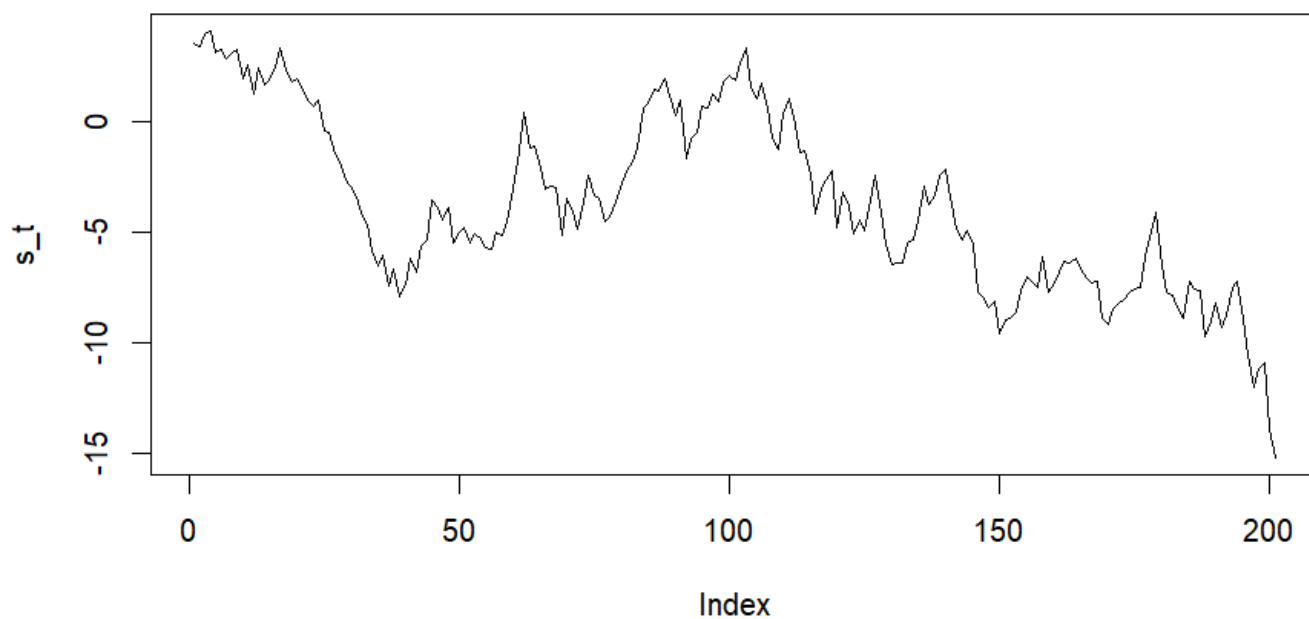


1.

(a)

程式碼：

`s_0<-3.5``z<-rnorm(n = 200, mean = 0, sd = 1)``rw<-c(s_0, z)``s_t<-cumsum(rw)``plot(s_t, type = "l")`

(b)

程式碼：

`s_0<-3.5``s_200<-numeric(5000)``for(i in 1:5000){``z<-rnorm(n = 200, mean = 0, sd = 1)``s_200[i]<-s_0+sum(z)``}``mean(s_200)``var(s_200)`

計算 S200 的樣本平均是 3.45455，變異數是 194.9954。理論平均=3.5+200*0=3.5，理論變異數會是 200*1=200。兩者數值有差異，但兩者差距不大。

2.

