lab week 11

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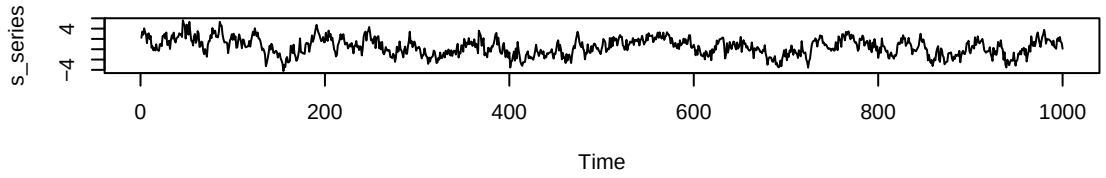
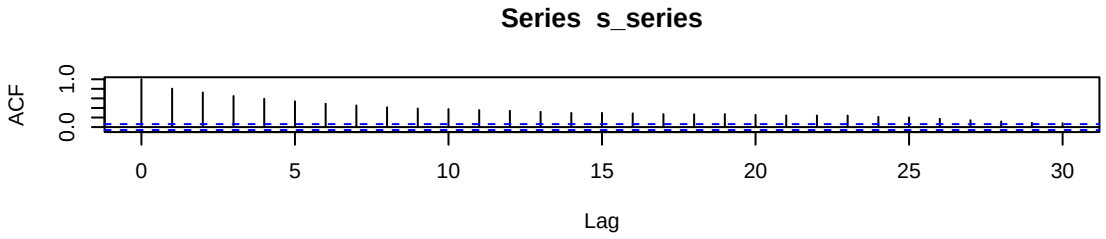
9nd May 2022

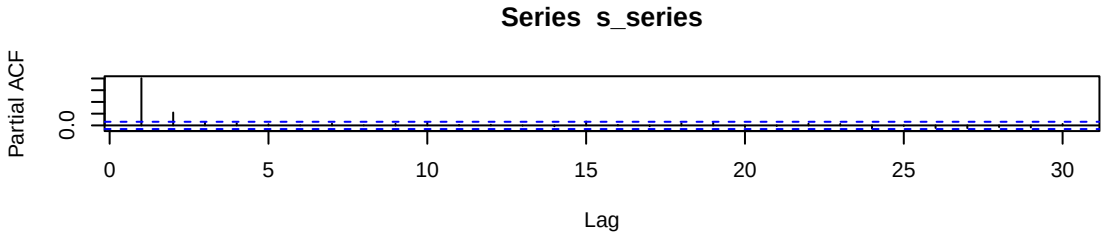
Question 1

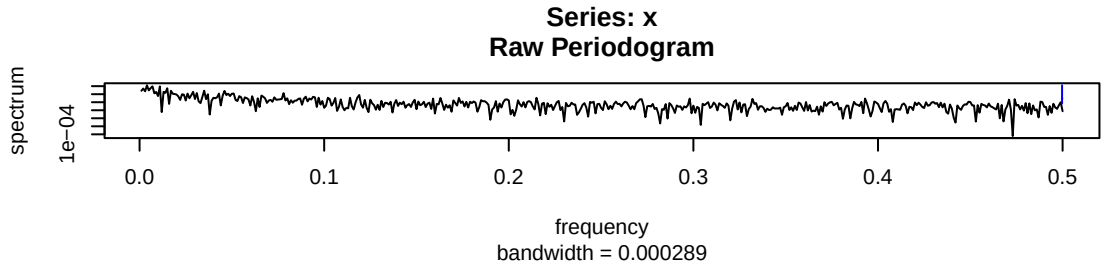
Simulate 1300 values from ARFIMA(1, 0.35, 1) with $\alpha = 0.7$ and $\beta = 0.4$

```
# Question 1
par(mfrow = c(4, 1))
library("fracdiff")
s = fracdiff.sim(1300, ar = 0.7, ma = 0.4, d = 0.35)
s_series = s$series[301:1300]
ts.plot(s_series)
acf(s_series)
pacf(s_series)
spectrum(s_series)
```









