PSTAT174_Lab05

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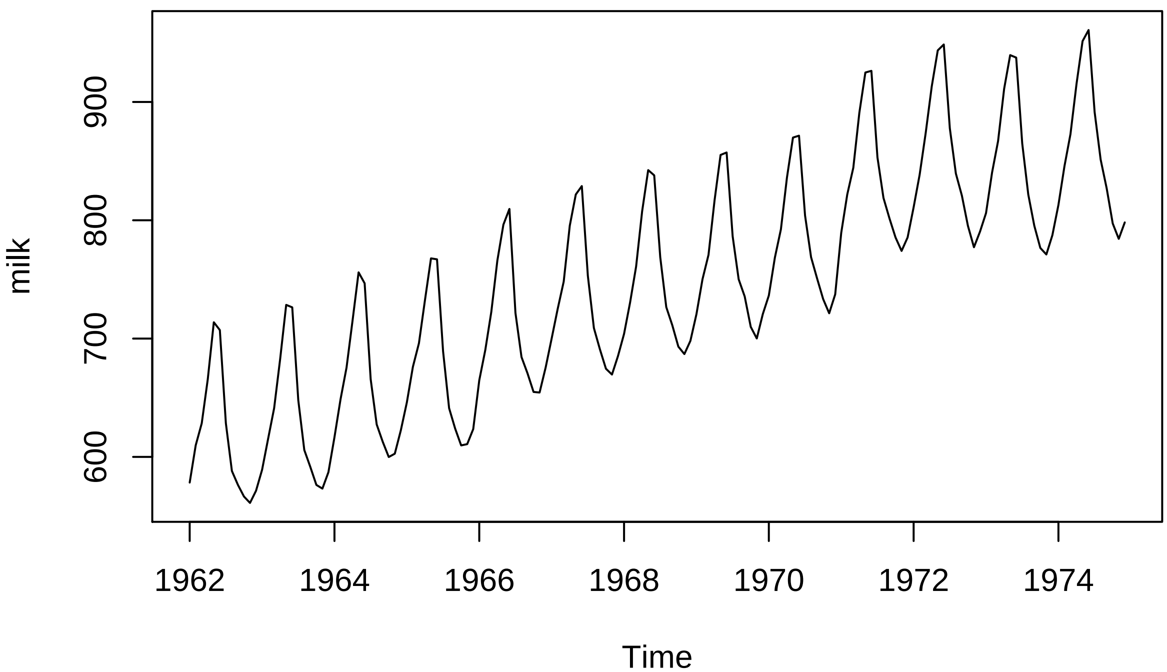
1. We will analyze monthly milk production measured in pounds per from Jan. 1962 to Dec. 1975 from the package tsdl as Lab 4 (if you want to re-install tsdl, please refer to Lab 4). Let's denote the time series milk as X_t.

```
getwd()
```

```
## [1] "/Users/celesteherrera/Documents/PSTAT174/Lab/Lab05"
```

```
setwd("/Users/celesteherrera/Documents/PSTAT174/Lab/Lab05")
```

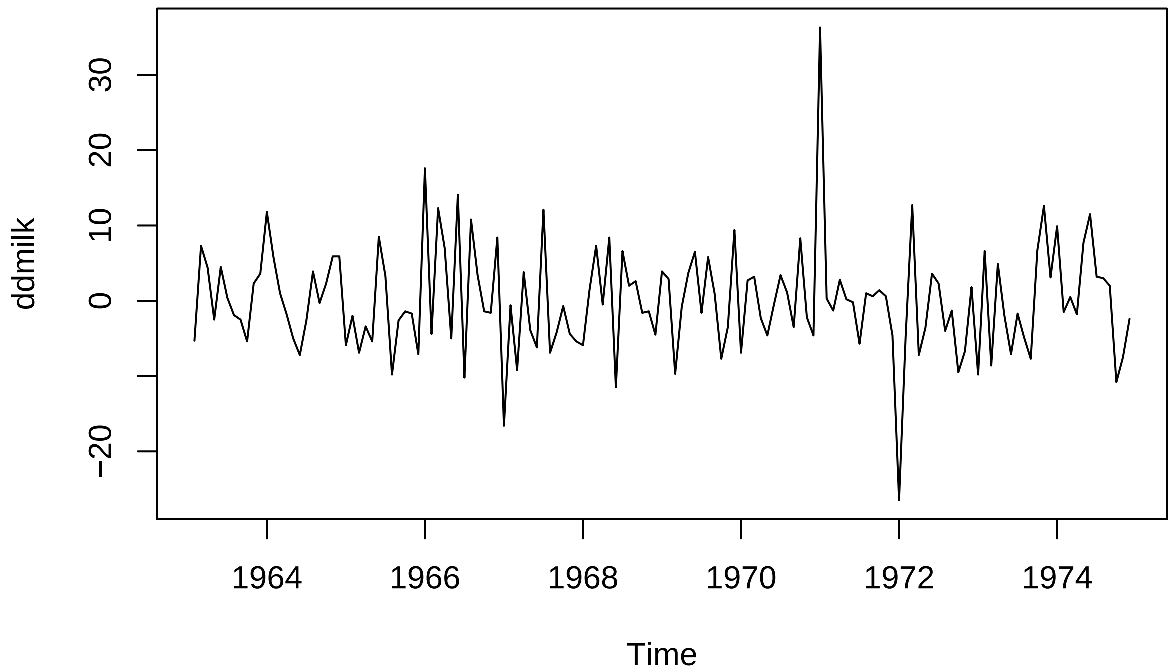
```
library(tsdl)
milk <- subset(tsdl, 12, "Agriculture")[[3]]
plot(milk)
```



