

# Lista\_02

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## Carregando bibliotecas

```
knitr::opts_chunk$set(warning = FALSE, message = FALSE)

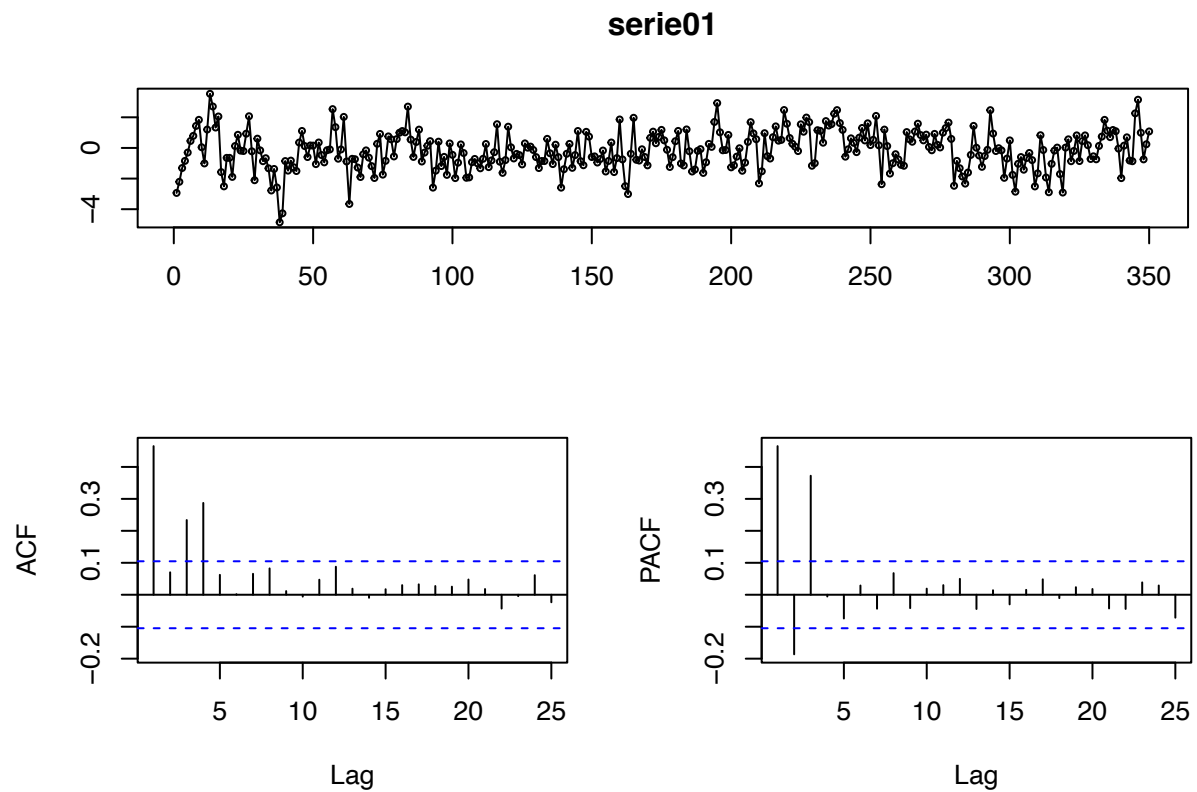
library(forecast)
library(lmtest)
library(readxl)
```

1. Baseando-se nos procedimentos vistos no curso, faça a modelagem das séries 1, 2, 3 e 4. Utilizando os modelos escolhidos para cada uma, calcule as previsões para  $l = 1, 2$  e 3 passos à frente. Escreva as equações de previsão de cada série utilizando os parâmetros estimados. Comente cada caso.

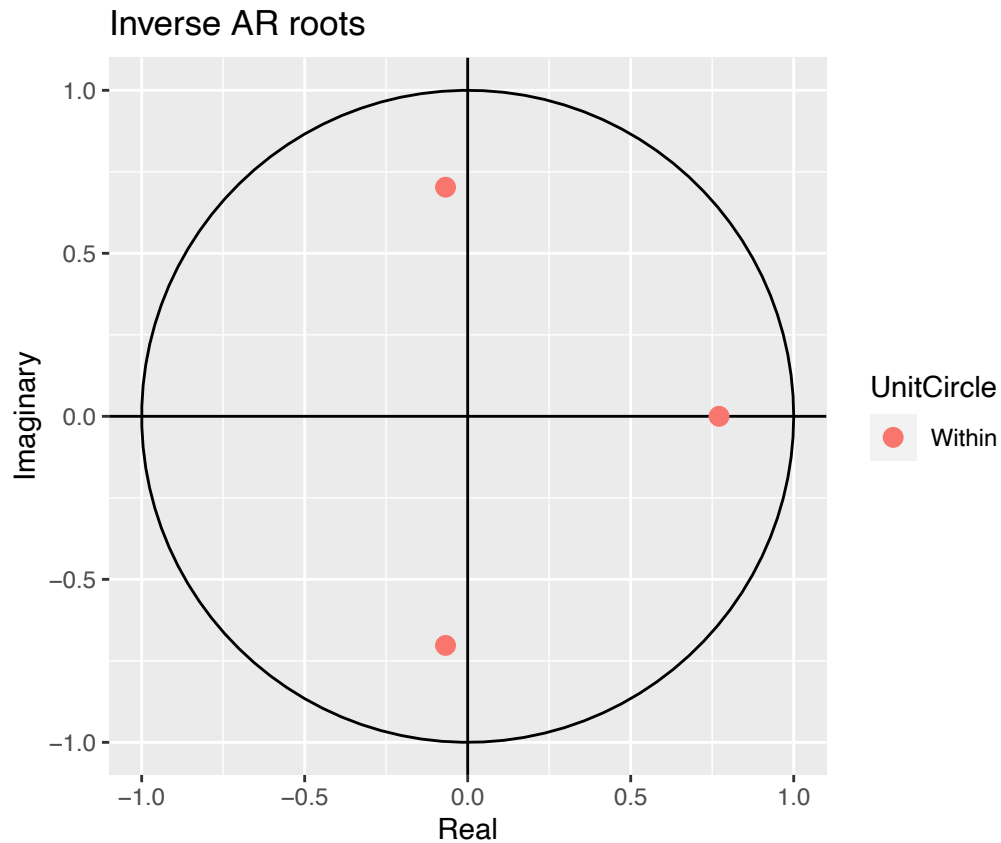
Série\_01

Modelo AR(3)

```
serie01 <- scan("./Dados/Series/serie1.csv")
tsdisplay(serie01)
```



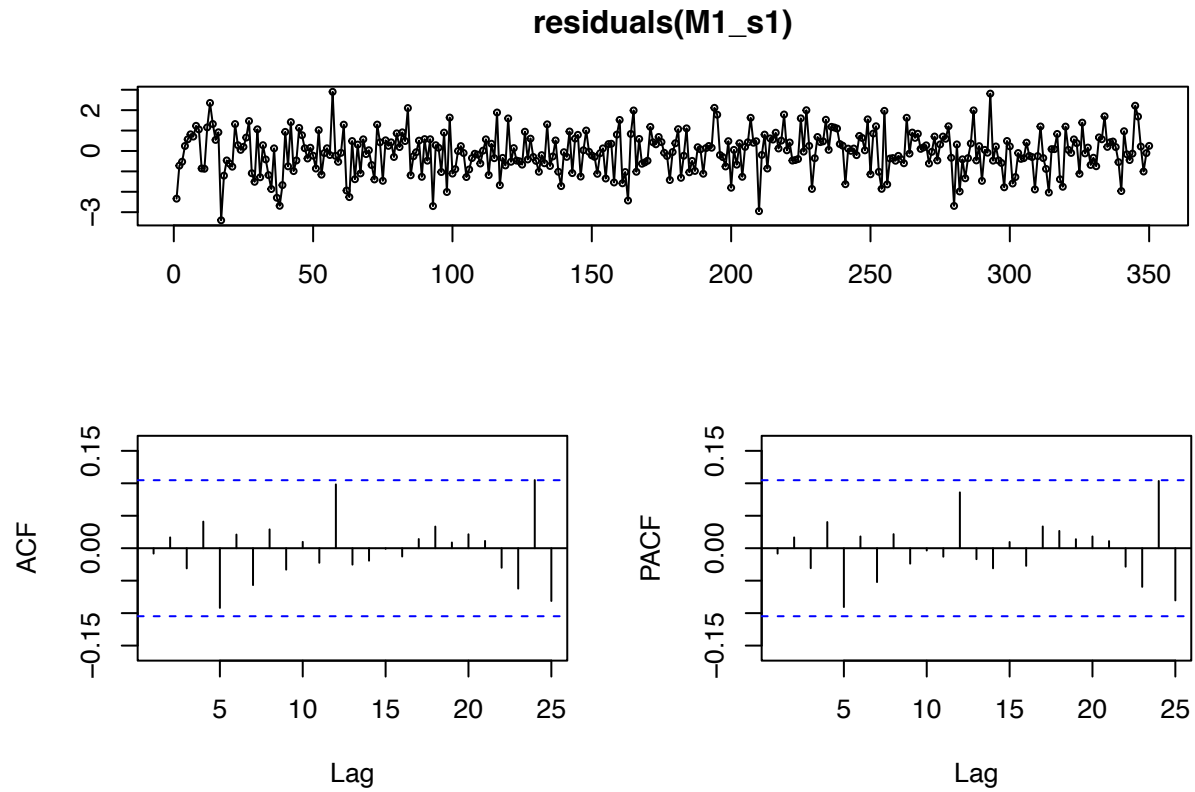
```
M1_s1 <- Arima(serie01, order=c(3,0,0), include.mean = FALSE) # Modelo AR(3) média = 0
autoplot(M1_s1) # Raízes inversas caem dentro do círculo unitário
```



```
coeftest(M1_s1) # Coeficientes são estatisticamente significantes
```

```
##
## z test of coefficients:
##
##      Estimate Std. Error z value Pr(>|z|)
## ar1  0.635417   0.049520 12.8315 < 2.2e-16 ***
## ar2 -0.393856   0.056136 -7.0161 2.282e-12 ***
## ar3  0.384269   0.049576  7.7512 9.105e-15 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
tsdisplay(residuals(M1_s1)) # Resíduo é Ruído Branco
```