(a)

```
data_2330<-read.table("C:/Users/chouchiahuan/Desktop/財務資訊分析/HW3/2330.TW.csv", sep = ",",  
na.strings = "null", header = T)
```

```
data_3008<-read.table("C:/Users/chouchiahuan/Desktop/財務資訊分析/HW3/3008.TW.csv", sep = ",",  
na.strings = "null", header = T)
```

```
data_2330[,1]<-as.Date(data_2330[,1])
```

```
data_3008[,1]<-as.Date(data_3008[,1])
```

```
na_2330<-which(is.na(data_2330[,6]))
```

```
na_3008<-which(is.na(data_3008[,6]))
```

```
na_2330
```

```
na_3008
```

```
for(i in na_2330){
```

```
    data_2330[i, 6]<-data_2330[(i-1), 6]
```

```
}
```

```
which(is.na(data_2330[, 6]))
```

```
for(i in na_3008){
```

```
    data_3008[i, 6]<-data_3008[(i-1), 6]
```

```
}
```

```
which(is.na(data_3008[, 6]))
```

```
## 2330, simple returns and log returns
```

```
data_2330$ret<-c(NA, retx(data_2330$Adj.Close))
```

```
data_2330$lret<-c(NA, logrx(data_2330$Adj.Close))
```

```
## 3008, simple returns and log returns
```

```
data_3008$ret<-c(NA, retx(data_3008$Adj.Close))
```

```
data_3008$lret<-c(NA, logrx(data_3008$Adj.Close))
```

return and log return of 2330 :

	Date	Open	High	Low	Close	Adj.Close	Volume	ret	lret
1	2014-12-31	139.0	141.0	139.0	141.0	106.71606	18306000	NA	NA
2	2015-01-05	140.5	140.5	137.5	139.5	105.58077	32046000	-0.010638371	-0.010695363
3	2015-01-06	137.5	137.5	133.0	133.5	101.03966	66778000	-0.043010739	-0.043963109
4	2015-01-07	133.5	135.0	133.5	134.0	101.41810	43703000	0.003745390	0.003738394
5	2015-01-08	136.5	138.0	136.0	138.0	104.44551	42491000	0.029850816	0.029413953
6	2015-01-09	135.0	135.5	133.0	134.0	101.41810	61558000	-0.028985573	-0.029413953
7	2015-01-12	132.5	133.5	132.0	132.0	99.90442	30338000	-0.014925137	-0.015037638
8	2015-01-13	131.0	133.0	130.5	132.5	100.28283	37818000	0.003787720	0.003780565
9	2015-01-14	132.5	133.0	130.0	130.0	98.39071	48740000	-0.018867836	-0.019048105
10	2015-01-15	131.5	133.0	131.5	131.5	99.52597	40607000	0.011538295	0.011472236
11	2015-01-16	140.0	140.0	136.0	137.0	103.68868	124042000	0.041825315	0.040974285
12	2015-01-19	138.5	139.5	137.5	139.0	105.20238	49986000	0.014598528	0.014492995
13	2015-01-20	139.0	139.0	137.5	138.0	104.44551	32739000	-0.007194381	-0.007220386
14	2015-01-21	139.5	141.0	139.5	141.0	106.71606	70464000	0.021739048	0.021506125
15	2015-01-22	141.5	142.0	139.5	140.0	105.95921	43846000	-0.007092194	-0.007117463
16	2015-01-23	142.5	145.0	142.5	145.0	109.74348	82089000	0.035714481	0.035091508
17	2015-01-26	145.5	145.5	143.5	145.0	109.74348	46716000	0.000000000	0.000000000
18	2015-01-27	145.5	147.0	144.5	147.0	111.25716	52805000	0.013792819	0.013698564

return and log return of 3008 :

	Date	Open	High	Low	Close	Adj.Close	Volume	ret	lret
1	2014-12-31	2375	2395	2375	2395	1896.163	327000	NA	NA
2	2015-01-05	2400	2410	2350	2350	1860.536	832000	-0.018789289	-0.018968050
3	2015-01-06	2320	2340	2260	2275	1801.157	1427000	-0.031915014	-0.032435400
4	2015-01-07	2300	2325	2265	2300	1820.950	1228000	0.010989167	0.010929225
5	2015-01-08	2340	2380	2325	2365	1872.411	1356000	0.028260689	0.027868724
6	2015-01-09	2395	2400	2340	2340	1852.619	1106000	-0.010570584	-0.010626849
7	2015-01-12	2350	2355	2315	2320	1836.784	485000	-0.008547075	-0.008583810
8	2015-01-13	2320	2365	2320	2340	1852.619	570000	0.008620757	0.008583810
9	2015-01-14	2355	2355	2310	2350	1860.536	574000	0.004273406	0.004264301
10	2015-01-15	2355	2365	2325	2360	1868.453	613000	0.004255418	0.004246389
11	2015-01-16	2450	2450	2375	2385	1888.246	1982000	0.010592976	0.010537264
12	2015-01-19	2420	2430	2400	2430	1923.873	898000	0.018868011	0.018692218
13	2015-01-20	2435	2565	2425	2555	2022.838	1946000	0.051440483	0.050161113
14	2015-01-21	2580	2610	2570	2580	2042.631	1412000	0.009784872	0.009737311
15	2015-01-22	2600	2625	2560	2625	2078.258	726000	0.017441456	0.017291100
16	2015-01-23	2640	2770	2640	2770	2193.057	2040000	0.055238246	0.053766567
17	2015-01-26	2765	2790	2725	2760	2185.140	996000	-0.003609914	-0.003616446
18	2015-01-27	2790	2805	2745	2750	2177.223	842000	-0.003623328	-0.003629908

