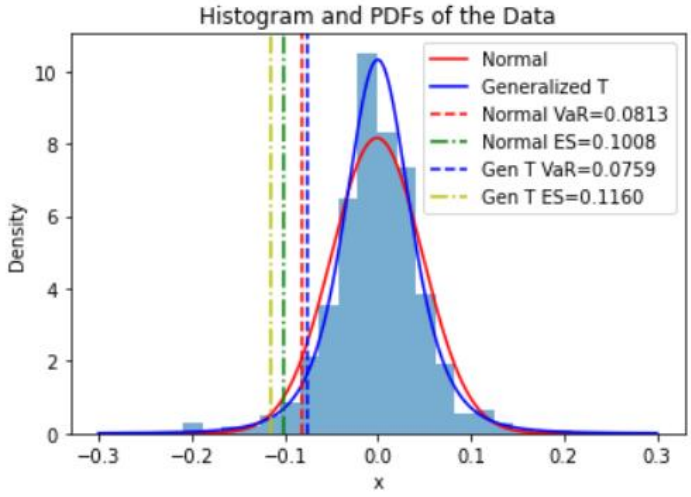
Q1:

Under Normal Distribution, the VaR is 0.0812 and ES is 0.1008 while under Generalized T distribution, the VaR is 0.0759 and ES is 0.1160. From the graph, I noticed that VaR under Normal Distribution is larger than under Genralized T distribution while ES under Normal Distribution is smaller than under Genralized T distribution. I think such a difference is because that T distribution has a fatter tail so that there will be more extreme values under T distribution.

```
VaR at 5% level: 0.08125483171032236
Expected Shortfall at 5% level: 0.10079349540127162

Generalized T Distribution:
VaR: 0.075861511162783
ES: 0.11595365600765128
```

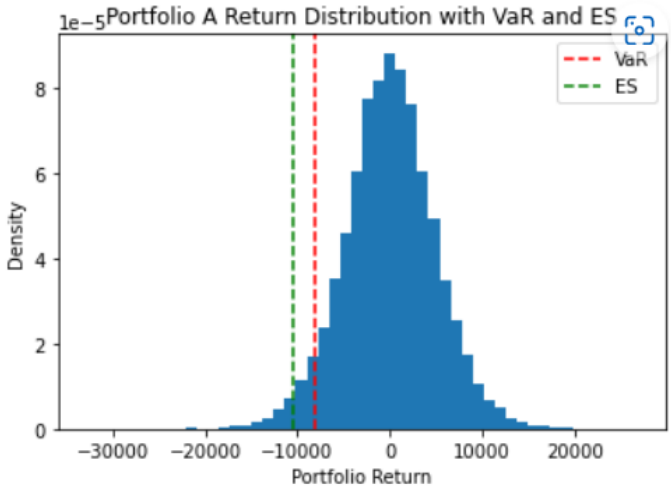


Q2:

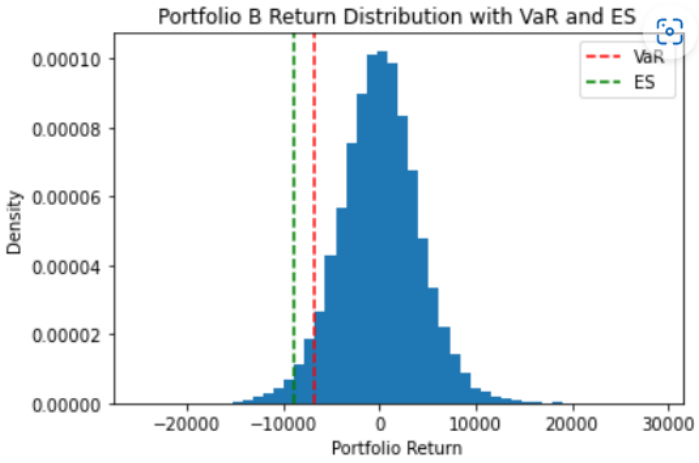
All functions perform as expected which is shown in FinTech 545 Week05 Q2.py.

Q3:

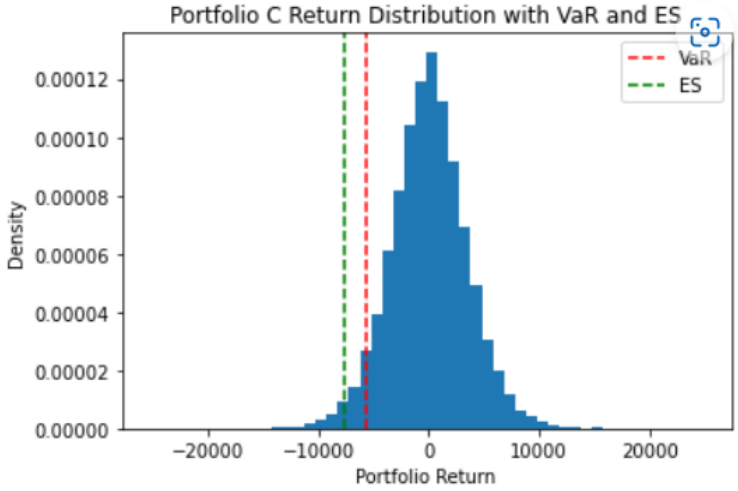
```
VaR and ES under T distribution for Portfolio A are:
VaR:  8077.906498917204
ES:  10516.352376256835
```



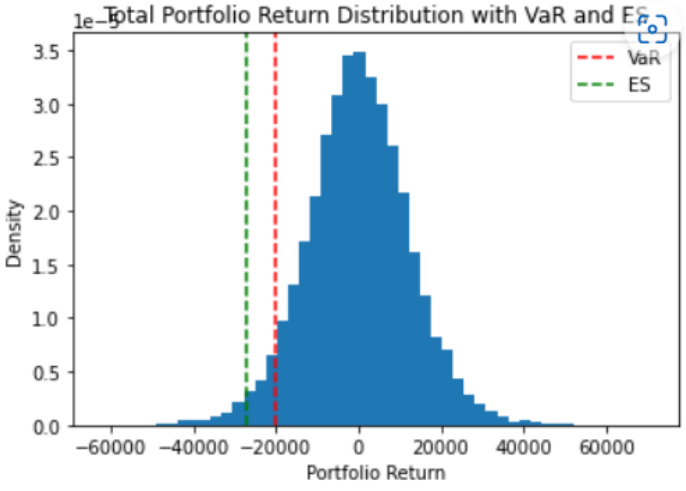
VaR and ES under T distribution for Portfolio B are:
VaR: 6760.097042977868
ES: 8850.23531875362



VaR and ES under T distribution for Portfolio C are:
VaR: 5615.317713276192
ES: 7625.454079777498



VaR and ES under T distribution for total portfolio are:
VaR: 20202.363956442918
ES: 26970.800051852235



Compared with the VaR using an exponentially weighted covariance with lambda = 0.94 and normal distribution from problem 3 in week 4, the VaR is higher using the t distribution. The reason behind it may seem because that the t distribution has a fatter tail which means that more extreme loss and gain will be included in the distribution so that the absolute values in the first and last quantiles will be larger while under normal distribution, it has a thinner tail so that less extreme loss and gain will be included in the distribution. Therefore, under the same level of VaR, the value under the t distribution will be larger than the normal distribution. The t distribution will be more suitable if there are more extreme gains or losses.