(a)

Explain why the series milk looks not stationary.

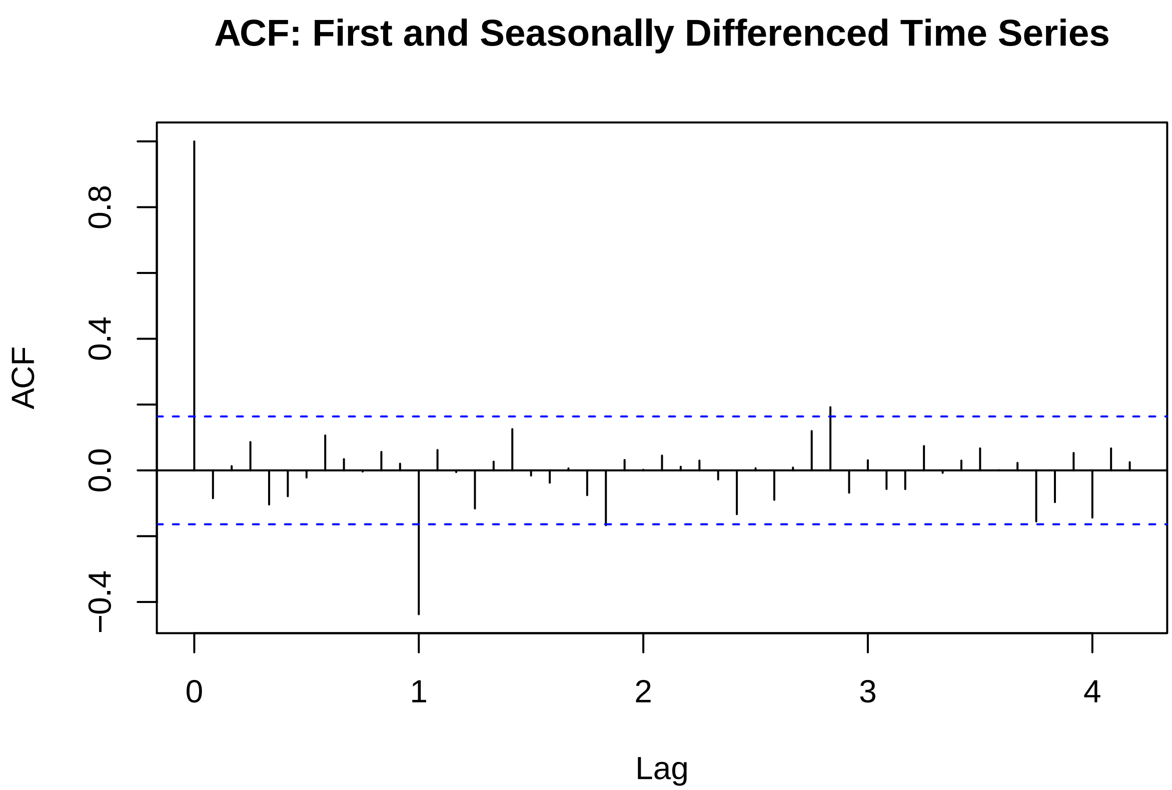
```
dmilk <- diff(milk,12)
ddmilk <- diff(dmilk,1)
plot(ddmilk)
```



