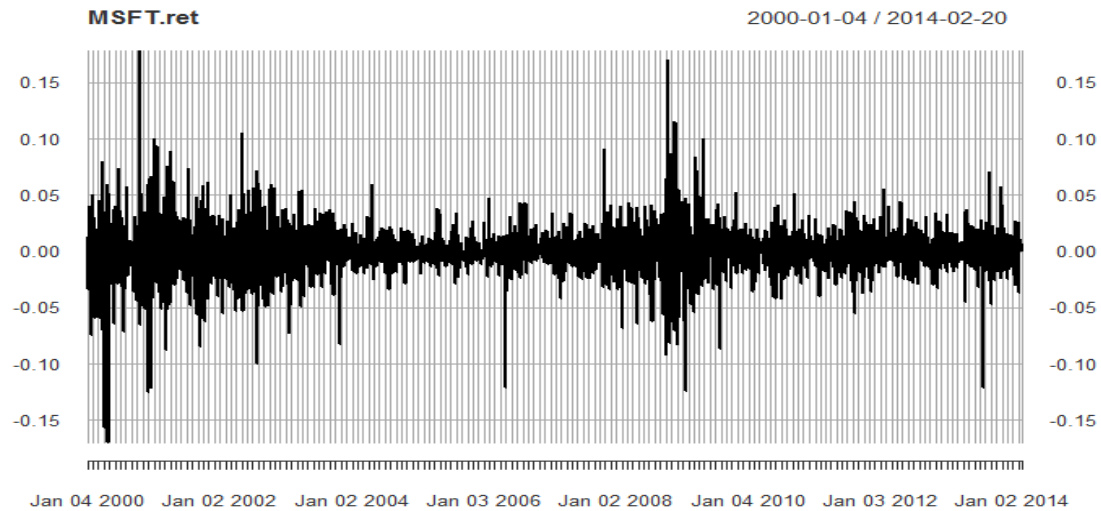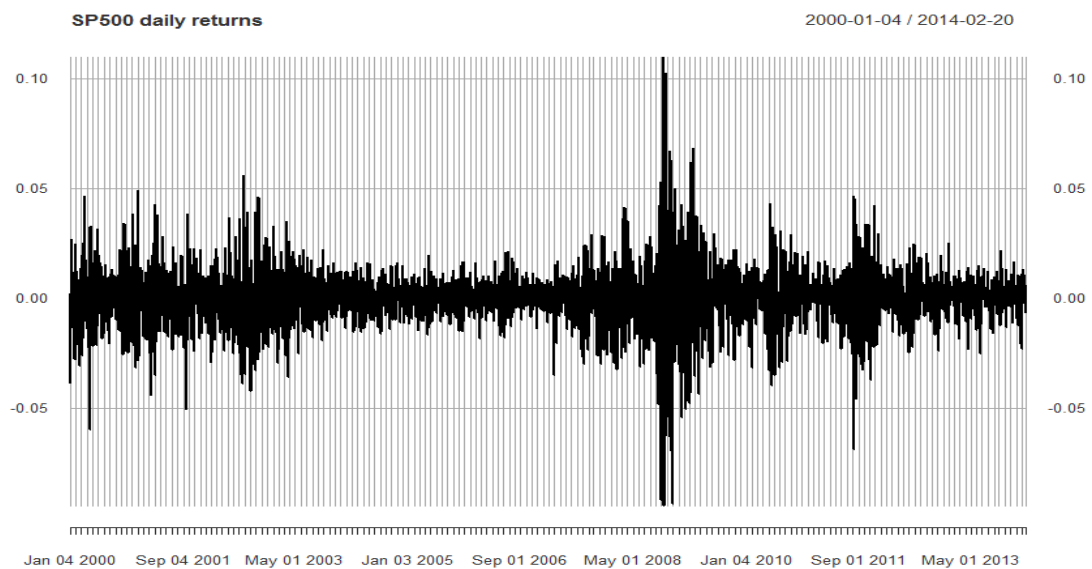# Econ 147 Homework 5 Answer Keys

