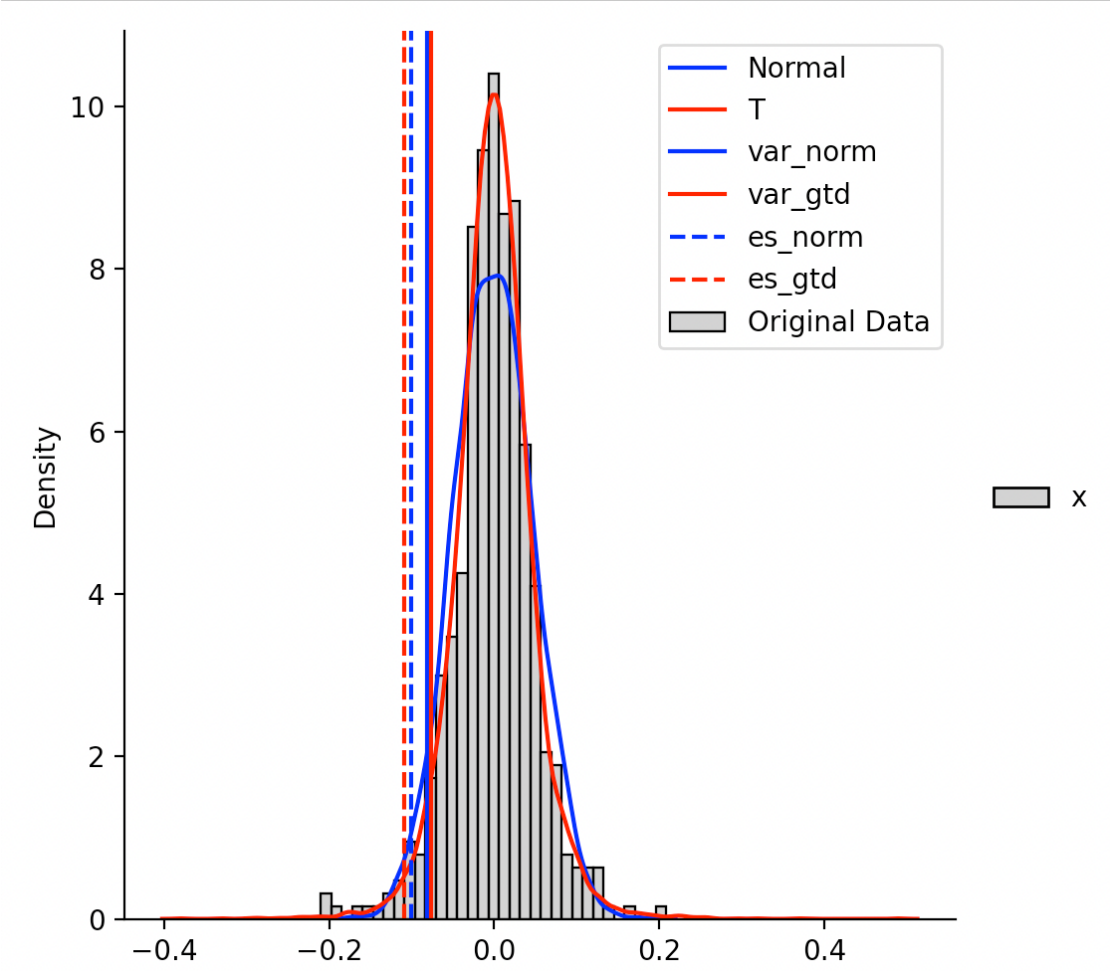
Problem 1

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



Based on the data presented, it can be observed that when the number of data points exceeds 30, the t distribution, which has a similar shape to the normal distribution according to the central limit theorem, provides a better fit for the original data than the normal distribution. The graph shows that the variance of the normal distribution is to the left of the variance of t distribution, indicating that on a bad day with a probability of 5%, the loss under the normal distribution would be greater than that under the t distribution. This difference may be attributed to the critical values of the two distributions, with the critical value of the normal distribution being smaller than that of the t distribution in this case. However, the graph also shows that the ES value of normal distribution is to the right of the ES value of t distribution, indicating that the expected loss given the loss beyond VaR is higher under the t distribution. The expected shortfall is numerically calculated as the mean of all values less than or equal to VaR. Despite the differences in the VaR values between the two distributions, the t distribution has fatter tails and more extremely small values, resulting in a smaller mean of all values and therefore a smaller expected shortfall, which is shown to be to the left of the ES value of normal distribution in the graph.