**Equação modelo AR(3)**

$$y_t = \phi_1 y_{t-1} + \phi_2 y_{t-2} + \phi_3 y_{t-3} + \epsilon_t$$

**Encontrando equações de previsão para  $l = 1, 2$  e  $3$**

$$y_T(1) = \phi_1 y_T + \phi_2 y_{T-1} + \phi_3 y_{T-2}$$

$$y_T(2) = \phi_1 y_{T(1)} + \phi_2 y_T + \phi_3 y_{T-1}$$

$$y_T(3) = \phi_1 y_{T(2)} + \phi_2 y_{T(1)} + \phi_3 y_T$$

Substituindo valores estimados dos coeficientes

$$y_T(1) = 0,6354 y_T - 0,3938 y_{T-1} + 0,3842 y_{T-2}$$

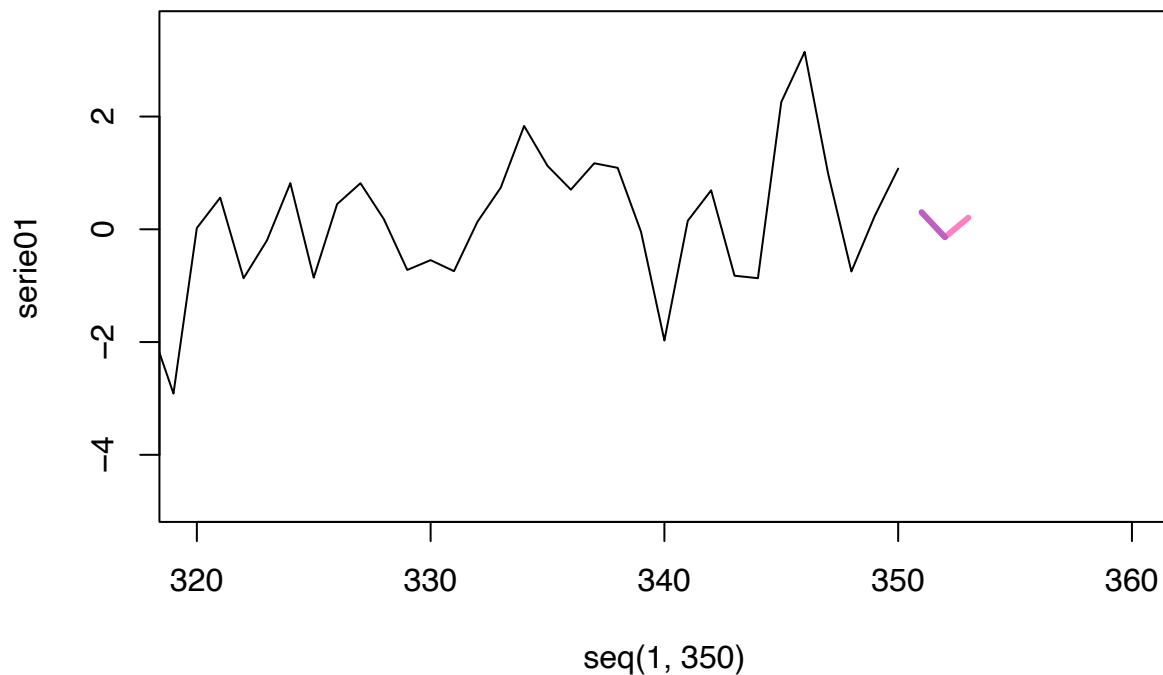
$$y_T(2) = 0,6354 y_{T(1)} - 0,3938 y_T + 0,3842 y_{T-1}$$

$$y_T(3) = 0,6354 y_{T(2)} - 0,3938 y_{T(1)} + 0,3842 y_T$$

```
forecast(M1_s1, h = 3)
```

```
##      Point Forecast      Lo 80      Hi 80      Lo 95      Hi 95
## 351      0.3025850 -1.007668  1.612838 -1.701275  2.306445
## 352     -0.1399293 -1.692320  1.412461 -2.514106  2.234247
## 353      0.2057075 -1.346737  1.758152 -2.168552  2.579967
```

```
plot(seq(1, 350), serie01, type = "l", xlim = c(320, 360))
lines(forecast(M1_s1, h = 1)$mean, lwd = 3, col = rgb(0.5,0,0, alpha = 0.5))
lines(forecast(M1_s1, h = 2)$mean, lwd = 3, col = rgb(0,0.5,1, alpha = 0.5))
lines(forecast(M1_s1, h = 3)$mean, lwd = 3, col = rgb(1,0,0.5, alpha = 0.5))
```

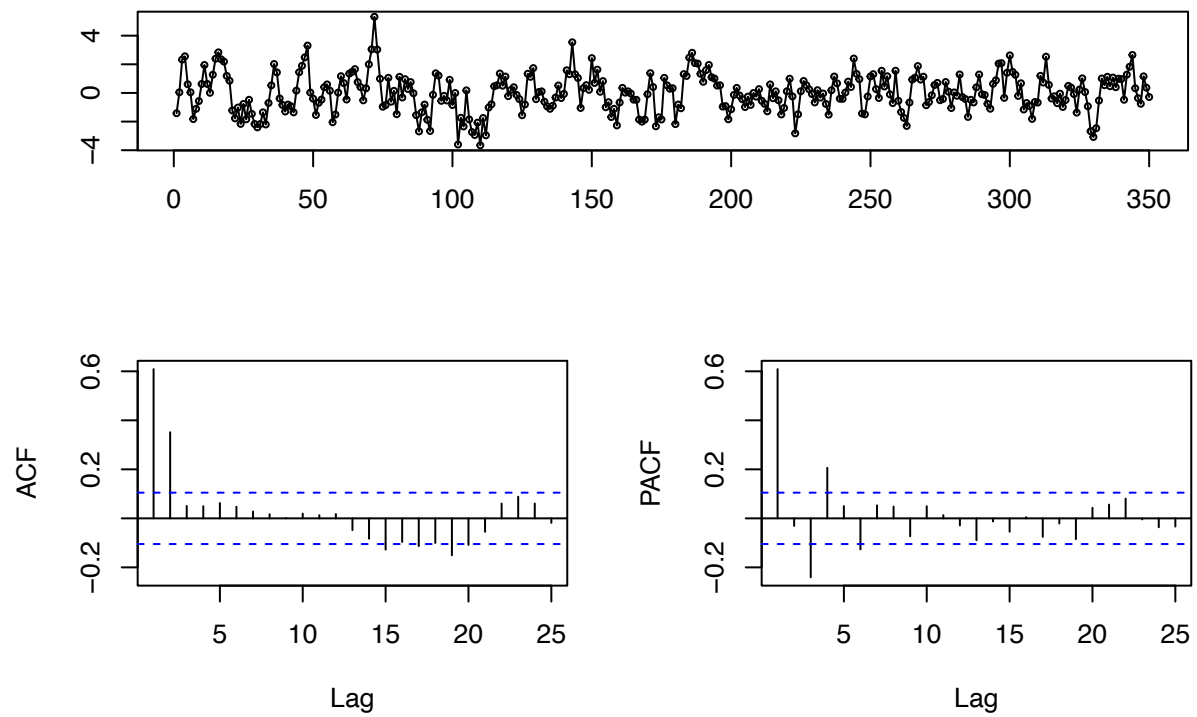


Serie\_02

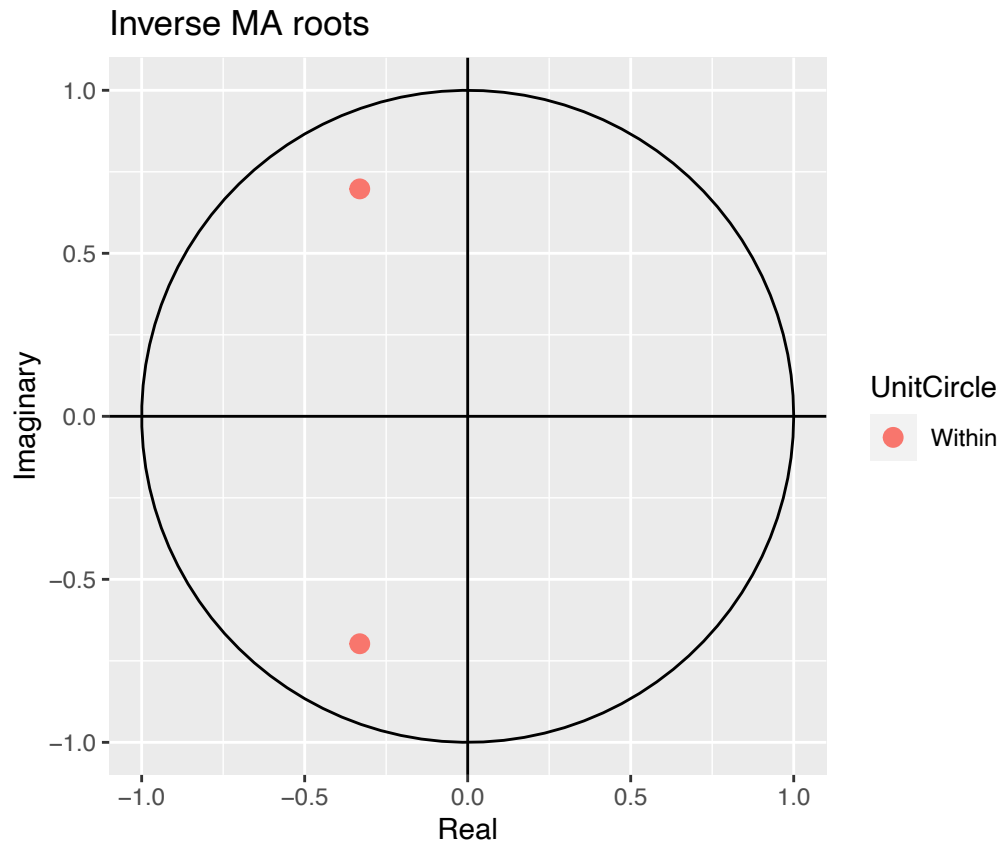
Modelo MA(2)

```
serie02 <- scan("./Dados/Series/serie2.csv")
tsdisplay(serie02)
```

