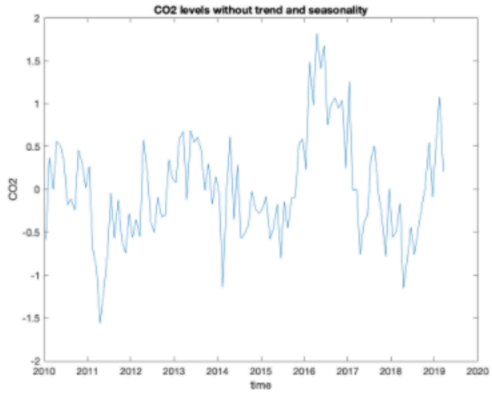
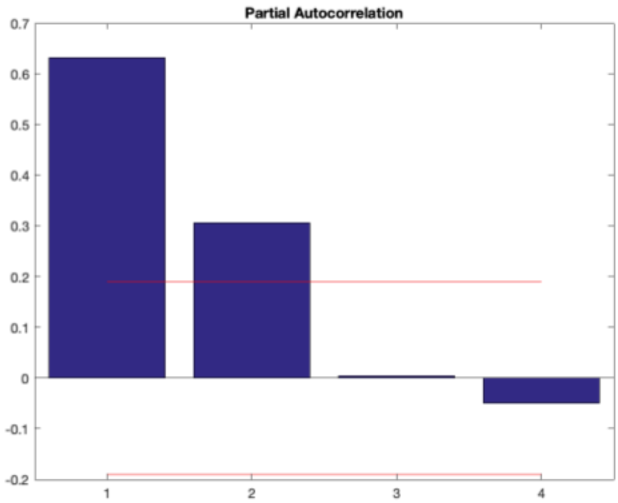
1. a)) *removing the trend and the seasonality from the data.*



b)*performing a PACF on the residuals (up to order 4: φ44) in order to find the relevant coefficients for an AR(p) model;*



c)*determine the model coefficients and display the model together with the data in order to verify that your fitting make sense (corresponds to the left plot in Figure 8.7 in the course book).*

Two coefficients: $\phi_1 = 0.4445$
$\phi_2 = 0.3138$

2.

$$D(x) = Ae^{-\sqrt[3]{x}}$$

a)

$$\int_0^{\infty} D(x')\,dx' = 1$$

$$\int_0^{\infty} Ae^{-\sqrt[3]{x'}}\,dx' = 1 \implies \int_0^{\infty} e^{-\sqrt[3]{x'}}\,dx' = \frac{1}{A}$$

Make variable separation $u = \sqrt[3]{x'}$
When $x \to \infty,\ u \to \infty$
When $x \to 0,\ u \to 0$

$$\frac{du}{dx'} = \frac{1}{3}x^{-2/3} \implies dx' = 3u^2 du$$

Use eq 7.20

$$\int Ae^{-u}\,3u^2 du = 3A\Gamma(3) \implies A = \frac{1}{3\Gamma(3)}$$

b)

We can make the similar variable sub again and then use eq.7.23.

$$C(x) = \int_0^{x} D(x')\,dx' = \frac{1}{3\Gamma(3)}\int_0^{x} e^{-\sqrt[3]{x'}}dx' \ , \quad \frac{u}{2} = \sqrt[3]{x'} \quad dx' = 3\frac{u}{4}^2 d\frac{u}{2}$$

$$\implies \frac{1}{8\Gamma(3)}\int_0^{u^3/8} e^{-u/2}\,3u^2 du = \int_0^{u^3/8} \frac{1}{\Gamma(6/2)2^{(n/2)}} e^{-u}\,u^{6/2-1}du = P(6/2,\ x/2)$$

Where P is the incomplete gamma function.

2c)d)

By using built in functions gamma and gammainc, the following was obtained