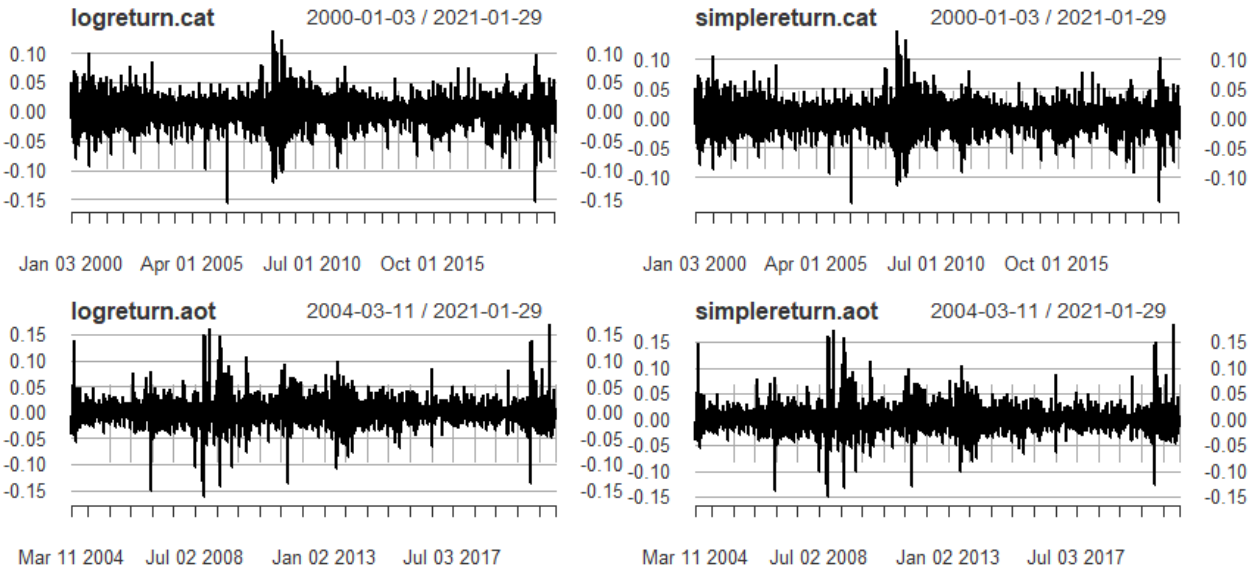
1.a)

```
par(mfrow=c(2,2))
plot(logreturn.cat,type='l')
plot(simplereturn.cat)
plot(logreturn.aot,type='l')
plot(simplereturn.aot)
```




```
newlogreturn.cat <- logreturn.cat[2:nrow(logreturn.cat),]
newsimplereturn.cat <- simplereturn.cat[2:nrow(simplereturn.cat),]
newlogreturn.aot <- logreturn.aot[2:nrow(logreturn.aot),]
newsimplereturn.aot <- simplereturn.aot[2:nrow(simplereturn.aot),]
```

1.b)

For Simple return of CAT,

```
table.Stats(simplereturn.cat)
```

```
##                   CAT.Adjusted
## Observations        5302.0000
## NAs                    1.0000
## Minimum               -0.1452
## Quartile 1            -0.0095
## Median                 0.0005
## Arithmetic Mean        0.0007 (Sample Mean)
## Geometric Mean         0.0005
## Quartile 3             0.0110
## Maximum                0.1472
## SE Mean                0.0003
## LCL Mean (0.95)        0.0001
```

```
## UCL Mean (0.95)       0.0013
## Variance              0.0004
## Stdev                 0.0205 (Standard Deviation)
## Skewness              0.0197
## Kurtosis              4.5480 (Excess Kurtosis)
```

For Simple return of AOT,

```
table.Stats(simplereturn.aot)
```

```
##                  AOT.BK.Adjusted
## Observations          4158.0000
## NAs                      1.0000
## Minimum                 -0.1505
## Quartile 1              -0.0093
## Median                   0.0000
## Arithmetic Mean          0.0010 (Sample Mean)
## Geometric Mean           0.0007
## Quartile 3               0.0103
## Maximum                  0.1834
## SE Mean                  0.0003
## LCL Mean (0.95)          0.0003
## UCL Mean (0.95)          0.0016
## Variance                 0.0005
## Stdev                    0.0213 (Standard Deviation)
## Skewness                 0.5443
## Kurtosis                10.0827 (Excess Kurtosis)
```

1.c)

Normality Test: H0: simple return of CAT is normally distributed.