**serie02**



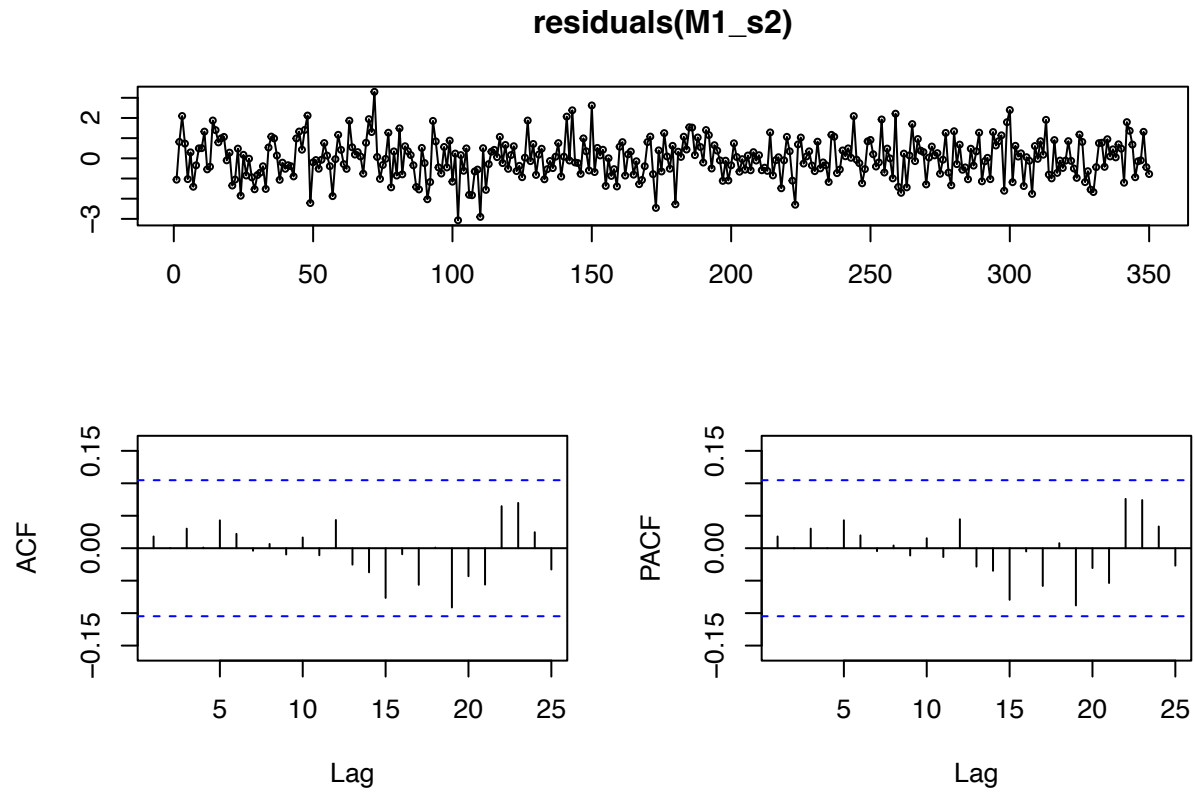
```
M1_s2 <- Arima(serie02, order=c(0,0,2), include.mean = FALSE) # Modelo MA(2) média = 0
autoplot(M1_s2) # Raízes inversas caem dentro do círculo unitário
```



```
coeftest(M1_s2) # Coeficientes são estatisticamente significantes
```

```
##
## z test of coefficients:
##
##      Estimate Std. Error z value Pr(>|z|)
## ma1 0.662046   0.042356  15.630 < 2.2e-16 ***
## ma2 0.596160   0.042899  13.897 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
tsdisplay(residuals(M1_s2)) # Resíduo é Ruído Branco
```



**Equação modelo MA(2)**

$$y_t = \theta_1 \epsilon_{t-1} + \theta_2 \epsilon_{t-2} + \epsilon_t$$

**Encontrando equações de previsão para  $l = 1, 2$  e  $3$**

$$y_T(1) = \theta_1 \epsilon_T + \theta_2 \epsilon_{T-1}$$

$$y_T(2) = \theta_2 \epsilon_T$$

$$y_T(3) = 0$$

**Substituindo valores estimados dos coeficientes**

$$y_T(1) = 0,6620 \epsilon_T + 0,5962 \epsilon_{T-1}$$

$$y_T(2) = 0,5962 \epsilon_T$$

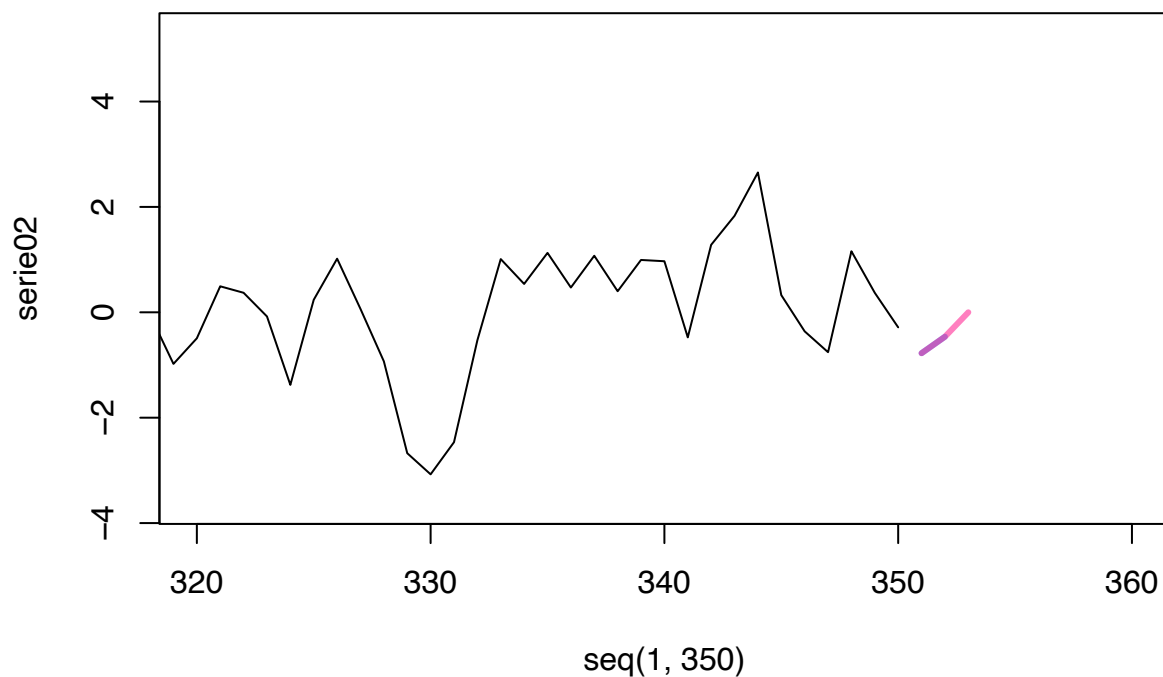
$$y_T(3) = 0$$



```
forecast(M1_s2, h = 3)
```

```
##      Point Forecast      Lo 80      Hi 80      Lo 95      Hi 95
## 351      -0.7761947 -2.032164  0.4797749 -2.697034  1.144645
## 352      -0.4632019 -1.969478  1.0430739 -2.766852  1.840448
## 353       0.0000000 -1.682114  1.6821137 -2.572571  2.572571
```

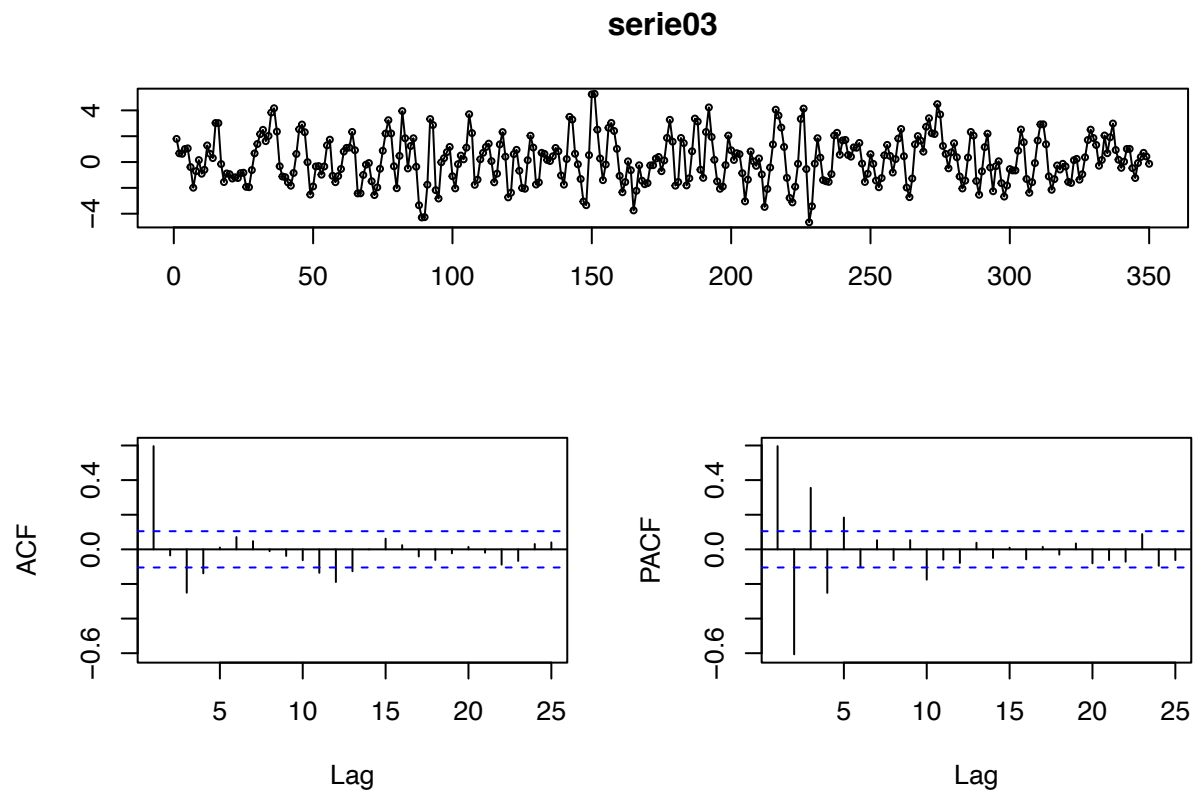
```
plot(seq(1, 350), serie02, type = "l", xlim = c(320, 360))
lines(forecast(M1_s2, h = 1)$mean, lwd = 3, col = rgb(0.5,0,0, alpha = 0.5))
lines(forecast(M1_s2, h = 2)$mean, lwd = 3, col = rgb(0,0.5,1, alpha = 0.5))
lines(forecast(M1_s2, h = 3)$mean, lwd = 3, col = rgb(1,0,0.5, alpha = 0.5))
```



