Lab4

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1. Fit a cubic polynomial (centered) model to the chicken data and see if it improves the fit. Have the data and the cubic fit in one plot.

```r
t1= time(chicken)-mean(time(chicken)) # centered
t2= t1^2
t3= t1^3

chick.lm<-lm(chicken ~ t1+t2+t3, na.action=NULL)
summary(lm(chicken ~ ., data = chicken))
```

```
##
## Call:
## lm(formula = chicken ~ ., data = chicken)
##
## Residuals:
##        Min         1Q     Median         3Q        Max
## -3.692e-15 -8.500e-17 -3.060e-17  1.940e-17  3.429e-15
##
## Coefficients:
##              Estimate Std. Error   t value Pr(>|t|)
## (Intercept) 0.000e+00  3.598e-16 0.000e+00        1
## x           1.000e+00  4.126e-18 2.424e+17   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.989e-16 on 178 degrees of freedom
## Multiple R-squared:      1,  Adjusted R-squared:      1
## F-statistic: 5.875e+34 on 1 and 178 DF,  p-value: < 2.2e-16
```

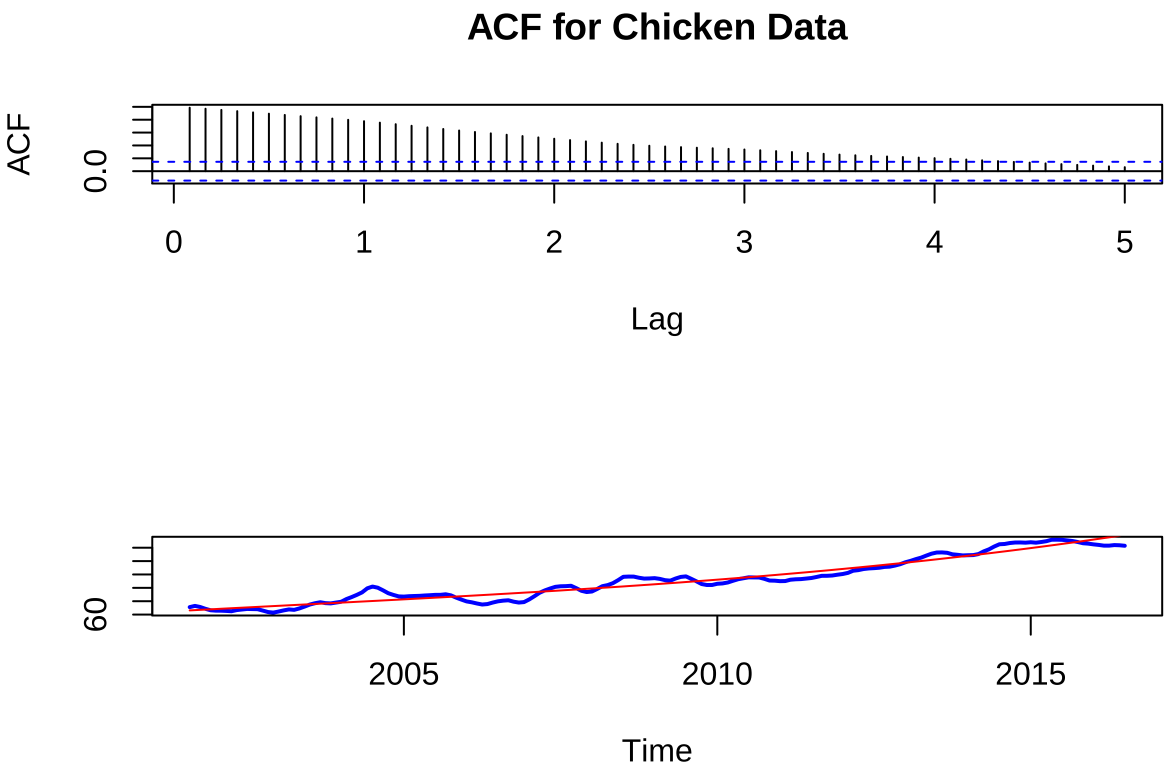
```r
summary(chick.lm)
```

```
##
## Call:
## lm(formula = chicken ~ t1 + t2 + t3, na.action = NULL)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -8.0565 -3.0868 -0.1503  2.9479 10.7806
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 82.801672   0.436630 189.638  < 2e-16 ***
## t1           3.302015   0.168076  19.646  < 2e-16 ***
## t2           0.153181   0.017358   8.825 1.07e-15 ***
## t3           0.008596   0.004565   1.883   0.0613 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Residual standard error: 3.905 on 176 degrees of freedom
## Multiple R-squared:  0.9435, Adjusted R-squared:  0.9425
## F-statistic: 978.9 on 3 and 176 DF,  p-value: < 2.2e-16
```

```r
par(mfrow=c(2,1))
acf(chicken, lag.max = 60, main="ACF for Chicken Data")

ts.plot(chicken, ylab="", col=4, lwd=2)
lines(fitted(chick.lm), col="red")
```