(c)

程式碼：

```
c(summary(data_2330$ret), sd(data_2330$ret[-1]),
  my_skewness(data_2330$ret[-1]), my_kurtosis(data_2330$ret[-1]))
c(summary(data_2330$lret), sd(data_2330$lret[-1]),
  my_skewness(data_2330$lret[-1]), my_kurtosis(data_2330$lret[-1]))
c(summary(data_3008$ret), sd(data_3008$ret[-1]),
  my_skewness(data_3008$ret[-1]), my_kurtosis(data_3008$ret[-1]))
c(summary(data_3008$lret), sd(data_3008$lret[-1]),
  my_skewness(data_3008$lret[-1]), my_kurtosis(data_3008$lret[-1]))
```

```

>
> ## 2330
> c(summary(data_2330$ret), sd(data_2330$ret[-1]),
+ my_skewness(data_2330$ret[-1]), my_kurtosis(data_2330$ret[-1]))
      Min.      1st Qu.      Median      Mean      3rd Qu.      Max.      NA's
-0.083332988 -0.0082195248 0.0000000000 0.0009026578 0.0098340792 0.0997408293 1.0000000000 0.0157505889 0.3507070081 3.0467014939
> c(summary(data_2330$lret), sd(data_2330$lret[-1]),
+ my_skewness(data_2330$lret[-1]), my_kurtosis(data_2330$lret[-1]))
      Min.      1st Qu.      Median      Mean      3rd Qu.      Max.      NA's
-0.0870113393 -0.0082534914 0.0000000000 0.0007788543 0.0097860393 0.0950745423 1.0000000000 0.0157030313 0.2368428198 2.8468400498
>
> ## 3008
> c(summary(data_3008$ret), sd(data_3008$ret[-1]),
+ my_skewness(data_3008$ret[-1]), my_kurtosis(data_3008$ret[-1]))
      Min.      1st Qu.      Median      Mean      3rd Qu.      Max.      NA's
-0.0999999225 -0.0128371217 0.0000000000 0.0005051927 0.0136492635 0.09999999998 1.0000000000 0.0259353516 0.1274170325 2.4485923516
> c(summary(data_3008$lret), sd(data_3008$lret[-1]),
+ my_skewness(data_3008$lret[-1]), my_kurtosis(data_3008$lret[-1]))
      Min.      1st Qu.      Median      Mean      3rd Qu.      Max.      NA's
-0.1053604295 -0.0129202299 0.0000000000 0.0001693614 0.0135569514 0.0953101796 1.0000000000 0.0259207705 -0.0458909538 2.4958292846
> |

```

(d)

程式碼：

```
data_2330$cum.ret<-c(NA, cumprod((1+data_2330$ret[-1])))
```

```
data_3008$cum.ret<-c(NA, cumprod((1+data_3008$ret[-1])))
```

```
data_2330$cum.lret<-c(NA, cumsum(data_2330$lret[-1]))+1
```

```
data_3008$cum.lret<-c(NA, cumsum(data_3008$lret[-1]))+1
```