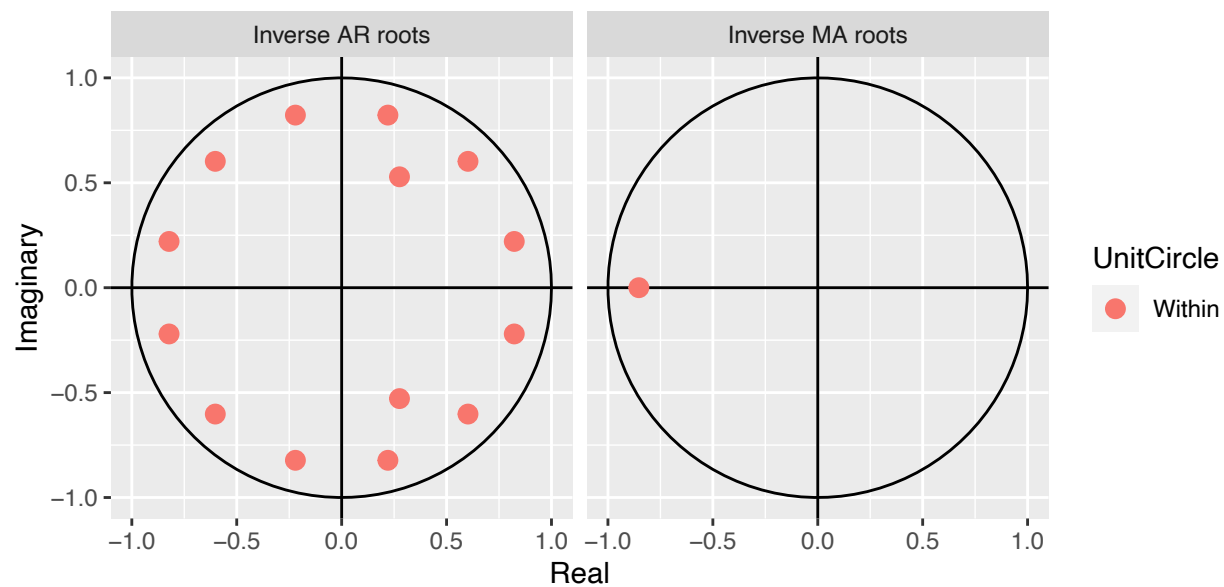
### Série\_03

Modelo SARMA(2,1)x(1,0)<sub>12</sub>

```
serie03 <- scan("./Dados/Series/serie3.csv")
tsdisplay(serie03)
```



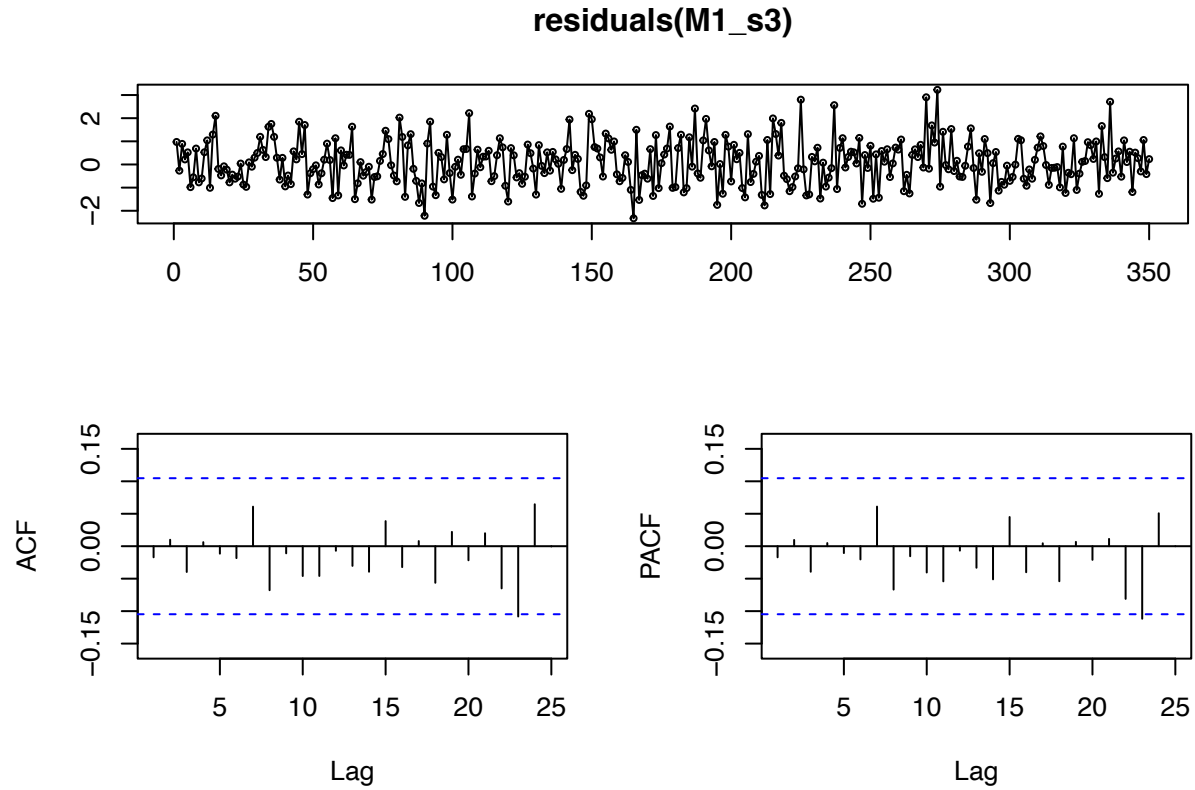
```
# Modelo SARMA(2,1)x(1,0)_12 média = 0
M1_s3 <- Arima(serie03, order=c(2,0,1),
               seasonal = list(order = c(1,0,0), period = 12),
               include.mean = FALSE)
autoplot(M1_s3) # Raízes inversas caem dentro do círculo unitário
```



```
coeftest(M1_s3) # Coeficientes são estatisticamente significantes
```

```
##
## z test of coefficients:
##
##      Estimate Std. Error z value Pr(>|z|)
## ar1   0.551389   0.056190   9.8130 < 2.2e-16 ***
## ar2  -0.355327   0.055328  -6.4222 1.343e-10 ***
## ma1   0.852654   0.038158  22.3451 < 2.2e-16 ***
## sar1 -0.145524   0.052739  -2.7593 0.005792 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
tsdisplay(residuals(M1_s3)) # Resíduo é Ruído Branco
```



**Equação modelo SARMA(2,1)x(1,0)<sub>12</sub>**

$$y_t = \phi_1 y_{t-1} + \phi_2 y_{t-2} + \theta_1 \epsilon_{t-1} + \phi_1^{12} y_{t-12} + \epsilon_t$$

**Encontrando equações de previsão para l = 1, 2 e 3**

$$y_T(1) = \phi_1 y_T + \phi_2 y_{T-1} + \phi_1^{12} y_T + \theta_1 \epsilon_T$$

$$y_T(2) = \phi_1 y_{T(1)} + \phi_2 y_T + \phi_1^{12} y_{T(1)}$$

$$y_T(3) = \phi_1 y_{T(2)} + \phi_2 y_{T(1)} + \phi_1^{12} y_{T(2)}$$

**Substituindo valores estimados dos coeficientes**

$$y_T(1) = 0,05514 y_T - 0,3553 y_{T-1} - 0,1455 y_T + 0,8526 \epsilon_T$$

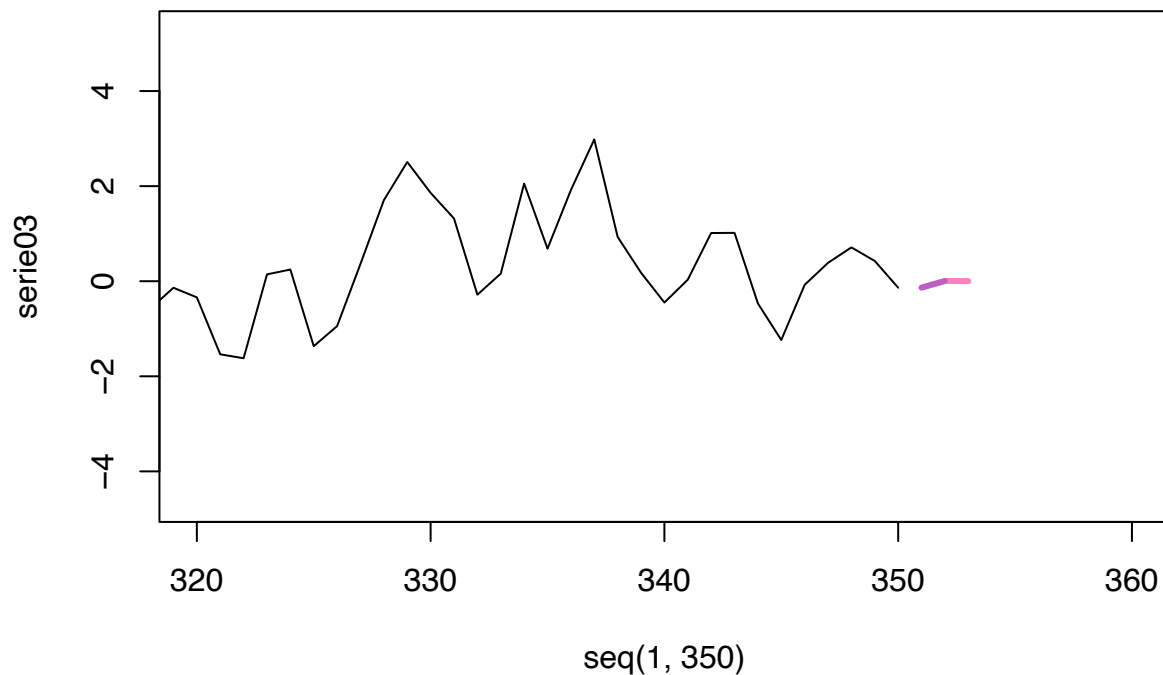
$$y_T(2) = 0,05514 y_{T(1)} - 0,3553 y_T - 0,1455 y_{T(1)}$$

$$y_T(3) = 0,05514 y_{T(2)} - 0,3553 y_{T(1)} - 0,1455 y_{T(2)}$$

```
forecast(M1_s3, h = 3)
```

```
##      Point Forecast      Lo 80      Hi 80      Lo 95      Hi 95
## 351   -0.135017861 -1.385707  1.115671 -2.047782  1.777746
## 352    0.005535478 -2.150348  2.161419 -3.291604  3.302675
## 353    0.001007625 -2.217607  2.219622 -3.392071  3.394086
```

```
plot(seq(1, 350), serie03, type = "l", xlim = c(320, 360))
lines(forecast(M1_s3, h = 1)$mean, lwd = 3, col = rgb(0.5,0,0, alpha = 0.5))
lines(forecast(M1_s3, h = 2)$mean, lwd = 3, col = rgb(0,0.5,1, alpha = 0.5))
lines(forecast(M1_s3, h = 3)$mean, lwd = 3, col = rgb(1,0,0.5, alpha = 0.5))
```