2. Generate a signal

$$x_t = 1 + 3t + e_t$$

, with n = 200 and where 1)

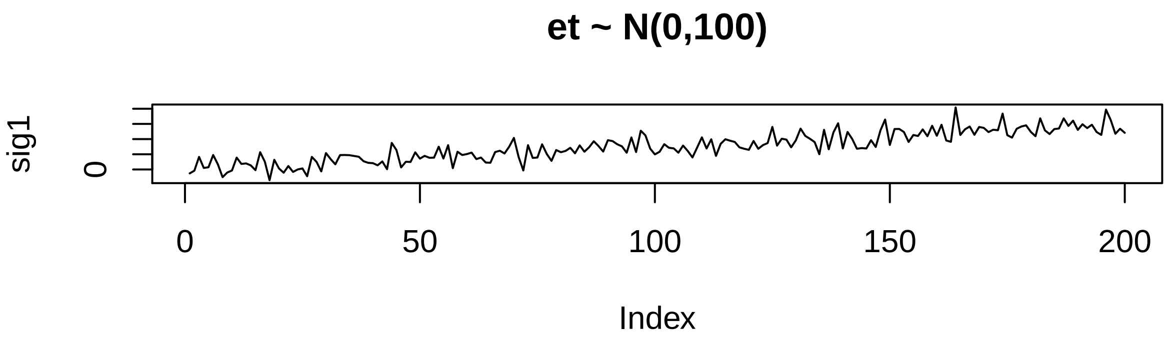
$$e_t = N(0, 100)$$

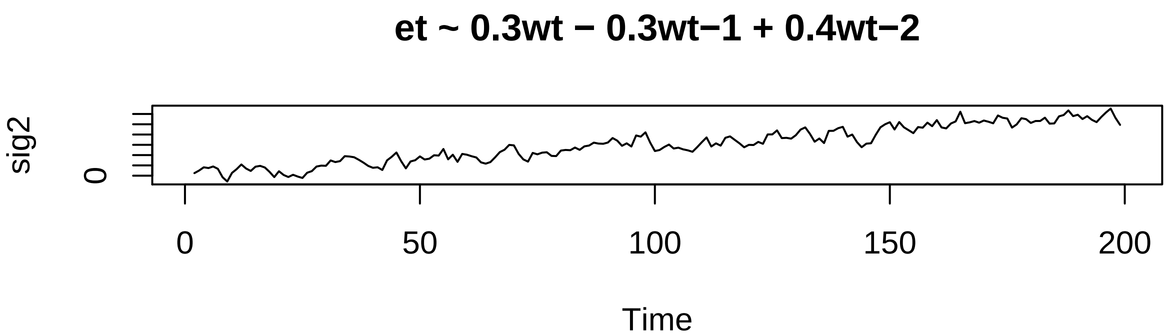
2)

$$e_t = 0.3w_t - 0.3w_{(t-1)} + 0.4w_{(t-2)}$$

```r
set.seed(123)
par(mfrow=c(2,1))
n=200
et = rnorm(n,0,100)
t=1:n
sig1= 1 +3*t +et
sig1.lm= lm(sig1 ~ t)
plot(sig1, type = "l", main="et ~ N(0,100)")
et1 = filter(et,filter = c(0.3,0.3,0.4), method = c("convolution","recursive"),sides=2)
```