Gross daily return with simple return and log return of 2330：

	Date	Open	High	Low	Close	Adj.Close	Volume	ret	lret	cum.ret	cum.lret
1	2014-12-31	139.0	141.0	139.0	141.0	106.71606	18306000	NA	NA	NA	NA
2	2015-01-05	140.5	140.5	137.5	139.5	105.58077	32046000	-0.010638371	-0.010695363	0.9893616	0.9893046
3	2015-01-06	137.5	137.5	133.0	133.5	101.03966	66778000	-0.043010739	-0.043963109	0.9468085	0.9453415
4	2015-01-07	133.5	135.0	133.5	134.0	101.41810	43703000	0.003745390	0.003738394	0.9503546	0.9490799
5	2015-01-08	136.5	138.0	136.0	138.0	104.44551	42491000	0.029850816	0.029413953	0.9787235	0.9784939
6	2015-01-09	135.0	135.5	133.0	134.0	101.41810	61558000	-0.028985573	-0.029413953	0.9503546	0.9490799
7	2015-01-12	132.5	133.5	132.0	132.0	99.90442	30338000	-0.014925137	-0.015037638	0.9361704	0.9340423
8	2015-01-13	131.0	133.0	130.5	132.5	100.28283	37818000	0.003787720	0.003780565	0.9397164	0.9378228
9	2015-01-14	132.5	133.0	130.0	130.0	98.39071	48740000	-0.018867836	-0.019048105	0.9219860	0.9187747
10	2015-01-15	131.5	133.0	131.5	131.5	99.52597	40607000	0.011538295	0.011472236	0.9326241	0.9302470
11	2015-01-16	140.0	140.0	136.0	137.0	103.68868	124042000	0.041825315	0.040974285	0.9716314	0.9712213
12	2015-01-19	138.5	139.5	137.5	139.0	105.20238	49986000	0.014598528	0.014492995	0.9858158	0.9857143
13	2015-01-20	139.0	139.0	137.5	138.0	104.44551	32739000	-0.007194381	-0.007220386	0.9787235	0.9784939
14	2015-01-21	139.5	141.0	139.5	141.0	106.71606	70464000	0.021739048	0.021506125	1.0000000	1.0000000
15	2015-01-22	141.5	142.0	139.5	140.0	105.95921	43846000	-0.007092194	-0.007117463	0.9929078	0.9928825
16	2015-01-23	142.5	145.0	142.5	145.0	109.74348	82089000	0.035714481	0.035091508	1.0283690	1.0279740

Gross daily return with simple return and log return of 3008：

	Date	Open	High	Low	Close	Adj.Close	Volume	ret	lret	cum.ret	cum.lret
1	2014-12-31	2375	2395	2375	2395	1896.163	327000	NA	NA	NA	NA
2	2015-01-05	2400	2410	2350	2350	1860.536	832000	-0.018789289	-0.018968050	0.9812107	0.9810319
3	2015-01-06	2320	2340	2260	2275	1801.157	1427000	-0.031915014	-0.032435400	0.9498954	0.9485965
4	2015-01-07	2300	2325	2265	2300	1820.950	1228000	0.010989167	0.010929225	0.9603339	0.9595258
5	2015-01-08	2340	2380	2325	2365	1872.411	1356000	0.028260689	0.027868724	0.9874736	0.9873945
6	2015-01-09	2395	2400	2340	2340	1852.619	1106000	-0.010570584	-0.010626849	0.9770354	0.9767676
7	2015-01-12	2350	2355	2315	2320	1836.784	485000	-0.008547075	-0.008583810	0.9686846	0.9681838
8	2015-01-13	2320	2365	2320	2340	1852.619	570000	0.008620757	0.008583810	0.9770354	0.9767676
9	2015-01-14	2355	2355	2310	2350	1860.536	574000	0.004273406	0.004264301	0.9812107	0.9810319
10	2015-01-15	2355	2365	2325	2360	1868.453	613000	0.004255418	0.004246389	0.9853862	0.9852783
11	2015-01-16	2450	2450	2375	2385	1888.246	1982000	0.010592976	0.010537264	0.9958243	0.9958156
12	2015-01-19	2420	2430	2400	2430	1923.873	898000	0.018868011	0.018692218	1.0146136	1.0145078
13	2015-01-20	2435	2565	2425	2555	2022.838	1946000	0.051440483	0.050161113	1.0668058	1.0646689
14	2015-01-21	2580	2610	2570	2580	2042.631	1412000	0.009784872	0.009737311	1.0772443	1.0744062
15	2015-01-22	2600	2625	2560	2625	2078.258	726000	0.017441456	0.017291100	1.0960331	1.0916973