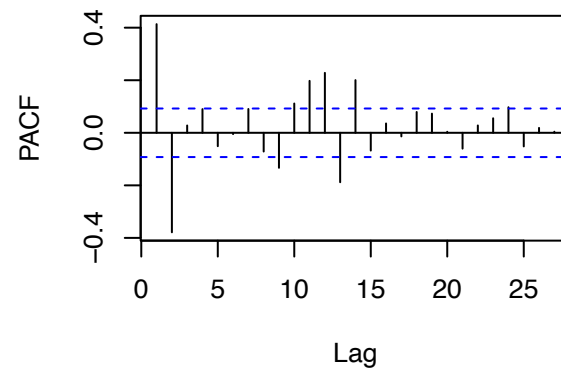
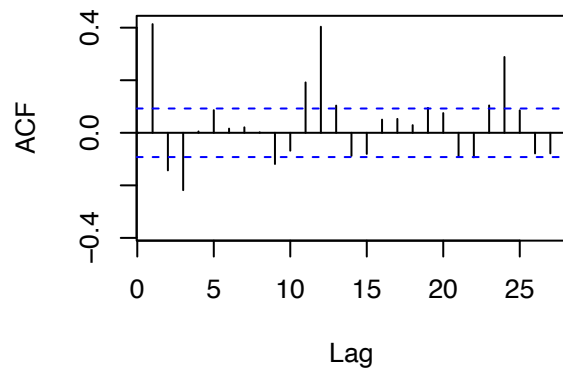
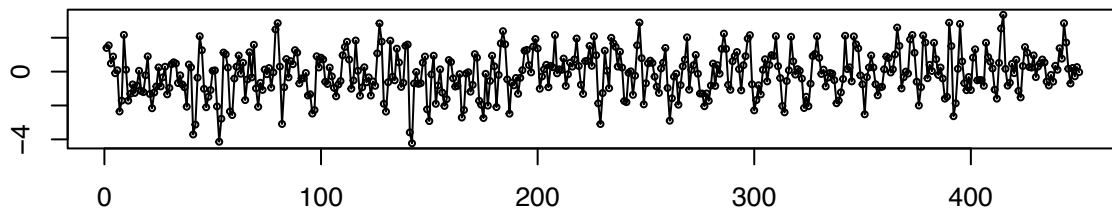


## Série\_04

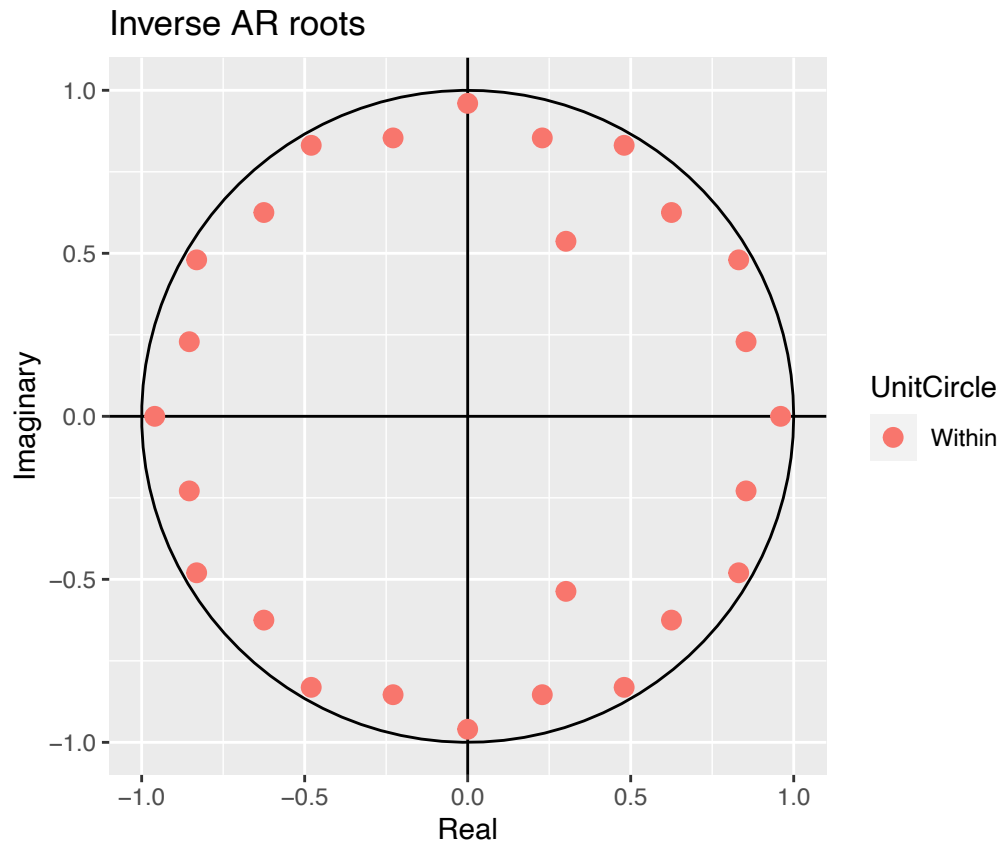
Modelo SARMA(2,0)x(2,0)<sub>12</sub>

```
serie04 <- scan("./Dados/Series/serie4.csv")
tsdisplay(serie04)
```

**serie04**



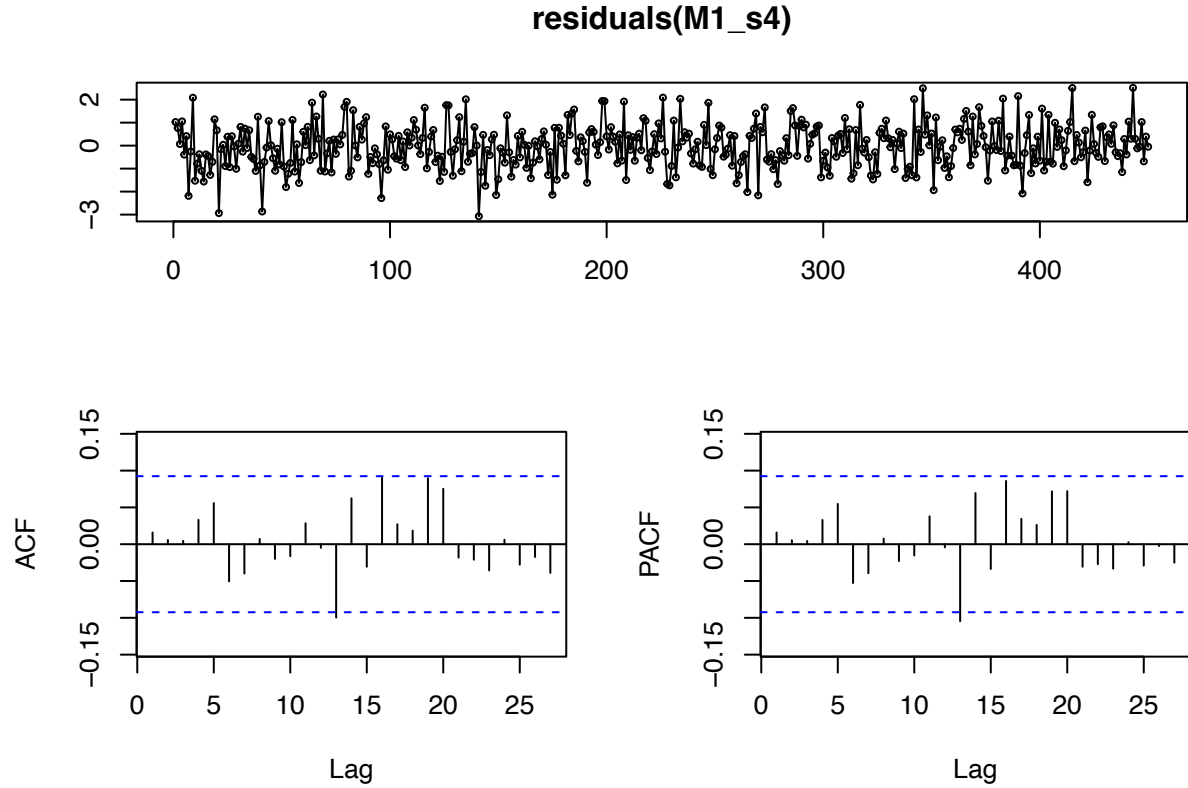
```
# Modelo SARMA(2,0)x(2,0)_12 média = 0
M1_s4 <- Arima(serie04, order=c(2,0,0),
               seasonal = list(order = c(2,0,0), period = 12),
               include.mean = FALSE)
autoplot(M1_s4) # Raízes inversas caem dentro do círculo unitário
```



```
coeftest(M1_s4) # Coeficientes são estatisticamente significantes
```

```
##
## z test of coefficients:
##
##      Estimate Std. Error z value Pr(>|z|)
## ar1    0.602942   0.043654 13.8120 < 2.2e-16 ***
## ar2   -0.379146   0.043756 -8.6650 < 2.2e-16 ***
## sar1    0.383900   0.047817  8.0286 9.86e-16 ***
## sar2    0.139348   0.048113  2.8963 0.003776 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
tsdisplay(residuals(M1_s4)) # Resíduo é Ruído Branco (lag 13 julgo ser correlação expúria)
```



**Equação modelo SARMA(2,0)x(2,0)<sub>12</sub>**

$$y_t = \phi_1 y_{t-1} + \phi_2 y_{t-2} + \phi_1^{12} y_{t-12} + \phi_2^{12} y_{t-24} + \epsilon_t$$

**Encontrando equações de previsão para l = 1, 2 e 3**

$$y_T(1) = \phi_1 y_T + \phi_2 y_{T-1} + \phi_1^{12} y_T + \phi_2^{12} y_{T-12}$$

$$y_T(2) = \phi_1 y_{T(1)} + \phi_2 y_T + \phi_1^{12} y_{T(1)} + \phi_2^{12} y_T$$

$$y_T(3) = \phi_1 y_{T(2)} + \phi_2 y_{T(1)} + \phi_1^{12} y_{T(2)} + \phi_2^{12} y_{T(1)}$$

