STATS509 HW1

Code

Q1

a)

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```
source('startup.R')
qdexp(0.1, 0, sqrt(0.5)) - 2
```

Quantile is -4.27

b)

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```
# when x< 2, Z is increasing
1 / (qdexp(0.1, 0, sqrt(0.5)) - 2)**2
```

```
[1] 0.05468983
```

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```
# when x > 2, Z is decreasing
1 / (qdexp(0.9, 0, sqrt(0.5)) - 2)**2
```

```
[1] 13.11904
```

when x < 2 quantile is 0.05, and when x>2 quantile is 13.12

Q2 ## a)

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```
# because log -return is a increrasing function
p = 0.002
r = qnorm(p, 0, sd = 0.025)
R = exp(r) - 1
Total = R * 100
print(Total)
```

```
[1] -6.942634
```

Total return is -6.942634 million USD. ## b)

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```
library("fGarch")
q1 = qged(p, mean = 0 , sd =  0.025, nu = 0.5)
q2 = qged(p, mean = 0 , sd =  0.025, nu = 0.9)
q3 = qged(p, mean = 0 , sd =  0.025, nu = 1.4)
for (i in c(q1, q2, q3)){
  R = exp(i) - 1
  total = R *  100
  print(total)
}
```

```
[1] -12.60278
[1] -9.758018
[1] -8.011714
```

The Total return is -12.6, -9.75, -8.01 respectively for ν = 0.5, 0.9 , 1.4 # Q3 ## a

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```
df = read.csv("Nasdaq_daily_Jan1_2019-Dec31_2021.csv")
par(mar = c(5,5,2,5))
n = length(df$Adj.Close)
R = df$Adj.Close[-1]/df$Adj.Close[-n]  - 1
r  = diff(log(df$Adj.Close))
t = as.Date(df$Date, format = "%Y-%m-%d")
plot(t, df$Adj.Close, type = "l", xlab = "Time", ylab = "Price($)", col = 1)
par(new = T)
```

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```
plot(t[-1], r, type ="l", axes=F, xlab=NA, ylab=NA, cex=1.2, col = 2, lty = 2)
axis(side = 4)
```

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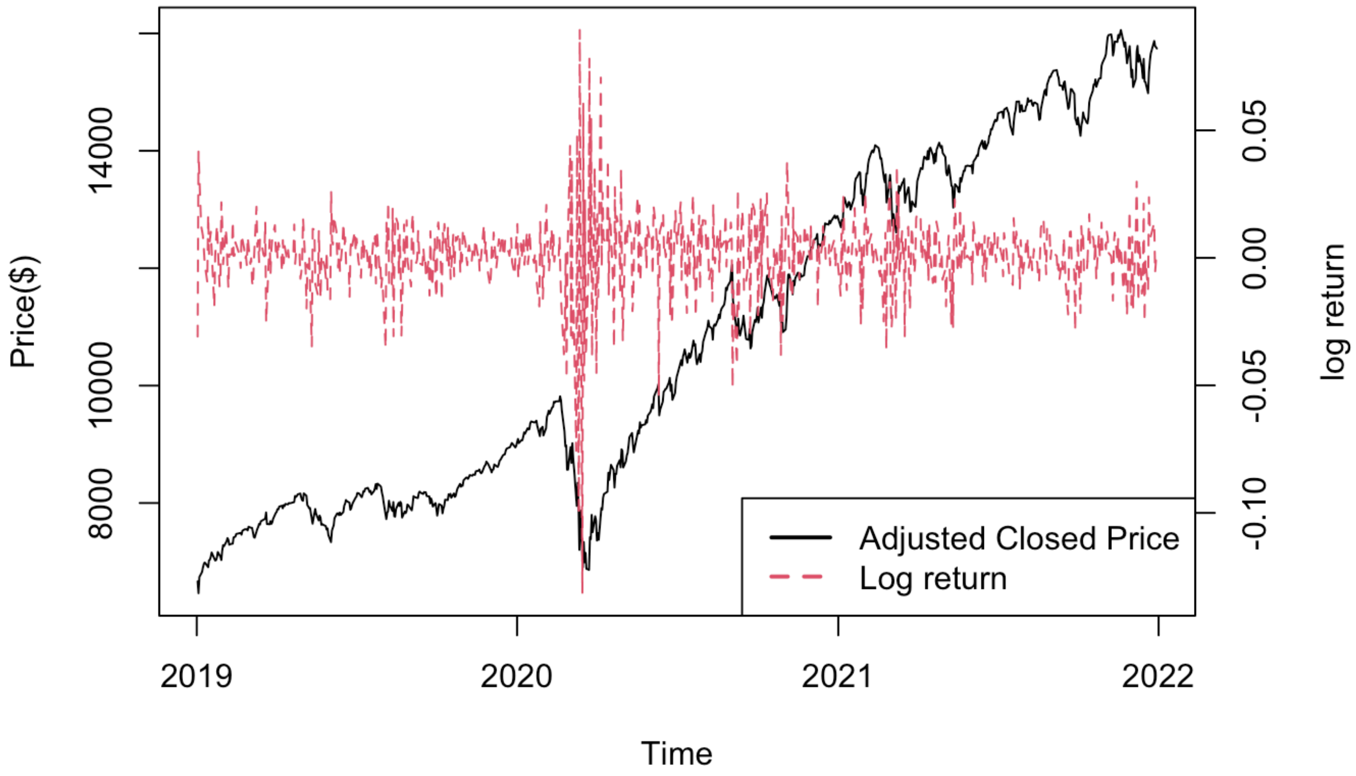
```
mtext(side = 4, line = 3, 'log return')
legend(x = "bottomright",          # Position
       legend = c("Adjusted Closed Price", "Log return"),  # Legend texts
       lty = c(1, 2),           # Line types
       col = c(1, 2),           # Line colors
       lwd = 2)
```



The graph shows that when there is a huge sludge or voilitility in the adjusted closed price, the log-return of that period tends to flucuate accordingly. Otherwise, the log-return bounces up and down around zero.

b

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```
library(fBasics)
library(psych)
describe(r)
```