Question 2

```
set.seed(100)
# Question 2
d = fracdiff(s_series, nar = length(s$ar), nma = length(s$ma))
d
```

```
##
## Call:
##   fracdiff(x = s_series, nar = length(s$ar), nma = length(s$ma))
##
## Coefficients:
##         d        ar        ma
## 0.2737594 0.7940284 0.4602355
## sigma[eps] = 0.9648955
## a list with components:
##  [1] "log.likelihood"  "n"               "msg"             "d"
##  [5] "ar"              "ma"              "covariance.dpq"  "fnormMin"
##  [9] "sigma"           "stderror.dpq"    "correlation.dpq" "h"
```

```
## [13] "d.tol"           "M"               "hessian.dpq"     "length.w"
## [17] "residuals"       "fitted"          "call"
```

```
d$stderror.dpq
```

```
## [1] 0.01044811 0.06149677 0.03736798
```

Parameter estimates with standard errors:

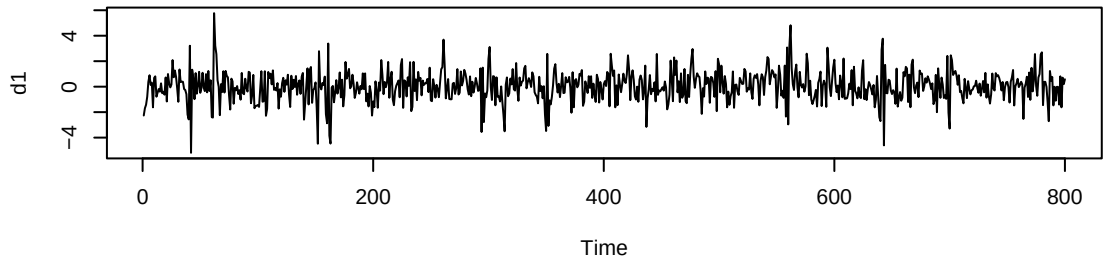
- $d \approx 0.2087386$ and $SE \approx 0.01078539$
- $ar \approx 0.7740661$ and $SE \approx 0.06614146$
- $ar \approx 0.3906665$ and $SE \approx 0.04085794$

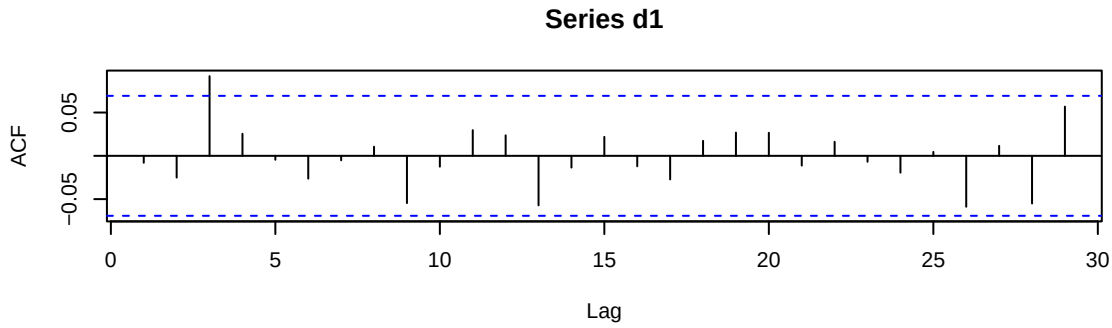
```
confint(d)
```

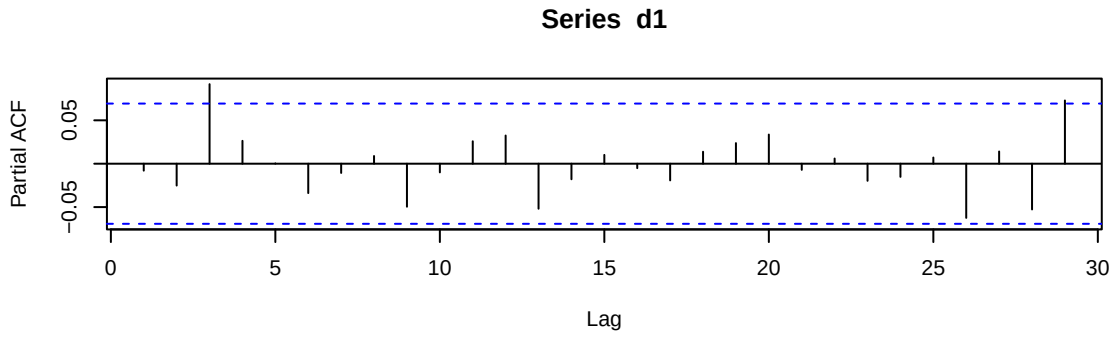
```
##        2.5 %    97.5 %
## d  0.2532814 0.2942373
## ar 0.6734970 0.9145599
## ma 0.3869956 0.5334754
```

