Week 5 Project

Question 1

In this question, we need to fit a Normal Distribution and a Generalized T distribution to the data and calculate the VaR and ES for both fitted distributions.

$$t\,VaR_{v,\alpha,h} = \sqrt{v^{-1}(v-2)}\,t_v^{-1}(1-\alpha)\sigma_h - \mu_h$$

$$t\,CVaR_{v,\alpha,h} = -\alpha^{-1}(1-v)^{-1}(v-2+x_{\alpha,v}^2)f_v(x_{\alpha,v})\sigma_h - \mu_h$$

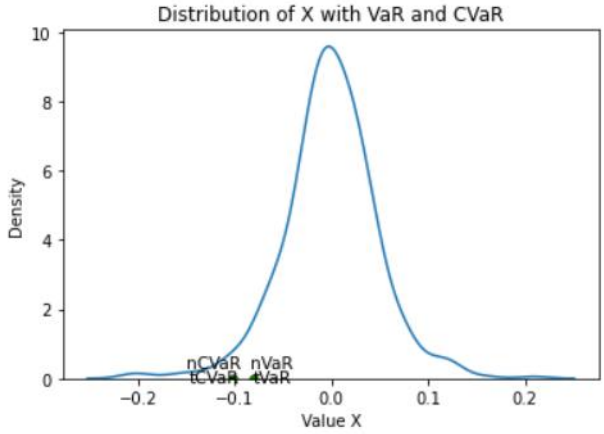
$$\mathrm{CVaR}_{h,\alpha}(X) = \alpha^{-1}\varphi(\Phi^{-1}(\alpha))\sigma_h - \mu_h$$

$\varphi(z)$ *standard normal density function*

$\Phi^{-1}(\alpha)$ α *quantile of the standard normal distribution*

After the calculation, I got the result and plot the graph of the distribution PDFs, VaR, and ES values.

	Name	Value
0	Empirical VaR	0.075981
1	Empirical CVaR	0.116777
2	Normal VaR	0.081335
3	Normal CVaR	0.101774
4	T VaR	0.081323
5	T CVaR	0.101660



I notice that VaR is closer to 0 compared to CVaR, because the meaning of the CVaR is actually the mean of the value below VaR, so it will be further that 0 compared to VaR.

Question 2

I put all the functions in the “library. ipynb” file, please check that file.

Question 3

After splitting the file into three portfolios, I calculated the weight and got the return, and then simulate a Generalized T model to get the VaR and ES.

	Name	VaR	CVaR
0	Portfolio_A	0.021169	0.026364
1	Portfolio_B	0.019104	0.023793
2	Portfolio_C	0.017026	0.021205
3	Whole_Portfolio	0.017594	0.021912