(e)

程式碼：

```
library(xts)
data_2330<-cbind(data_2330[, 1:5], data_2330[, 7:6])
data_3008<-cbind(data_3008[, 1:5], data_3008[, 7:6])
colnames(data_2330)[6:7]<-c("Volume", "Adjusted")
colnames(data_3008)[6:7]<-c("Volume", "Adjusted")
```

Calculate weekly return

2330

```
data_2330w<-to.weekly(data_2330, indexAt = "firstof")
data_2330w$ret<-c(NA, retx(data_2330w[,6]))
data_2330w$lret<-c(NA, logrx(data_2330w[,6]))
head(data_2330w)
```

3008

```
data_3008w<-to.weekly(data_3008, indexAt = "firstof")
data_3008w$ret<-c(NA, retx(data_3008w[,6]))
data_3008w$lret<-c(NA, logrx(data_3008w[,6]))
head(data_3008w)
```

Calculate monthly return

2330

```
data_2330m<-to.monthly(data_2330, indexAt = "firstof")
data_2330m$ret<-c(NA, retx(data_2330m[,6]))
data_2330m$lret<-c(NA, logrx(data_2330m[,6]))
head(data_2330m)
```

3008

```
data_3008m<-to.monthly(data_3008, indexAt = "firstof")
data_3008m$ret<-c(NA, retx(data_3008m[,6]))
data_3008m$lret<-c(NA, logrx(data_3008m[,6]))
head(data_3008m)
```

weekly simple return and log return of 2330 :

```
> head(data_2330w)
      data_2330.Open data_2330.High data_2330.Low data_2330.Close data_2330.Volume data_2330.Adjusted
2014-12-31         139.0         141.0         139.0          141         18306000         106.7161
2015-01-09         140.5         140.5         133.0          134         246576000         101.4181
2015-01-16         132.5         140.0         130.0          137         281545000         103.6887
2015-01-23         138.5         145.0         137.5          145         279124000         109.7435
2015-01-30         145.5         147.0         141.0          141         223544000         106.7161
2015-02-06         140.5         146.5         140.5          143         147421000         108.2298

      ret      lret
2014-12-31      NA      NA
2015-01-09 -0.04964538 -0.05092008
2015-01-16  0.02238828  0.02214134
2015-01-23  0.05839412  0.05675278
2015-01-30 -0.02758639 -0.02797404
2015-02-06  0.01418453  0.01408487
> |
```

weekly simple return and log return of 3008 :

```
> data_3008w$ret<-c(NA, log1x(data_3008w[,6]))
> head(data_3008w)
```

	data_3008.Open	data_3008.High	data_3008.Low	data_3008.Close	data_3008.Volume	data_3008.Adjusted
2014-12-31	2375	2395	2375	2395	327000	1896.163
2015-01-09	2400	2410	2260	2340	5949000	1852.619
2015-01-16	2350	2450	2310	2385	4224000	1888.246
2015-01-23	2420	2770	2400	2770	7022000	2193.057
2015-01-30	2765	2805	2630	2640	4384000	2090.134
2015-02-06	2640	2820	2595	2605	4720000	2062.424

```

ret      lret
2014-12-31      NA      NA
2015-01-09 -0.02296456 -0.02323235
2015-01-16  0.01923052  0.01904795
2015-01-23  0.16142571  0.14964831
2015-01-30 -0.04693133 -0.04806833
2015-02-06 -0.01325762 -0.01334629
~