**Substituindo valores estimados dos coeficientes**

$$y_T(1) = 0,6029 y_T - 0,3791 y_{T-1} + 0,3839 y_T + 0,1393 y_{T-12}$$

$$y_T(2) = 0,6029 y_{T(1)} - 0,3791 y_T + 0,3839 y_{T(1)} + 0,1393 y_T$$

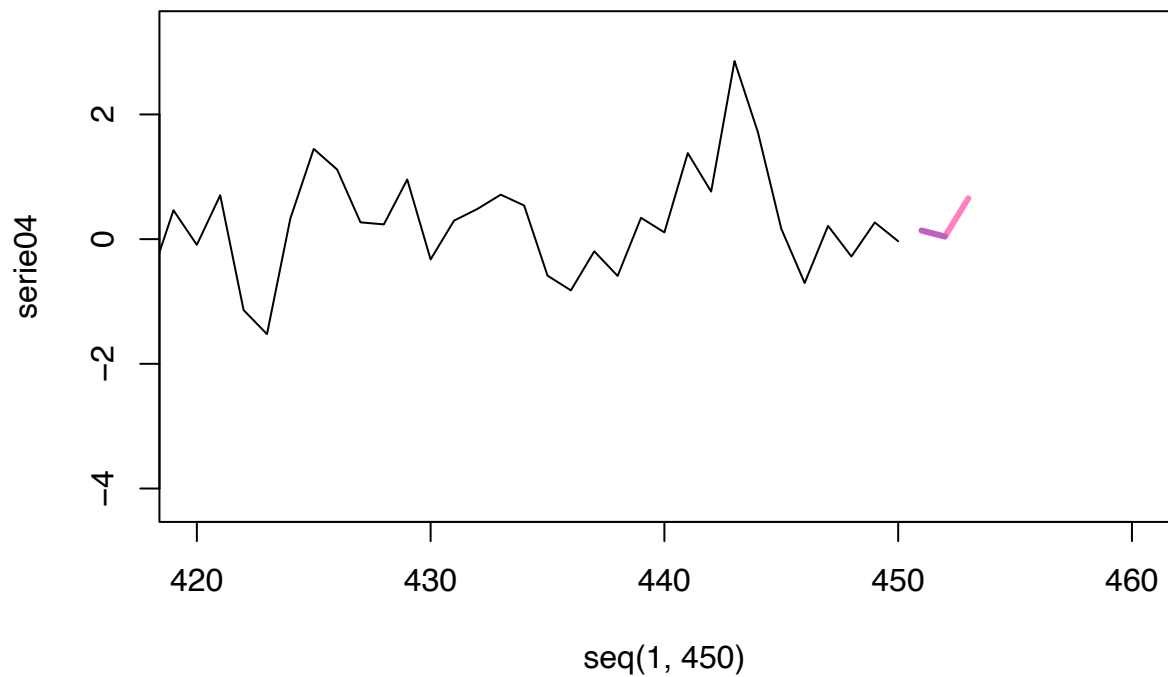
$$y_T(3) = 0,6029 y_{T(2)} - 0,3791 y_{T(1)} + 0,3829 y_{T(2)} + 0,1393 y_{T(1)}$$



```
forecast(M1_s4, h = 3)
```

##	Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
## 451	0.13797462	-1.1003338	1.376283	-1.755855	2.031804
## 452	0.04148724	-1.4044939	1.487468	-2.169950	2.252925
## 453	0.65493798	-0.7911723	2.101048	-1.556697	2.866573

```
plot(seq(1, 450), serie04, type = "l", xlim = c(420, 460))  
lines(forecast(M1_s4, h = 1)$mean, lwd = 3, col = rgb(0.5,0,0, alpha = 0.5))  
lines(forecast(M1_s4, h = 2)$mean, lwd = 3, col = rgb(0,0.5,1, alpha = 0.5))  
lines(forecast(M1_s4, h = 3)$mean, lwd = 3, col = rgb(1,0,0.5, alpha = 0.5))
```

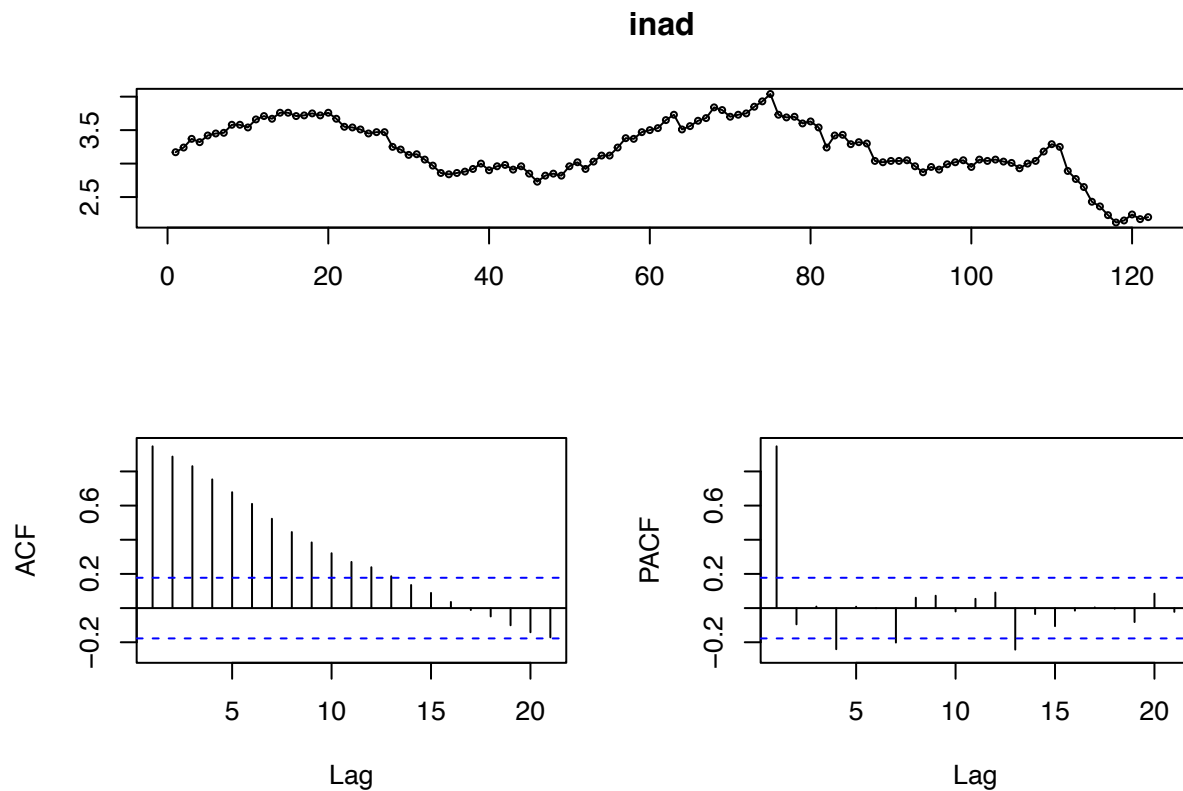


2. Para as séries Inadimplência no Crédito e Câmbio Contratado, realize os seguintes procedimentos:

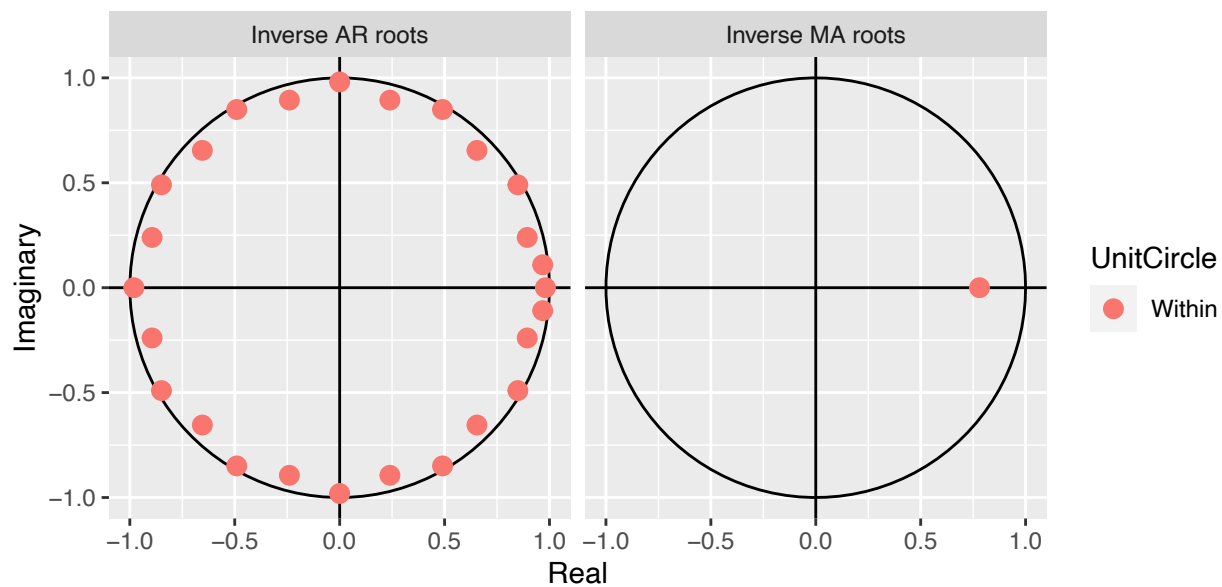
a. Modele as duas séries seguindo os procedimentos utilizados no item (1), desconsiderando as 4 últimas observações de cada série. Obs: se, por exemplo, a série “Inad” possuir 300 observações você poderá utilizar `Inad[1:296]` na linha de comando de estimação do R.

Série Inadimplência

```
inad <- read_xls("./Dados/Series/Inad_Credito2011.03.xls",  
                 col_names = FALSE)$...1  
inad <- inad[1:(length(inad)-4)]  
tsdisplay(inad)
```