	vars <dbl>	n <dbl>	mean <dbl>	sd <dbl>	median <dbl>	trimmed <dbl>	mad <dbl>	min <dbl>	max <dbl>
X1	1	755	0	0.02	0	0	0.01	-0.13	0.09

1 row | 1-10 of 13 columns

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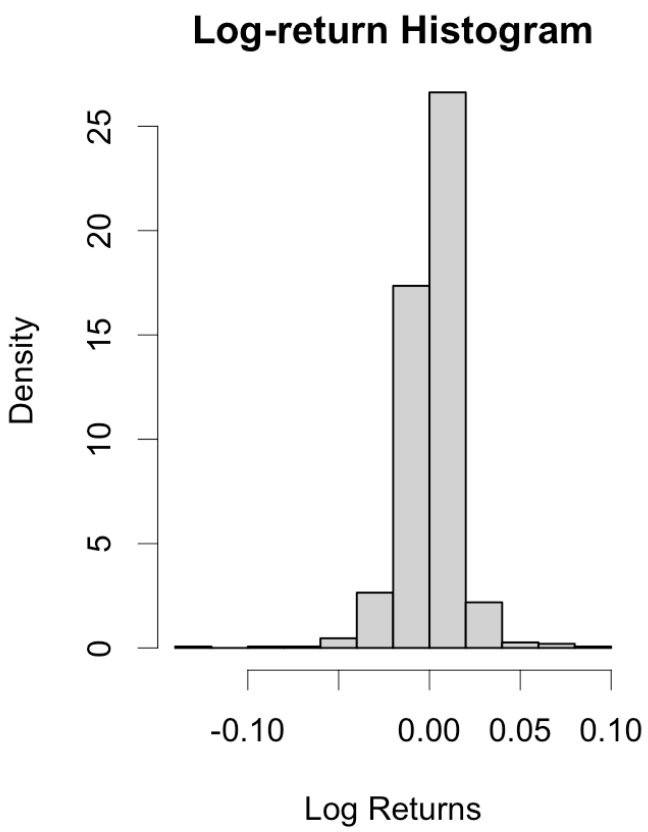
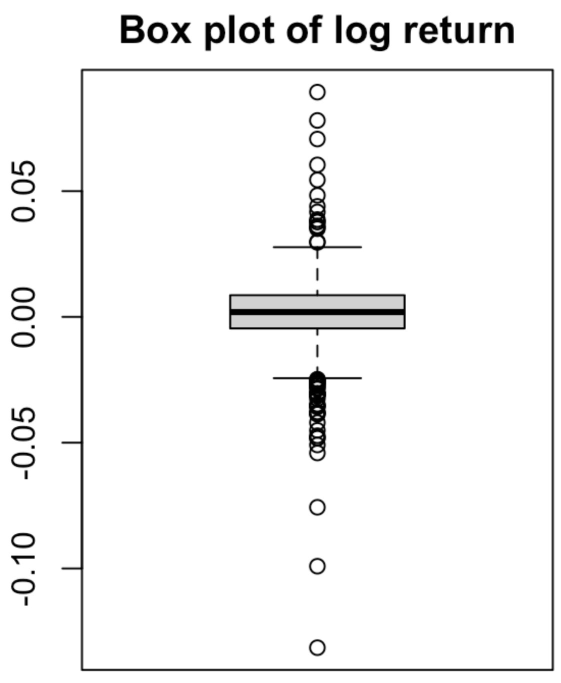
```
par(mfrow = c(1,2))
hist(r, xlab = "Log Returns", freq = FALSE, main = "Log-return Histogram", lwd = 0
.5)
boxplot(r,main = "Box plot of log return")
```





The skewness of log-return is -1.05, and kurtosis is 12.38. From the former statistics, we can tell the distribution is close to symmetric, while the latter statistics denotes huge deviation from normal tails, and density is concentrated across the mean 0.

c

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```
mu = mean(r)
std = sd(r)
qdexp(0.004, mu, sqrt(2)/std)
```

```
[1] -0.05234054
```

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```
quantile(r, 0.004)
```

```
      0.4%
-0.05404066
```

They are fairly close, the latter one is slightly lower than the former one.

Q4

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```
r = log(100/97)
pnorm(r, mean = 0.0002*20, sd = sqrt(20)*0.03)
```

```
[1] 0.5781705
```

The probability is 57.8%.

11

solve $P(S > (ln2 - \mu)/(t * \sigma)) > 0.9$ t>81583.05 t = 81584