H1: simple return of CAT is not normally distributed.

```
jarque.bera.test(newsimplereturn.cat)
```

```
##
##  Jarque Bera Test
##
## data:  newsimplereturn.cat
## X-squared = 4569.9, df = 2, p-value < 2.2e-16
```

The p-value < 0.05; hence, the computed chi-squared

Falls into rejection region. H0 is rejected at 0.05 level of significance.

That is, the simple return of CAT is **not** normally distributed.

1.d)

For log return of CAT,

```
table.Stats(logreturn.cat)

##                  CAT.Adjusted
## Observations       5302.0000
## NAs                  1.0000
## Minimum             -0.1569
## Quartile 1          -0.0095
## Median               0.0005
## Arithmetic Mean      0.0005 (Sample Mean)
## Geometric Mean       0.0003
## Quartile 3           0.0110
## Maximum              0.1373
## SE Mean              0.0003
## LCL Mean (0.95)     -0.0001
## UCL Mean (0.95)      0.0010
## Variance             0.0004
## Stdev                0.0205 (Standard deviation)
## Skewness            -0.1836
## Kurtosis             4.6982 (Excess Kurtosis)
```

For log return of AOT,

```
table.Stats(logreturn.aot)

##                  AOT.BK.Adjusted
## Observations          4158.0000
## NAs                      1.0000
## Minimum                 -0.1632
## Quartile 1              -0.0093
## Median                   0.0000
## Arithmetic Mean          0.0007 (Sample Mean)
## Geometric Mean           0.0005
## Quartile 3               0.0102
## Maximum                  0.1684
## SE Mean                  0.0003
## LCL Mean (0.95)          0.0001
## UCL Mean (0.95)          0.0014
## Variance                 0.0004
## Stdev                    0.0212 (Standard Deviation)
## Skewness                 0.1746
## Kurtosis                 9.6096 (Excess Kurtosis)
```

1.e)

Ho: E (log return of CAT) = 0

H1: E (log return of CAT) =! 0

```
t.test(newlogreturn.cat)
```

```
##  One Sample t-test
##
## data:  newlogreturn.cat
## t = 1.7296, df = 5301, p-value = 0.08377
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  -6.513168e-05  1.041069e-03
## sample estimates:
##    mean of x
## 0.0004879685
```

p-value > 0.05; the computed t-value < 2 not falling into rejection region. We fail to reject H0 at 0.05 level of significance. That is, the expected log return of CAT is equal to 0.

Ho: E (log return of AOT) = 0

H1: E (log return of AOT) =! 0

```
t.test(newlogreturn.aot)
```

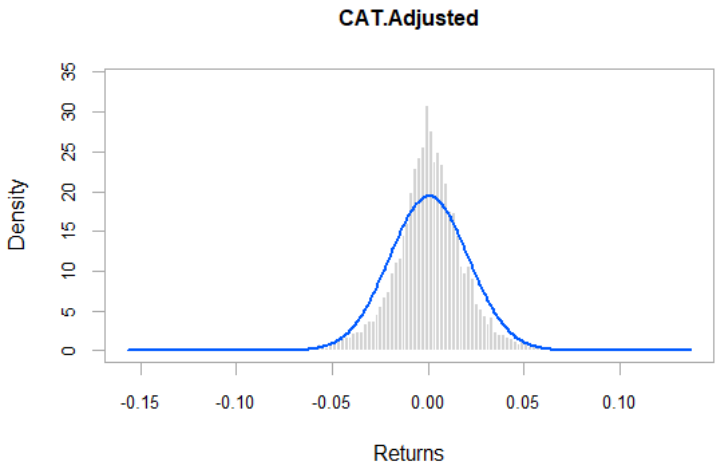
```
##  One Sample t-test
##
## data:  newlogreturn.aot
## t = 2.2696, df = 4157, p-value = 0.02328
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  0.0001016629 0.0013915769
## sample estimates:
##    mean of x
## 0.0007466199
```

p-value < 0.05; the computed t-value >2 falling into rejection region. H0 is rejected at 0.05 level of significance. That is, expected log return of AOT is not equal to 0.

