CFRM 410 Assignment 9

Use daily closing price data from the 2014 calendar year to compute a one-day $\alpha = 0.01$ Value at Risk for a \$25,000 investment in HMS Holdings Corp. (ticker HMSY) and provide a report supporting your calculation. Your report should include (at least) the following:

I carried out parts 1-5,7 (as well as I could) in my accompanying R file. I think it may be likely that part 4 was done incorrectly and I was unsuccessful in my attempt to to part 5.

1. A plot of the raw data (e.g., the price data during 2014).
2. An exploratory analysis (graphical and numerical) of the returns.
3. A normal quantile-quantile plot of the returns.
4. A double exponential quantile-quantile plot of the returns.
5. A t quantile-quantile plot of the returns (Note: you will have to estimate the degrees of freedom parameter: use maximum likelihood).
6. Based on the quantile-quantile plots, choose an appropriate family of distributions to model the returns.

   My best guess, based on what I have seen in my exploratory analysis in R, is that the normal distribution will be a fair enough choice for the distribution family.
7. Estimate the parameters of the returns distribution using maximum likelihood.
8. The computed Value at Risk.

We made the assumption that the HMS Holdings daily returns were normally distributed. Using MLE we found that $\hat{\mu} = 0.0002259106$ and $\hat{\sigma}^2 = 0.0005870577$, with the calculations carried out in the R script. To find the one day Value at Risk for $\alpha = 0.01$ we look in a standard normal cumulative density table to find that $\Phi(-2.33) \approx 0.01$. Using the normalizing transformation, with X as our daily return value, we have

$$\begin{aligned} .01 &\approx P(Z \leq -2.33) \\ &= P(\frac{X - \hat{\mu}}{\hat{\sigma}} \leq -2.33) \\ &= P(X \leq \hat{\mu} - 2.33\hat{\sigma}) \\ &= P(X \leq -0.0562283) \end{aligned}$$

Using this and the investment value of \$25,000, we report that the one-day $\alpha = 0.01$ VaR for \$25,000 invested in HMS Holdings Corporation is $\approx$ \$1405.