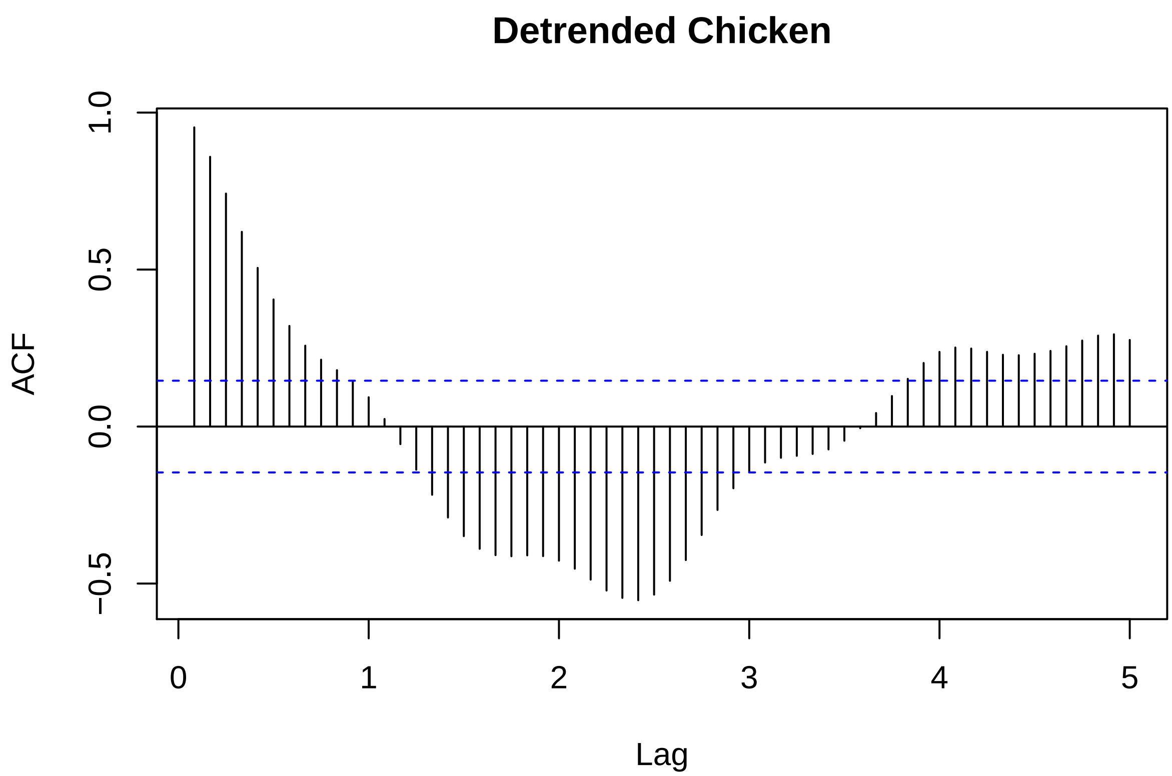
```r
sig2= 1 +3*t +et1
sig2.lm <-lm(sig2 ~ t)
plot(sig2, type = "l",main="et ~ 0.3wt - 0.3wt-1 + 0.4wt-2")
```