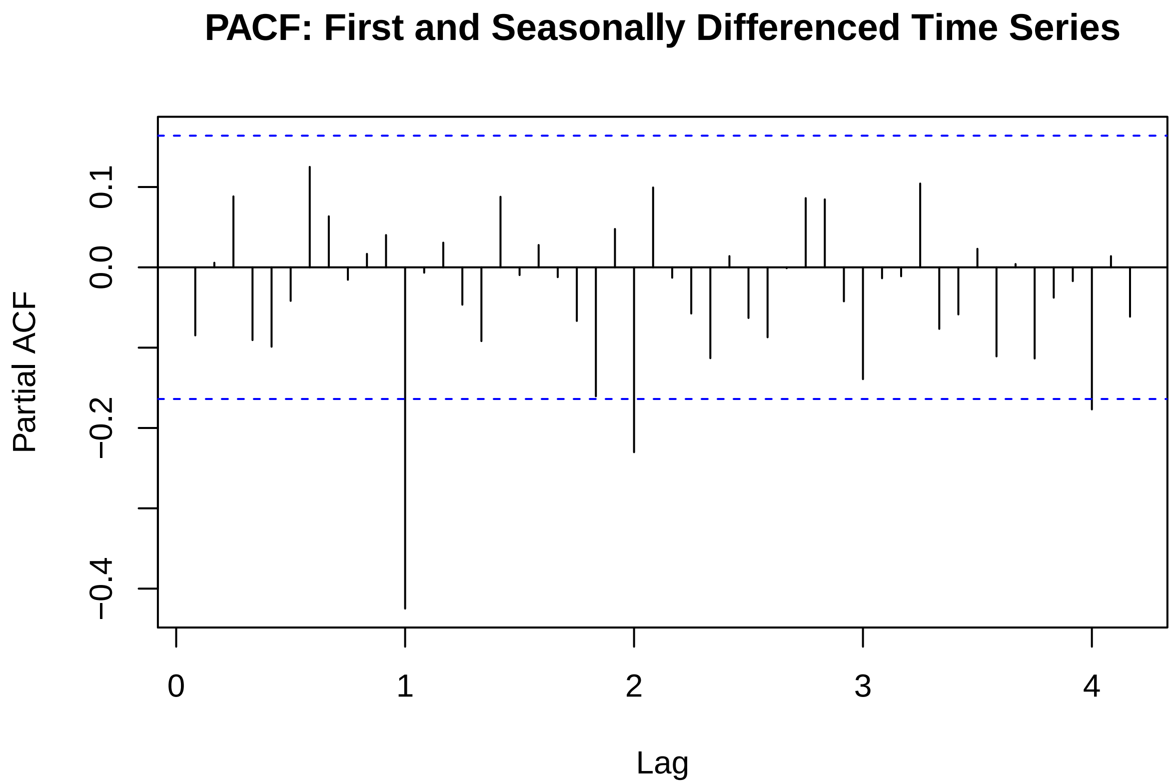
The milk series does not look stationary because the consistency looks a little off.

(b) Let Y_t be the series ddmilk, that is, Y_t = (1 - B)(1 - B^{12})X_t. Plot the ACF and PACF of Y_t with lag.max = 50.

```
acf(ddmilk, lag.max = 50, main = "ACF: First and Seasonally Differenced Time Series")
```




```
pacf(ddmilk, lag.max = 50, main = "PACF: First and Seasonally Differenced Time Series")
```



(c) Now, we assume that Y_t corresponds to a SARIMA model. Determine possible candidate models SARIMA(p, d, q) $\times$ (P, D, Q)s for the series Y_t.

```
library(astsa)
fit <- sarima(xdata = milk,
              p = 0, d = 1, q = 0,
              P = 2, D = 1, Q = 1, S = 12,
              details = F)
fit$fit$coef
```

```
##        sar1        sar2        sma1
##  0.03338578  0.01958261 -0.70174796
```

(d) Choose one model for this data set, and write down your fitted model.

```
library(astsa)

fit_1 <- sarima(xdata = milk, details = F,
                p = 0, d =1, q = 0, P = 1, D = 1, Q = 1, S =12)

cat('Coefficents'); fit_1$fit$coef
```

```
## Coefficents
```

```
##        sar1        sma1
##  0.01876417 -0.68617816
```

There the equation would be written as $(1 - 0.0188B^{12})(1 - B)(1 - B^{12})X_t = (1 - 0.6862B^{12})Z_t$