R exercises

1.a

The return plot for MSFT are shown below:

It seems that the MSFT daily return is mean variating and has mean zero.
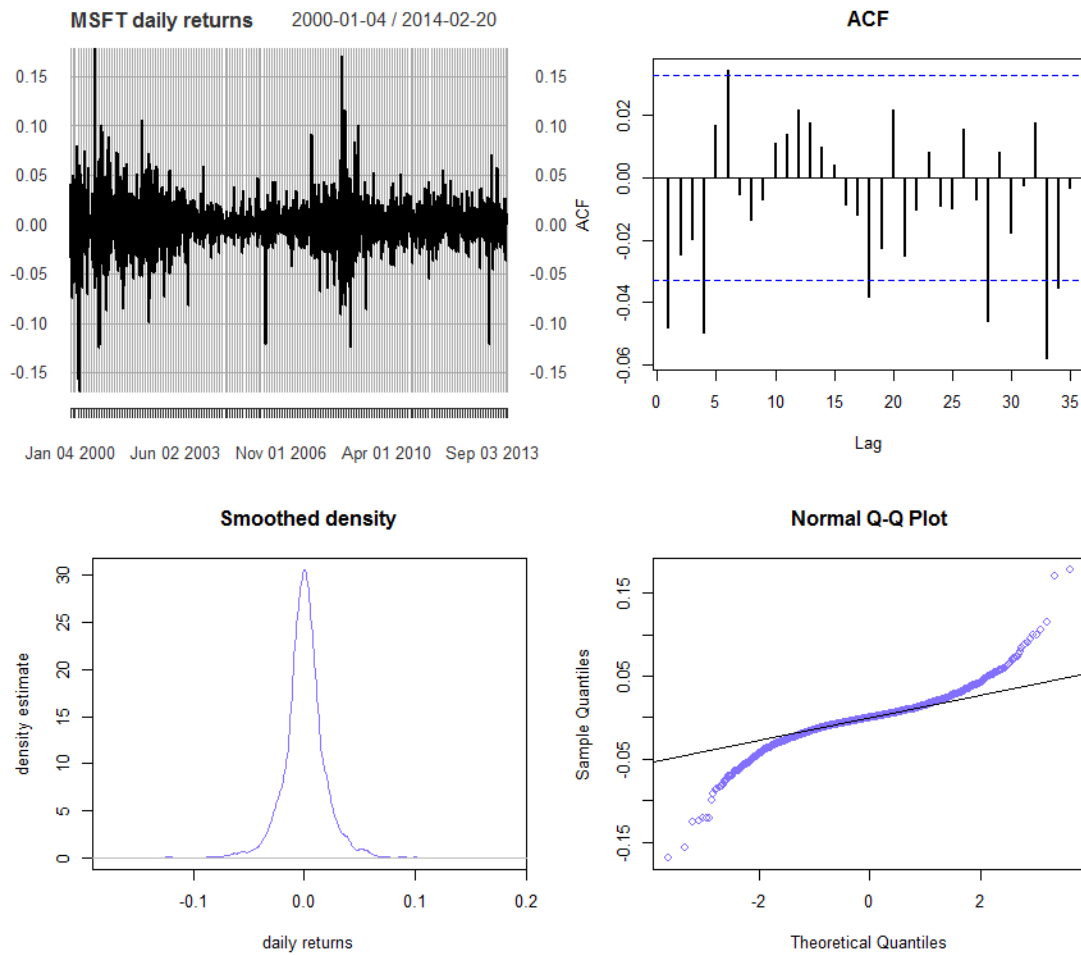
The return plot for S&P 500 are shown below:

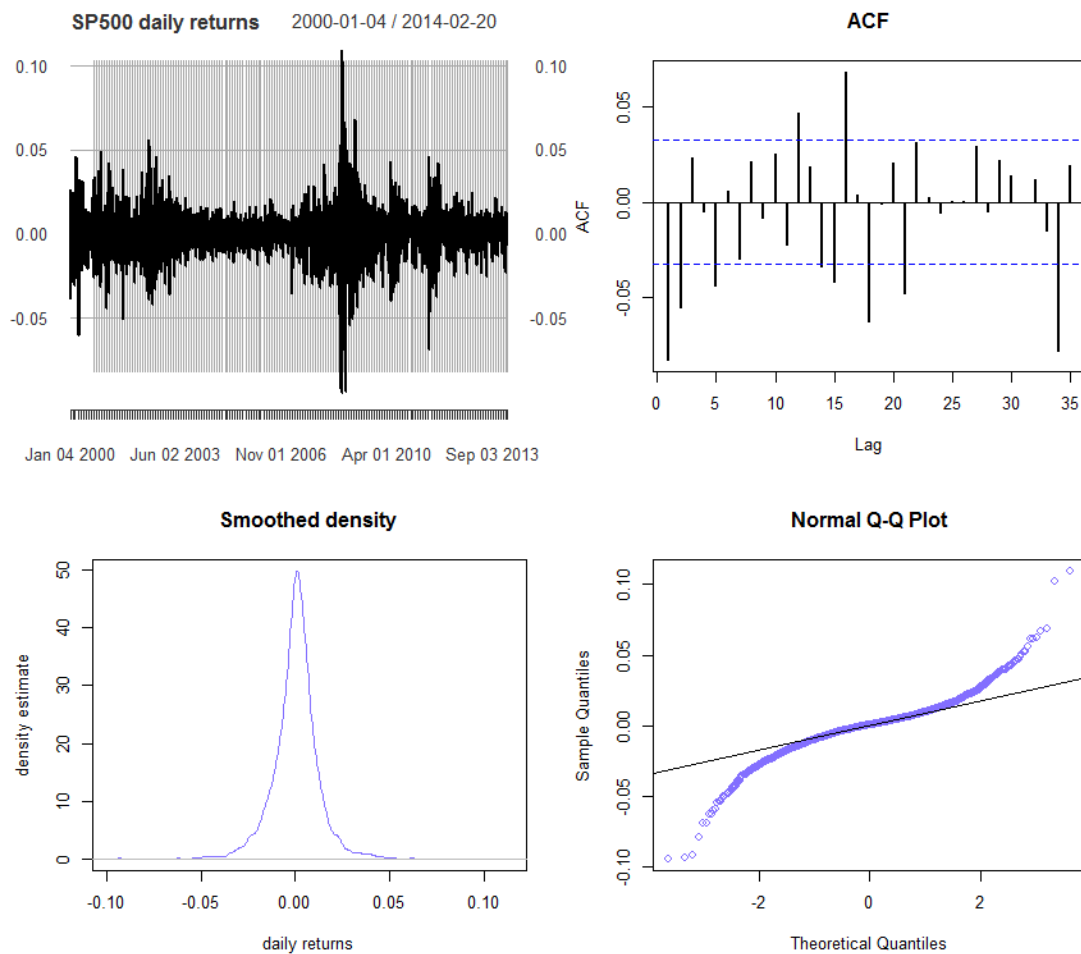It seems that S&P 500 daily return is also mean variating and has mean zero.

1.b

The four panel plot for MSFT is shown below:

The ACF plot shows that the daily returns of MSFT have zero autocorrelation. The density graph shows that it has a long tail and the normal Q-Q plot shows that it is not normally distributed

The four panel plot for S&P 500 are shown below:

According to the ACF plot, the autocorrelation of the S&P 500 daily returns is zero. The density and normal Q-Q plot show that the daily return of S&P 500 is not normally distributed.

1.c

For the MSFT daily return:
    Jarque Bera Test
    data: MSFT.ret
    X-squared = 12000, df = 2, p-value <2e-16
As X^2=12,000>6, we reject H_0: r_t is i.i.d. normally distributed, i.e., the returns of MSFT are not normally distributed.