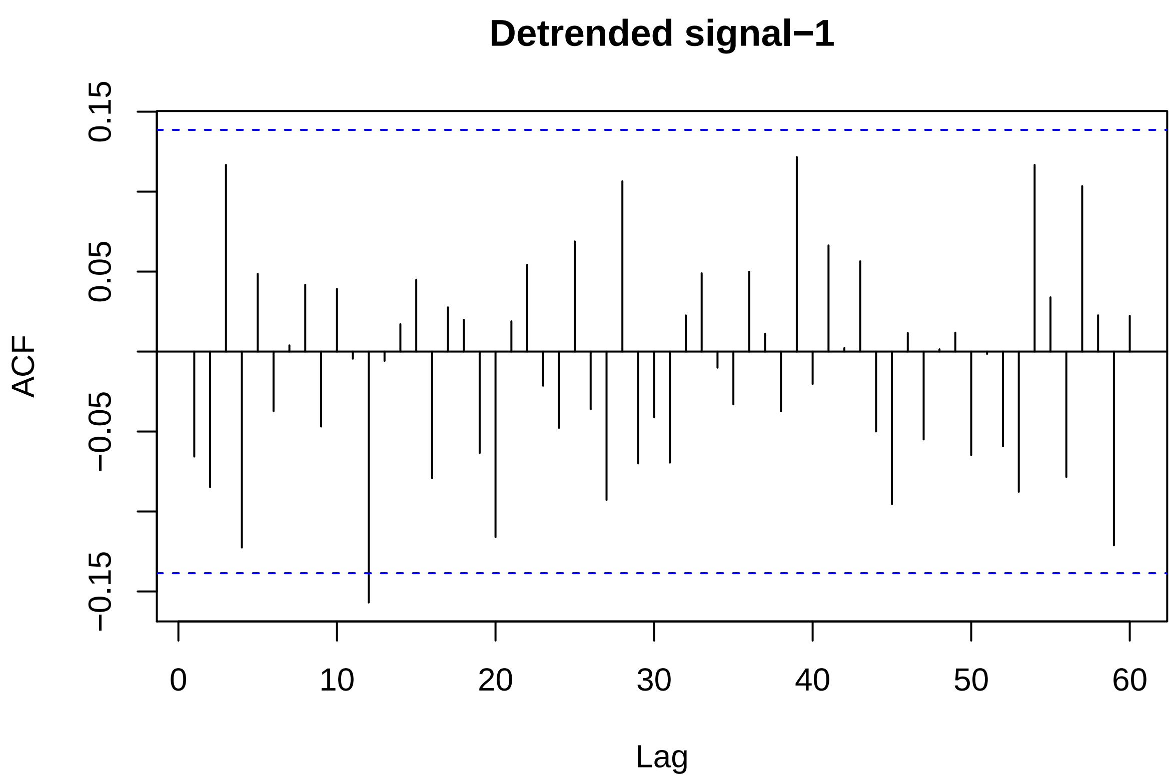


3. For 1 and 2 above, estimate and remove the trend. Examine the acf of the residuals

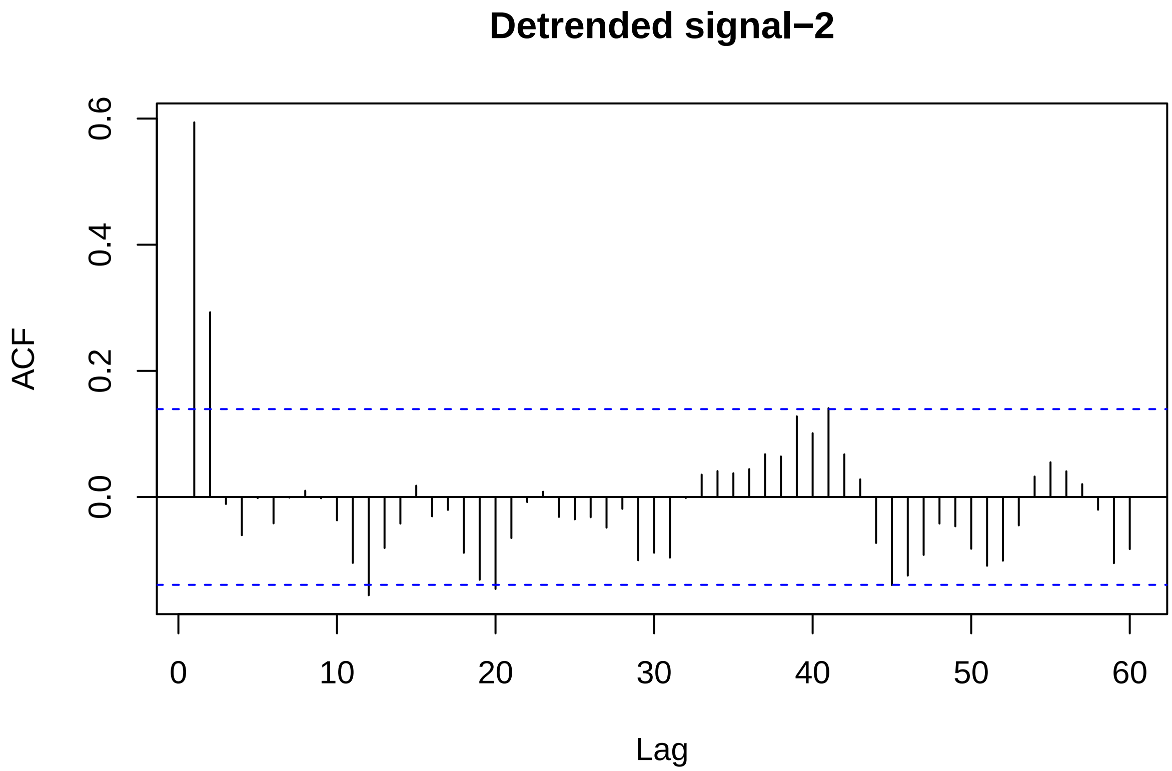
```r
acf(resid(chick.lm), 60, main="Detrended Chicken")
```




```r
acf(resid(sig1.lm), 60, main= "Detrended signal-1")
```




```r
acf(resid(sig2.lm), 60, main= "Detrended signal-2")
```


Detrended signal−2
ACF
0.0
0.2
0.4
0.6
0
10
20
30
40
50
60
Lag