4.

a)

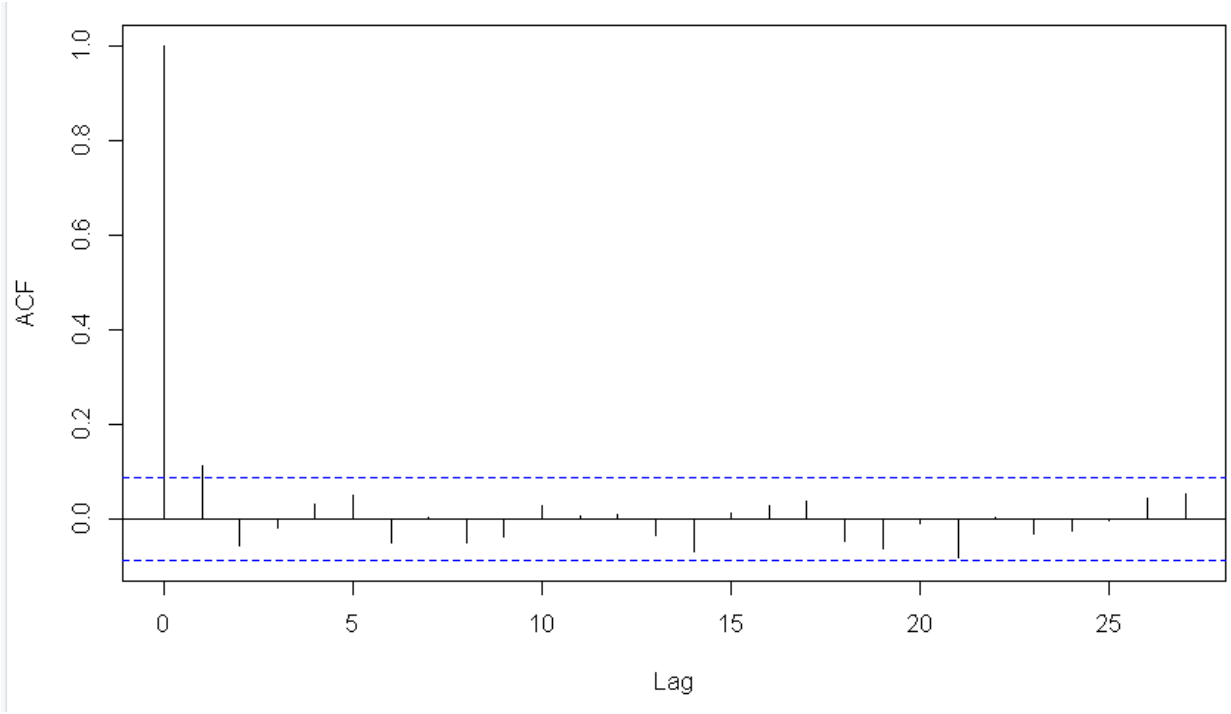
```
da = read.table("m-dec12910.txt", header = T)
d2  = da[, 3]
d10 = da[, 5]
Box.test(d2,  lag = 12, type = 'Ljung')
Box.test(d10, lag = 12, type = 'Ljung')
acf(d2)
pacf(d2)
ma1 = arima(d2, order = c(1, 0, 1))
ma1
predict(ma1, 12)
```

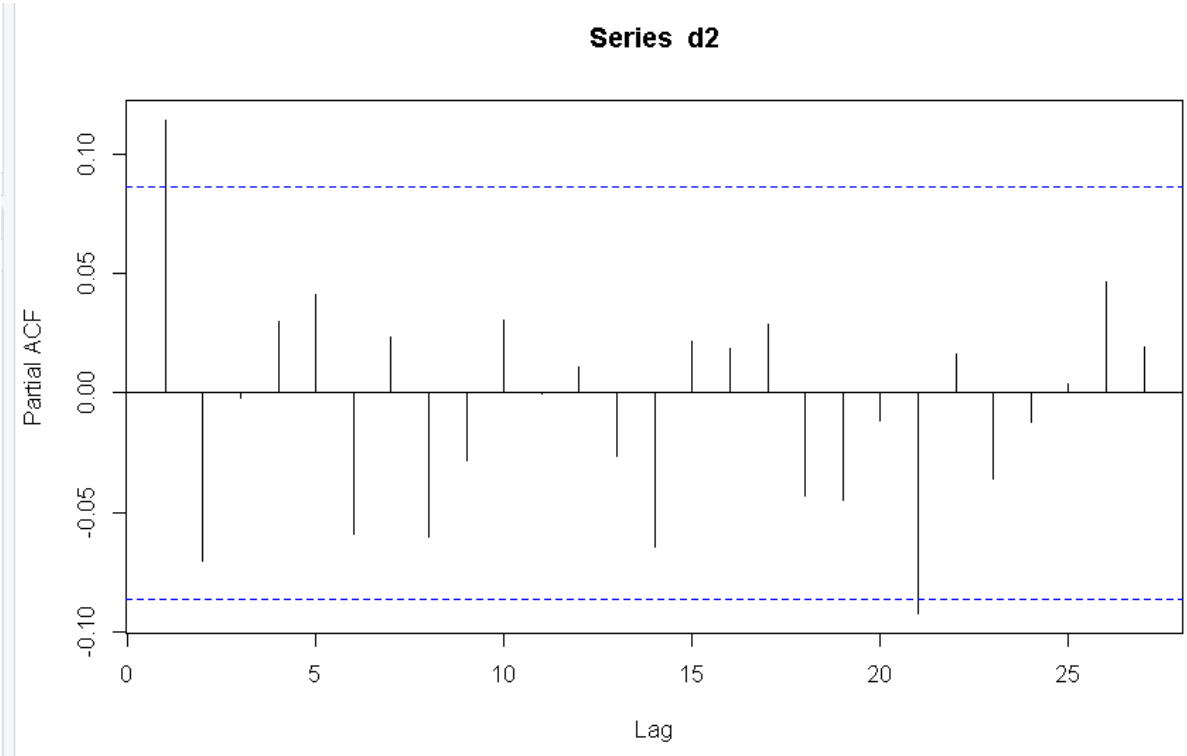
```
        Box-Ljung test

data:  d2
X-squared = 14.22, df = 12, p-value = 0.2869

> Box.test(d10, lag = 12, type = 'Ljung')

        Box-Ljung test

data:  d10
X-squared = 41.06, df = 12, p-value = 4.789e-05

>
```

For Decile 2, $p > 0.05$ so fail to reject the null hypothesis that the first 12 lags of autocorrelation are zero

For Decile 10, $p < 0.05$ so reject the null hypothesis that the first 12 lags are zero

b)





Based on the ACF and PACF plot, the best model is an ARMA(1,1)

```
Coefficients:
          ar1     ma1  intercept
      -0.3261  0.4505     0.0095
s.e.   0.3582  0.3394     0.0023
```

c)

```
$pred
Time Series:
Start = 517
End = 528
Frequency = 1
 [1] 0.010106521 0.009302900 0.009564969 0.009479506 0.009507376 0.009498287 0.009501251 0.009500285 0.009500600
[10] 0.009500497 0.009500531 0.009500520

$se
Time Series:
Start = 517
End = 528
Frequency = 1
 [1] 0.04831475 0.04868721 0.04872666 0.04873085 0.04873129 0.04873134 0.04873135 0.04873135 0.04873135 0.04873135
[11] 0.04873135 0.04873135
```