```

Monthly simple return and log return of 2330 :

```
> head(data_2330m)
```

	data_2330.Open	data_2330.High	data_2330.Low	data_2330.Close	data_2330.Volume	data_2330.Adjusted
2014-12-01	139.0	141.0	139.0	141.0	18306000	106.7161
2015-01-01	140.5	147.0	130.0	141.0	1030789000	106.7161
2015-02-01	140.5	154.5	140.5	150.5	525969000	113.9061
2015-03-01	151.5	155.0	142.0	145.5	1137639000	110.1219
2015-04-01	145.0	153.5	141.5	147.0	984734000	111.2572
2015-05-01	148.5	149.0	144.5	146.0	528720000	110.5003

```

ret      lret
2014-12-01      NA      NA
2015-01-01  0.0000000000  0.0000000000
2015-02-01  0.067375859  0.065203168
2015-03-01 -0.033222510 -0.033786914
2015-04-01  0.010309131  0.010256354
2015-05-01 -0.006802511 -0.006825753
~

```

Monthly simple return and log return of 3008 :

```
> head(data_3008m)
```

	data_3008.Open	data_3008.High	data_3008.Low	data_3008.Close	data_3008.Volume	data_3008.Adjusted
2014-12-01	2375	2395	2375	2395	327000	1896.163
2015-01-01	2400	2805	2260	2640	21579000	2090.134
2015-02-01	2640	2820	2585	2680	9994000	2121.802
2015-03-01	2710	2820	2600	2695	14407000	2133.678
2015-04-01	2695	3230	2670	3080	16392000	2438.490
2015-05-01	3130	3575	3080	3420	11584000	2707.673

```

ret      lret
2014-12-01      NA      NA
2015-01-01  0.102296340  0.097395586
2015-02-01  0.015151400  0.015037764
2015-03-01  0.005597117  0.005581511
2015-04-01  0.142857061  0.133531321
2015-05-01  0.110389582  0.104710929
~

```

(f)

程式碼：

```
data_3008$ret<-c(NA, retx(data_3008$Adjusted))
```

```
data_3008$lret<-c(NA, logrx(data_3008$Adjusted))
```

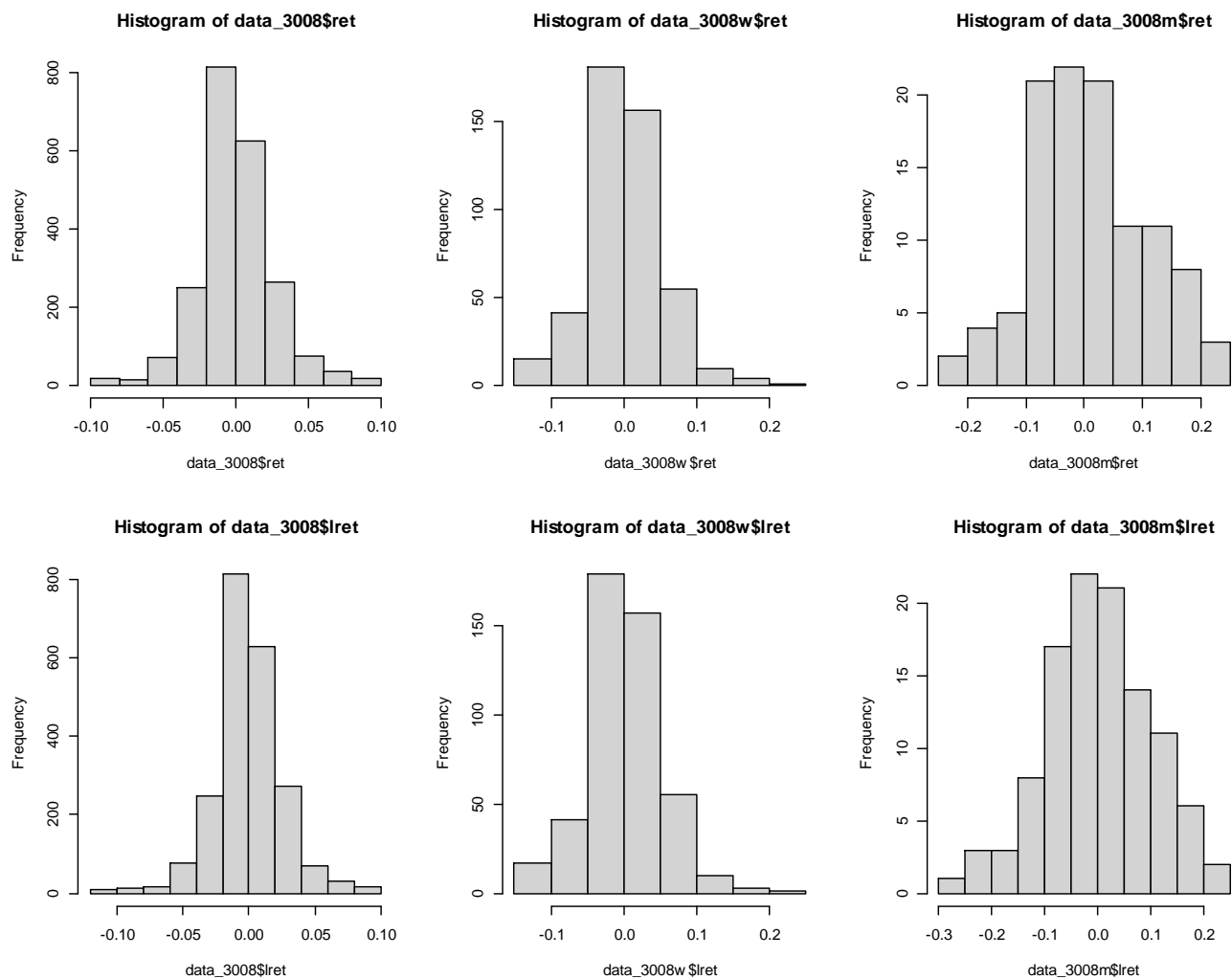
```
par(mfrow=c(2,3))
```

```
## Simple return: daily, weekly and monthly
```

```
hist(data_3008$ret); hist(data_3008w$ret); hist(data_3008m$ret)
```

```
## Log return: daily, weekly and monthly
```

```
hist(data_3008$lret); hist(data_3008w$lret); hist(data_3008m$lret)
```