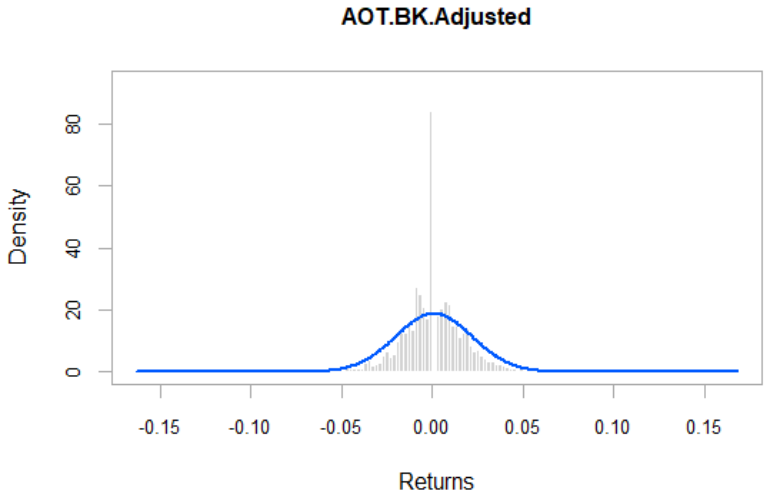
1.f)

```
par(mfrow=c(1,1))
```

```
hist(logreturn.cat, breaks=100, col="slateblue")
chart.Histogram(logreturn.cat,methods = c("add.normal"))
```




```
hist(logreturn.aot, breaks=100, col="slateblue")
chart.Histogram(logreturn.aot,methods = c("add.normal"))
```



1.g)

```
t.test(newlogreturn.cat)
```

```
##  One Sample t-test
##
## data:  newlogreturn.cat
## t = 1.7296, df = 5301, p-value = 0.08377
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  -6.513168e-05  1.041069e-03
## sample estimates:
##    mean of x
## 0.0004879685
```

95% confidence interval of log return of CAT is between `-6.513168e-05 and 1.041069e-03 or`

`[-6.513168e-05, 1.041069e-03]`

1.h)

Skewness test of CAT

```
#CAT
T=length(newlogreturn.cat)
m3=skewness(newlogreturn.cat)
tst=m3/sqrt(6/T)
tst
```

```
## [1] -5.458812
```

```
pv=2*pnorm(tst)
pv
```

```
## [1] 4.793299e-08
```

H0: m3 = 0

H1: m3 =! 0

The p-value < 0.05. The computed value fall into rejection region. H0 is rejected at 0.05 level of significance. That is, m3 =! 0, namely, the skewness of CAT return is not equal to zero.

Skewness test of AOT

```
#AOT
T=length(newlogreturn.aot)
m3=skewness(newlogreturn.aot)
tst=m3/sqrt(6/T)
tst
```

```
## [1] 4.596526
```

```
pv=2*(1-pnorm(tst))
pv
```

```
## [1] 4.29594e-06
```

H0: m3 = 0

H1: m3 =! 0

The p-value < 0.05. The computed value fall into rejection region. H0 is rejected at 0.05 level of significance. That is, m3 =! 0, namely, the skewness of AOT return is not equal to zero.

1.i)

Kurtosis test of CAT

```
#CAT
T=length(newlogreturn.cat)
s4=kurtosis(newlogreturn.cat) #excess kurtosis
K=s4+3 #kurtosis
tst=(K-3)/sqrt(24/T)
tst
```

```
## [1] 69.83078
```

```
pv=2*(1-pnorm(tst))
pv
```

```
## [1] 0
```

H0: K=3

H1: K=! 3

The p-value < 0.05. The computed value fall into rejection region. H0 is rejected at 0.05 level of significance. That is, K =! 3, namely, the kurtosis of CAT return is not equal to 3.

Kurtosis test of AOT

```
#AOT
T=length(newlogreturn.aot)
s4=kurtosis(newlogreturn.aot) #excess kurtosis
K=s4+3 #kurtosis
tst=(K-3)/sqrt(24/T)
tst
```

```
## [1] 126.4855
```

```
pv=2*(1-pnorm(tst))
pv
```

```
## [1] 0
```

H0: K=3

H1: K=! 3

The p-value < 0.05. The computed value fall into rejection region. H0 is rejected at 0.05 level of significance. That is, K =! 3, namely, the kurtosis of AOT return is not equal to 3.