Question 3

```
library("TSA")
set.seed(100)
d = garch.sim(alpha = c(0.7, 0.4), n = 1000)
d1 = d[201:1000]
par(mfrow = c(3, 1))
ts.plot(d1)
acf(d1)
pacf(d1)
```

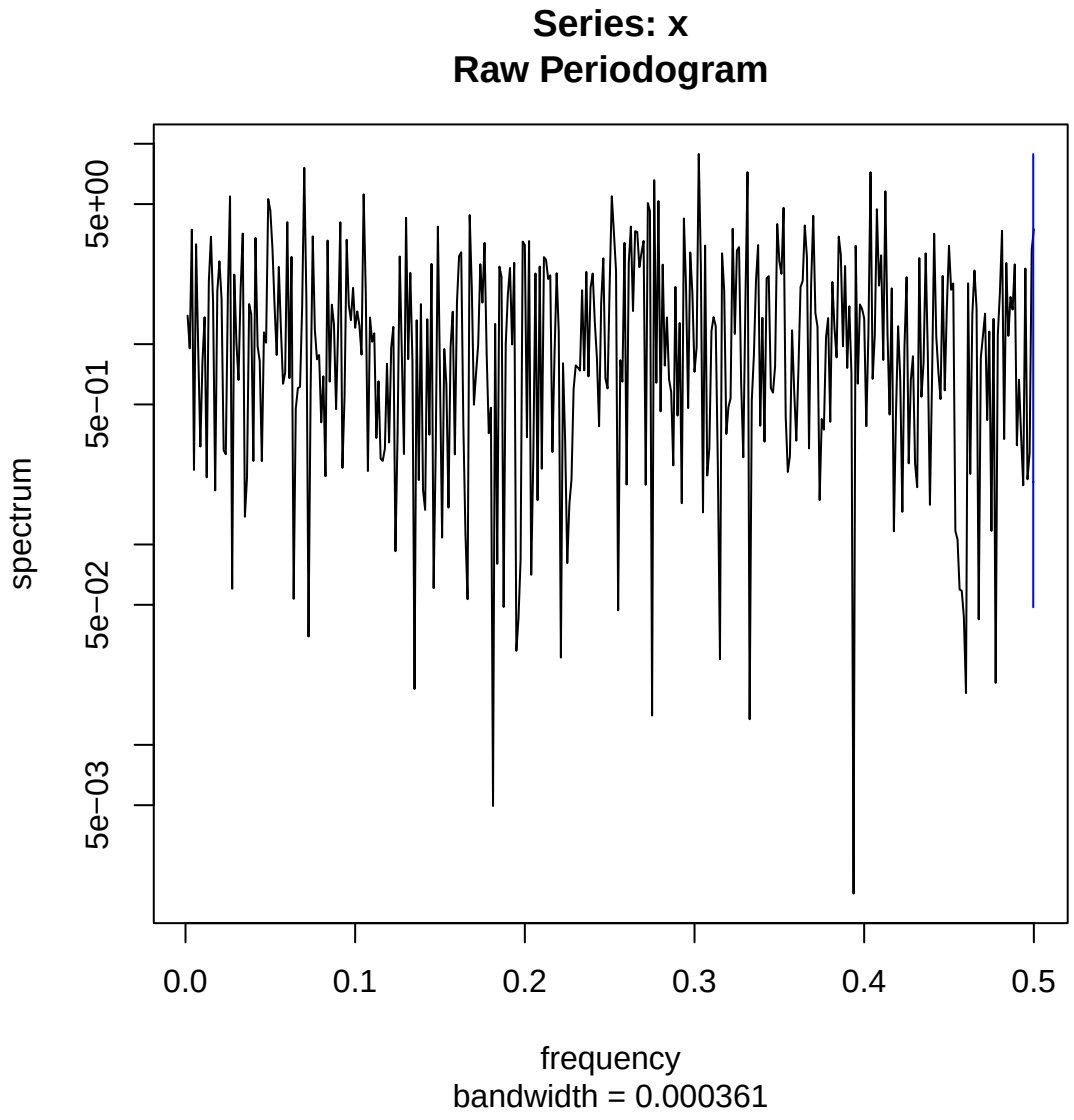






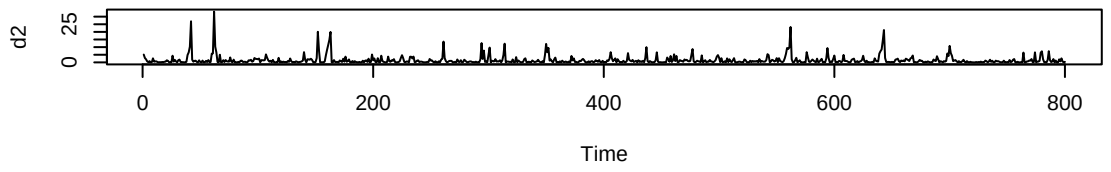
Question 4

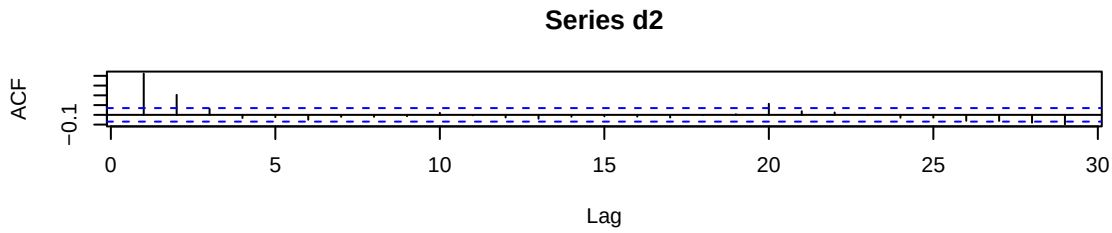
```
par(mfrow = c(1, 1))
x = spectrum(d1)
```

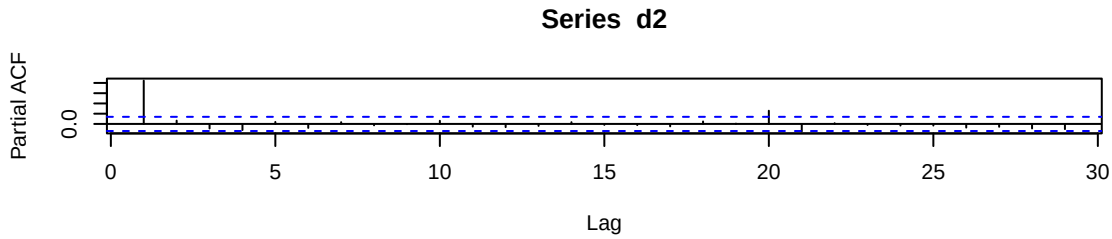


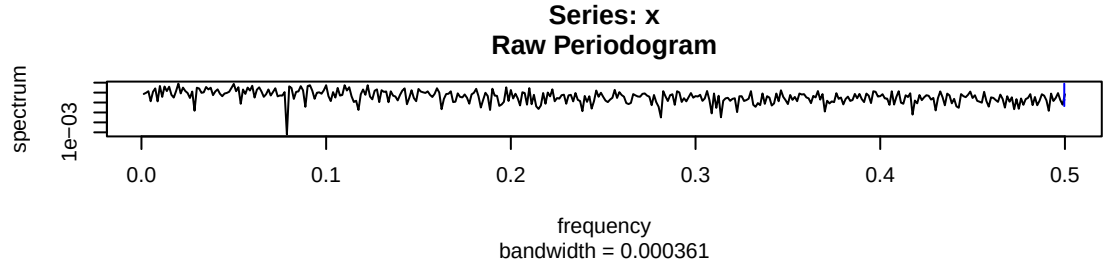
Question 5

```
par(mfrow = c(4, 1))
d2 = d1^2
ts.plot(d2)
acf(d2)
pacf(d2)
spectrum(d2)
```









Question 6

```
ar1 = arima(d1, order = c(1, 0, 0))
ar2 = arima(d2, order = c(2, 0, 0))
ma1 = arima(d2, order = c(0, 0, 1))
ma2 = arima(d2, order = c(0, 0, 2))
arma11 = arima(d2, order = c(1, 0, 1))

c(ar1$aic, ar2$aic, ma1$aic, ma2$aic, arma11$aic)
```

```
## [1] 2584.398 3824.300 3853.231 3827.927 3824.458
```

Thus based on the AIC criterios we see that AR(1) is the best model fit.