allows for the dependency structure between different assets, which provides a more realistic estimation of joint risk compared to assuming independence.

2.VaR and ES Comparison:

・The results from copula and Generalized T model approach yielded higher VaR and ES values across portfolios A, B, C, and the total portfolio. This substantial increase highlights the risk amplification when using heavier-tailed distributions (Generalized T) and capturing dependency (copula).

・The EW approach, while responsive to recent changes, may understate risk by not fully accounting for tail dependence or the possibility of extreme events.

3. Impact of Model Choice:

・Copula with Generalized T Model captures extreme events more robustly by modeling the heavier tails and dependency structure, leading to higher VaR and ES estimates. This approach is more conservative and provides a buffer against unexpected market shocks.

・EW Covariance Model: By focusing on recent price movements, this model offers a responsive measure of risk but might underestimate tail risk or correlated extreme losses, especially under calm market conditions leading up to a volatile event.

4.Conclusion:

·The shift to a copula and Generalized T distribution reflects a more cautious approach to risk, better suited for environments where extreme losses are of concern. While the EW model provides a quick, responsive measure of recent volatility, the copula with heavier-tailed distributions offers a deeper insight into potential extreme losses. This comparison underscores the importance of selecting a risk model based on the specific needs of the portfolio and the market environment.