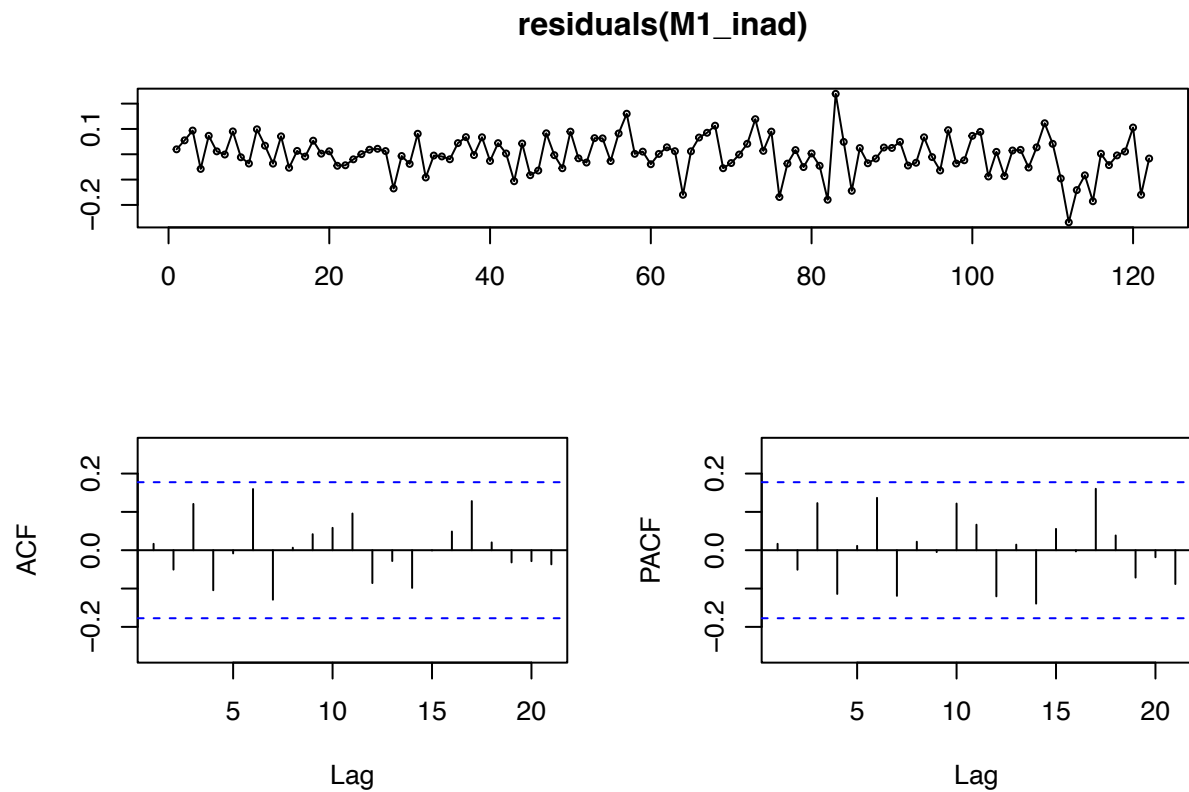
```
# Modelo SARMA(2,1)x(2,0)_12  
M1_inad <- Arima(inad, order=c(2,0,1),  
                 seasonal = list(order = c(2,0,0), period = 12),  
                 include.mean = TRUE)  
autoplot(M1_inad) # Raízes inversas caem dentro do círculo unitário
```



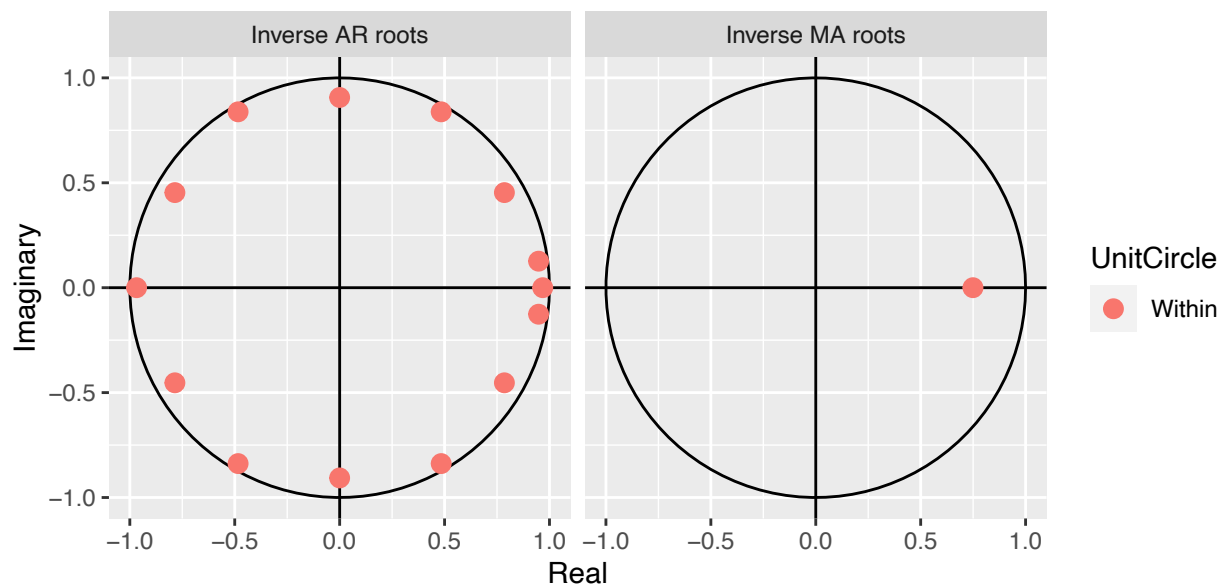
```
coeftest(M1_inad) # Coeficientes são estatisticamente significantes
```

```
##
## z test of coefficients:
##
##      Estimate Std. Error  z value  Pr(>|z|)
## ar1      1.935534   0.041399  46.7536 < 2.2e-16 ***
## ar2     -0.948508   0.040426 -23.4630 < 2.2e-16 ***
## ma1     -0.780296   0.082462  -9.4625 < 2.2e-16 ***
## sar1      0.395934   0.093623   4.2290 2.347e-05 ***
## sar2      0.312397   0.096226   3.2465 0.001168 **
## intercept 3.024662   0.313763   9.6400 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
tsdisplay(residuals(M1_inad)) # Resíduo é Ruído Branco
```



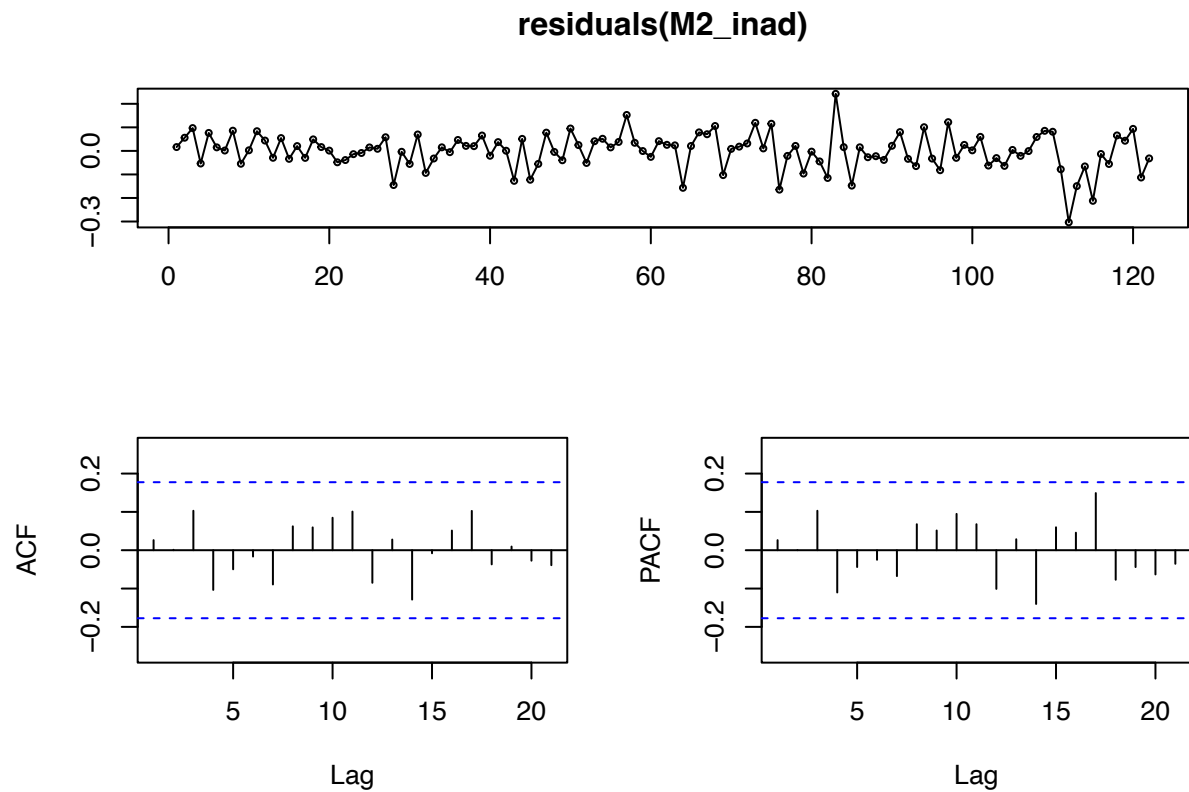
```
# Modelo SARMA(2,1)x(2,0)_06
M2_inad <- Arima(inad, order=c(2,0,1),
                 seasonal = list(order = c(2,0,0), period = 6),
                 include.mean = TRUE)
autoplots(M2_inad) # Raízes inversas caem dentro do círculo unitário
```



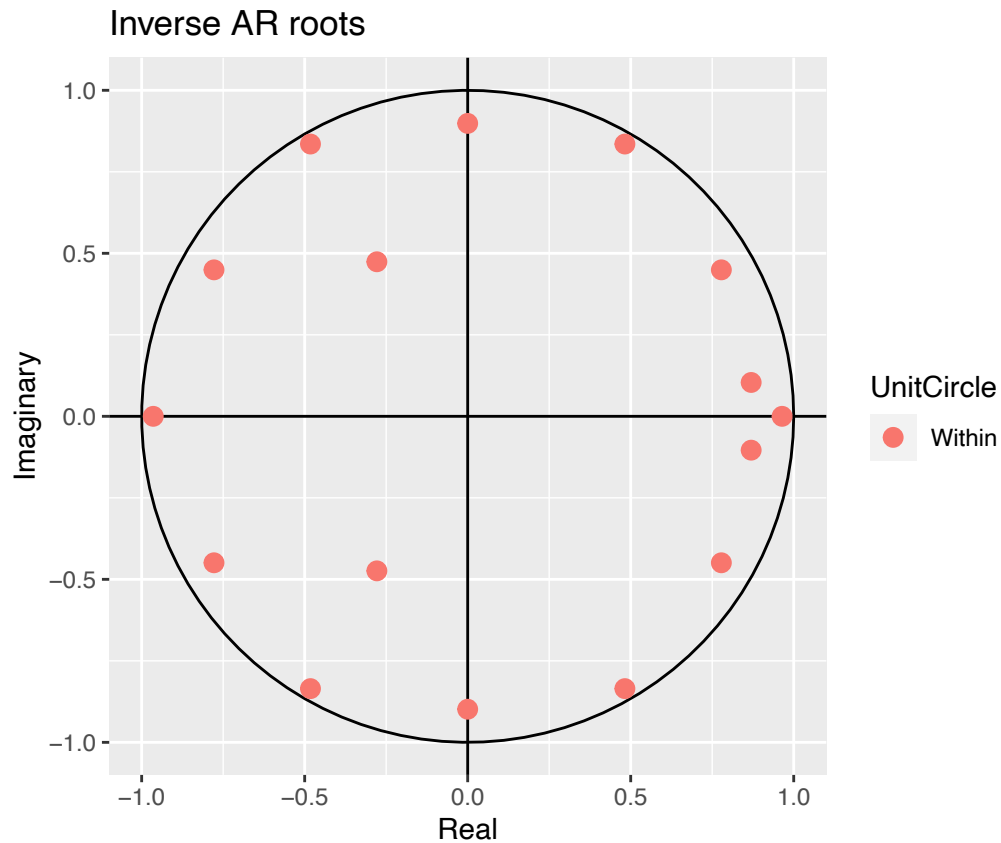
```
coeftest(M2_inad) # Coeficientes são estatisticamente significantes
```

```
##
## z test of coefficients:
##
##      Estimate Std. Error  z value  Pr(>|z|)
## ar1      1.896129   0.077123  24.5859 < 2.2e-16 ***
## ar2     -0.914790   0.073475 -12.4503 < 2.2e-16 ***
## ma1     -0.749194   0.134562  -5.5676 2.582e-08 ***
## sar1      0.266659   0.085422   3.1217 0.001798 **
## sar2      0.456387   0.090772   5.0278 4.960e-07 ***
## intercept 3.052967   0.289588  10.5424 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
tsdisplay(residuals(M2_inad)) # Resíduo é Ruído Branco
```