(g)

程式碼：

```
data_2330$ret<-c(NA, retx(data_2330$Adjusted))
data_2330$lret<-c(NA, logrx(data_2330$Adjusted))
```

```
par(mfrow = c(2,3))
```

```
## Simple return: daily, weekly and monthly
```

```
acf(data_2330$ret, na.action = na.pass)
```

```
acf(data_2330w$ret, na.action = na.pass)
```

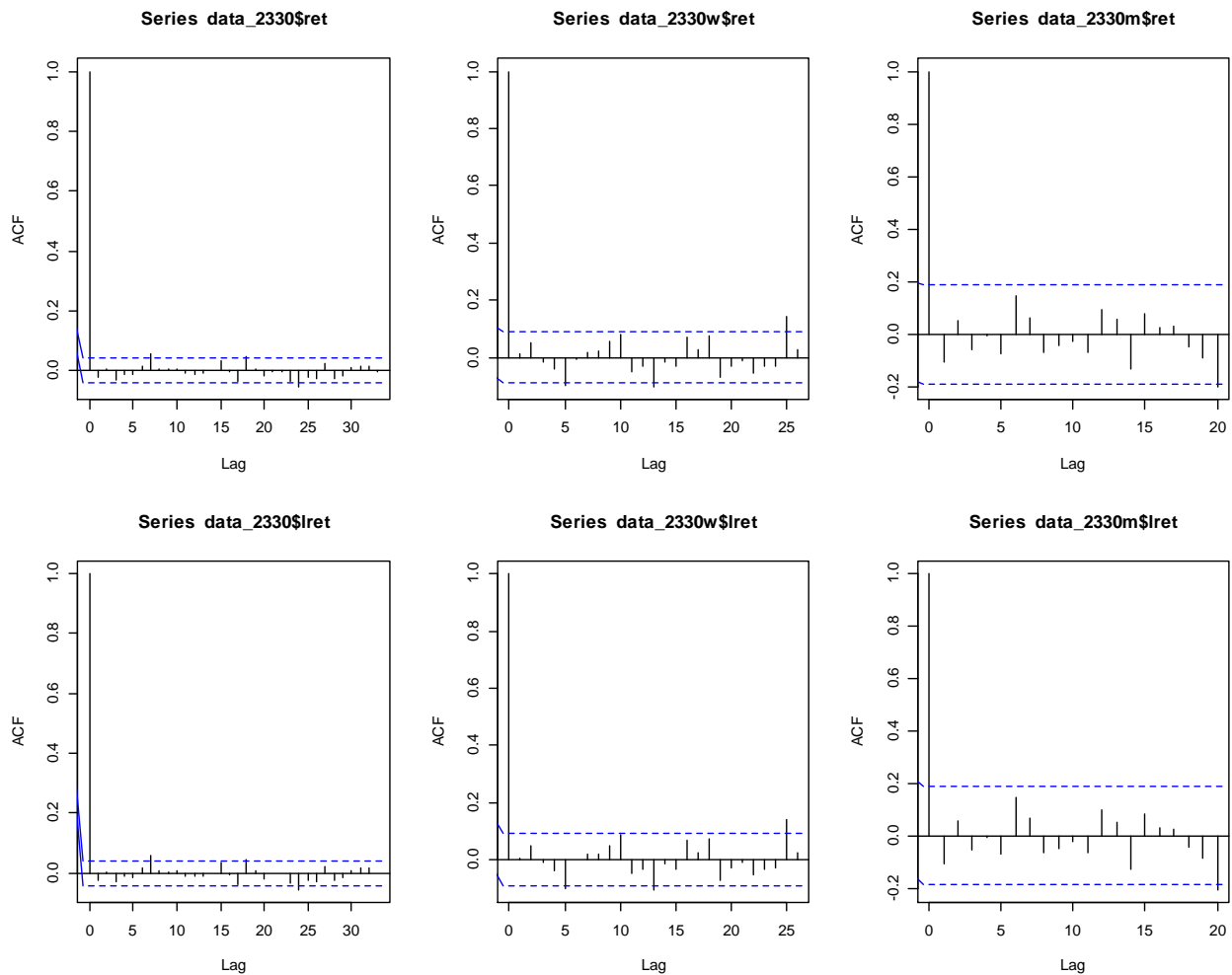
```
acf(data_2330m$ret, na.action = na.pass)
```

```
## Log returns: daily, weekly and monthly
```

```
acf(data_2330$lret, na.action = na.pass)
```

```
acf(data_2330w$lret, na.action = na.pass)
```

```
acf(data_2330m$lret, na.action = na.pass)
```



(h)

程式碼：

```
my_acf1x<-function(x, na.action = na.fail){
```

```
  acf(x, plot = F, na.action = na.action)[[1]][2]
```

```
}
```

```
## Calculate acf(1) with acf1x, simple returns: daily, weekly and monthly
```

```
my_acf1x(data_2330$ret, na.action = na.pass)
```

```
my_acf1x(data_2330w$ret, na.action = na.pass)
```

```
my_acf1x(data_2330m$ret, na.action = na.pass)
```

```
## Calculate acf(1) with acf1x, log returns: daily, weekly and monthly
```

```
my_acf1x(data_2330$lret, na.action = na.pass)
```

```
my_acf1x(data_2330w$lret, na.action = na.pass)
```

```
my_acf1x(data_2330m$lret, na.action = na.pass)
```



```

>
> ## Calculate acf(1) with acf1x, simple returns: daily, weekly and monthly
> my_acf1x(data_2330$ret, na.action = na.pass)
[1] -0.02285259
> my_acf1x(data_2330w$ret, na.action = na.pass)
[1] 0.0104792
> my_acf1x(data_2330m$ret, na.action = na.pass)
[1] -0.1048453
>
> ## Calculate acf(1) with acf1x, log returns: daily, weekly and monthly
> my_acf1x(data_2330$lret, na.action = na.pass)
[1] -0.02239865
> my_acf1x(data_2330w$lret, na.action = na.pass)
[1] 0.005916187
> my_acf1x(data_2330m$lret, na.action = na.pass)
[1] -0.1071275
>

```

first order autocorrelation coefficient of daily simple return is -0.02285259 , monthly simple return is 0.0104792, monthly simple return is -0.1048453.

first order autocorrelation coefficient of daily log return is -0.02239865 , monthly log return is 0.005916187, monthly log return is -0.1071275.