Task 1

1. Identify the 30 component stocks after the October 18, 2018 US trading session and record the end of-day prices. Verify that the DJIA index value is indeed equal to the sum of the 30 prices divided by 0.14748071991788. Report your finding.

Calculated DJIA=25379.45 and Real DJIA=25379.45 too, so based on the 30 component stocks, we can duplicate the DJIA index with little following error.

7. Compute and report the annualized average and volatility of log return in percent

Annualized log return of Dow Jones Index : 8.864706892185749\%

Annualized volatility of Dow Jones Index : 17.449283955950326\%

Annualized log return of S&P Index : 8.159664305298736\%

Annualized volatility of S&P Index : 17.857044278069334\%

We use the additive feature of log return to compute the annualized log return of Dow Jones and S\&P Index. So if we recognize that S\&P as the real market represent index since it has a superior breadth and depth of coverage compared with the Dow, then the annualized log return of US stock market is 8.16\%. In the meantime, Dow’s return is 0.7\% slightly higher than the whole market return. But as for the volatility, Dow is supposed to be more volatile that the S\&P due to the higher return rate, by contrast, its volatility is 0.4\% less than the S\&P’s 17.85\% volatility, which we may consider as the represent of real market volatility.

8. Compute and report the sample skewedness and sample kurtosis

Skewedness of Dow Jones Index : -1.6915630820777834

Kurtosis of Dow Jones Index : 45.39466619559327

Skewedness of S&P 500 : -1.283239589463856

Kurtosis of S&P 500 : 31.44364518517353

The skewedness of normal distribution is 0. Comparing these two figures of Dow Jones and S\&P, we can find out that both indexes have negative skewedness which represent that US stock market can be considered as left-skewed. This means that the left tail of log return is being drawn out and the mean value is being skewed to the left of a typical center of the data, which is true in stock market because we can observe more extreme low return especially in several stock market recession period and the mean return is less than what we can obtain in normal periods.

As for the kurtosis, for normal distribution it’s 3, but for Dow and S\&P is 45.39 and 31.44 respectively. This means US stock market is generally *leptokurtic* which has tails that approach zero more slowly than a Gaussian, and therefore produces more outliers than the normal distribution. It shows that extreme condition like stock price crush or skyrocket is happening more often than normal distribution in US stock market.

9. Report the JB and make an inference on the test of normality at the 5\% significance level.

The JB test null hypothesis is JB=0 which indicates that the distribution that we test is normal distribution under certain significance, and under 5\% significance the critical Chi-Square Value with 2 Degrees of Freedom is 5.991465. And the JB statistic of Dow Jones and S\&P is showing above and we can reach the conclusion that they can both reject the null hypothesis, which suggest that the log return of these two index portfolio is not normal distribution under 5\% significance.

Task 2

1. Compute and report the correlation between the log returns of DJIA and SP500

The correlation is 0.965149, this high correlation can be explained by the fact that Dow’s 30 component stocks are also concluded in S\&P. But according to the figures, there are sometimes that the correlation drops