For the S&P 500 daily return:
    Jarque Bera Test
    data: GSPC.ret
    X-squared = 8900, df = 2, p-value <2e-16
As X^2=8,800>6, we reject H_0: r_t is i.i.d. normally distributed, i.e., the returns of MSFT are not normally distributed.

1.d

For the MSFT daily cc return:

ω = 0.00000487 (sd = 0.000000446)
α_1 = 0.06437   (sd = 0.003937)
β_1 = 0.9241   (sd = 0.004887)

Therefore, $\alpha_1 + \beta_1$ = 0.98847. The squared daily cc return is close to the random walk process.

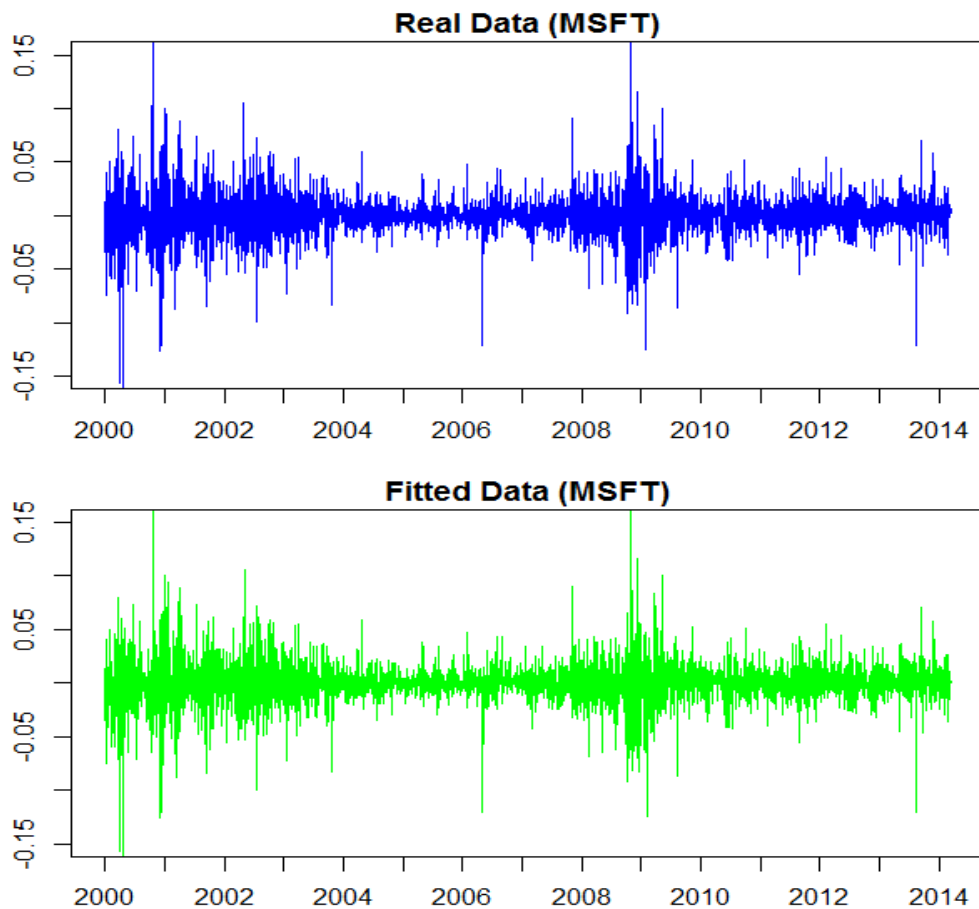For the GSPC daily cc return:

ω = 0.00000155 (sd = 0.000000225)
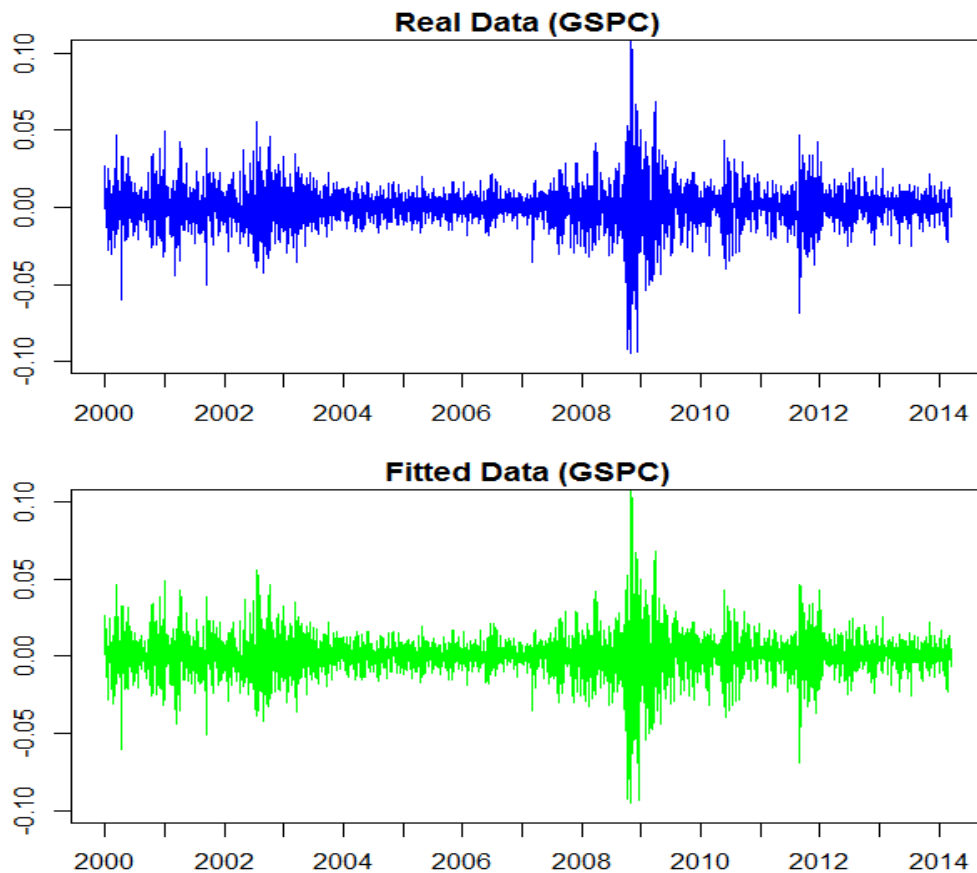α_1 = 0.08573   (sd = 0.006922)
β_1 = 0.9035   (sd = 0.007688)

Therefore, $\alpha_1 + \beta_1$ = 0.98923. The squared daily cc return is close to the random walk process.

1.e

For the MSFT daily cc return:

For the GSPC daily cc return:

We can see that GARCH(1,1) fit the data very well!

1.f

For the MSFT daily cc return:

CI for α_1 : [0.05665, 0.07208]
CI for β_1 : [0.9145, 0.9336]

For the GSPC daily cc return:

CI for α_1 : [0.07217, 0.0993]
CI for β_1 : [0.8885, 0.9186]

1.g

For the MSFT daily cc return:

Test α_1:
T = $(\alpha_1 - 0)/sd(\alpha_1)$= 16.35 > $z_{0.05}$=1.6449, so we reject the H_0: α_1=0 and accept H_1: α_1>0

Test β_1:

T = $|\beta_1 - 0.9|/sd(\beta_1)$= 4.92 > $z_{0.025}$=1.96, so we reject the H_0: β_1=0.9 and accept H_1: $\beta_1 \neq 0.9$

For the GSPC daily cc return:

Test α_1:

T = $(\alpha_1 - 0)/sd(\alpha_1)$= 12.39> $z_{0.05}$=1.6449, so we reject the H_0: α_1=0 and accept H_1: α_1>0

Test β_1:

T = $|\beta_1 - 0.9|/sd(\beta_1)$= 0.4605< $z_{0.025}$=1.96, so we reject the H_1: $\beta_1 \neq 0.9$ and accept H_0: β_1=0.9