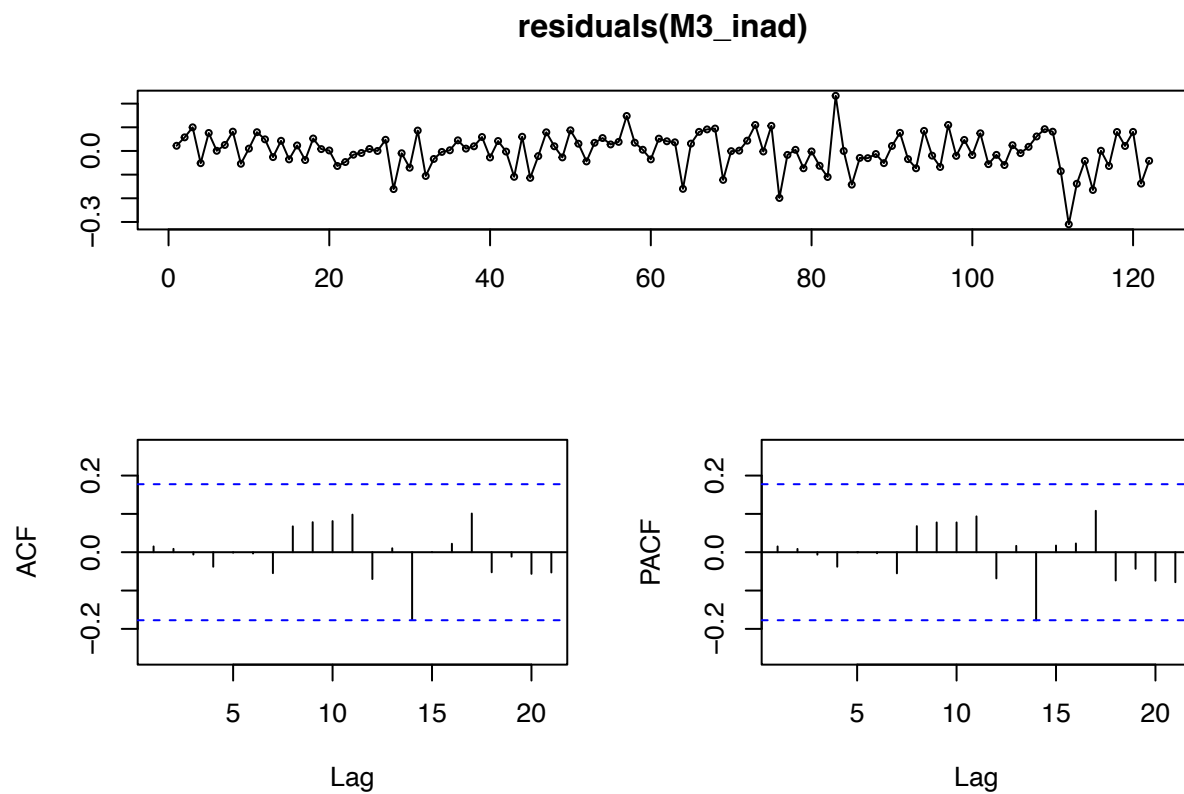
```
# Modelo SARMA(4,0)x(2,0)_06
M3_inad <- Arima(inad, order=c(4,0,0),
                 seasonal = list(order = c(2,0,0), period = 6),
                 include.mean = TRUE)
autoplot(M3_inad) # Raízes inversas caem dentro do círculo unitário
```



```
coeftest(M3_inad) # Coeficientes são estatisticamente significantes
```

```
##
## z test of coefficients:
##
##      Estimate Std. Error z value Pr(>|z|)
## ar1      1.182085  0.088336 13.3817 < 2.2e-16 ***
## ar2     -0.100469  0.141917 -0.7079  0.478982
## ar3      0.098496  0.145913  0.6750  0.499655
## ar4     -0.231805  0.093949 -2.4674  0.013611 *
## sar1      0.278553  0.087779  3.1733  0.001507 **
## sar2      0.423201  0.092428  4.5787 4.678e-06 ***
## intercept 2.987847  0.376460  7.9367 2.077e-15 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
tsdisplay(residuals(M3_inad)) # Resíduo é Ruído Branco
```

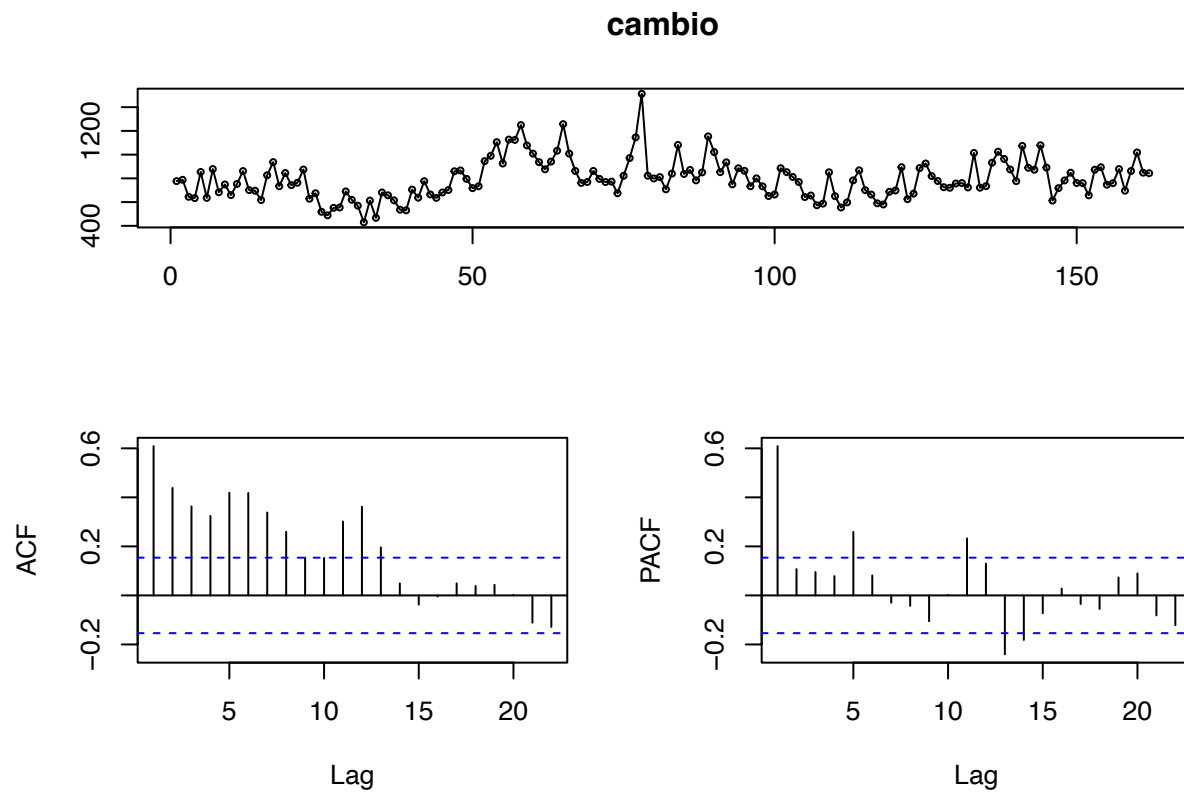


## Série Câmbio Contratado

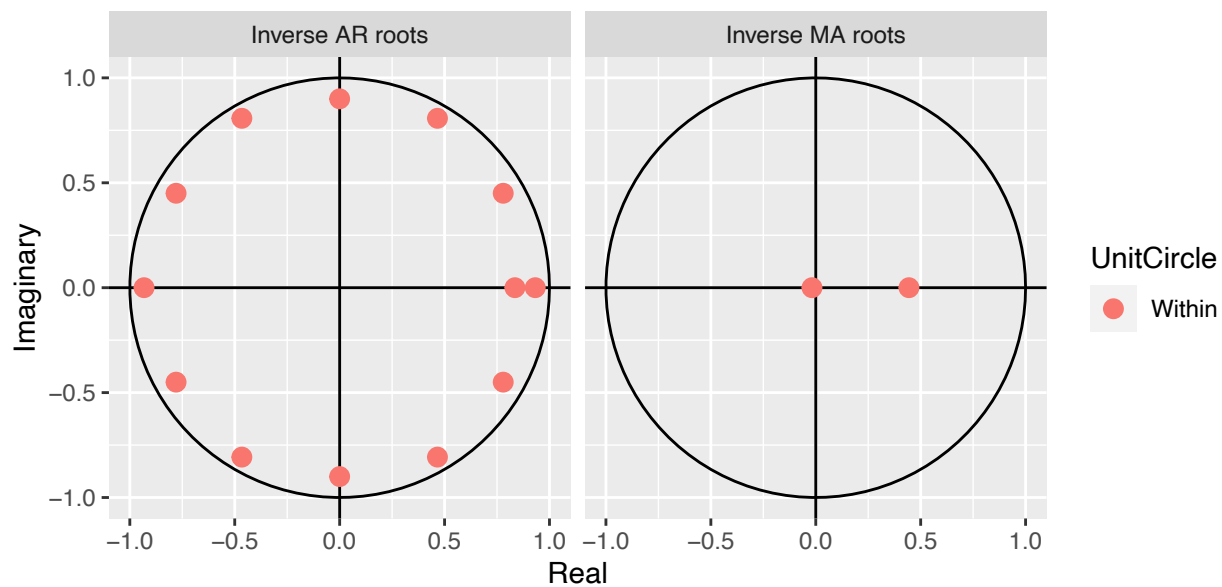
```
cambio <- scan("./Dados/Series/Cambio_Contratado_2005.01.csv")
cambio <- cambio[1:(length(cambio)-4)]

tsdisplay(cambio)
```





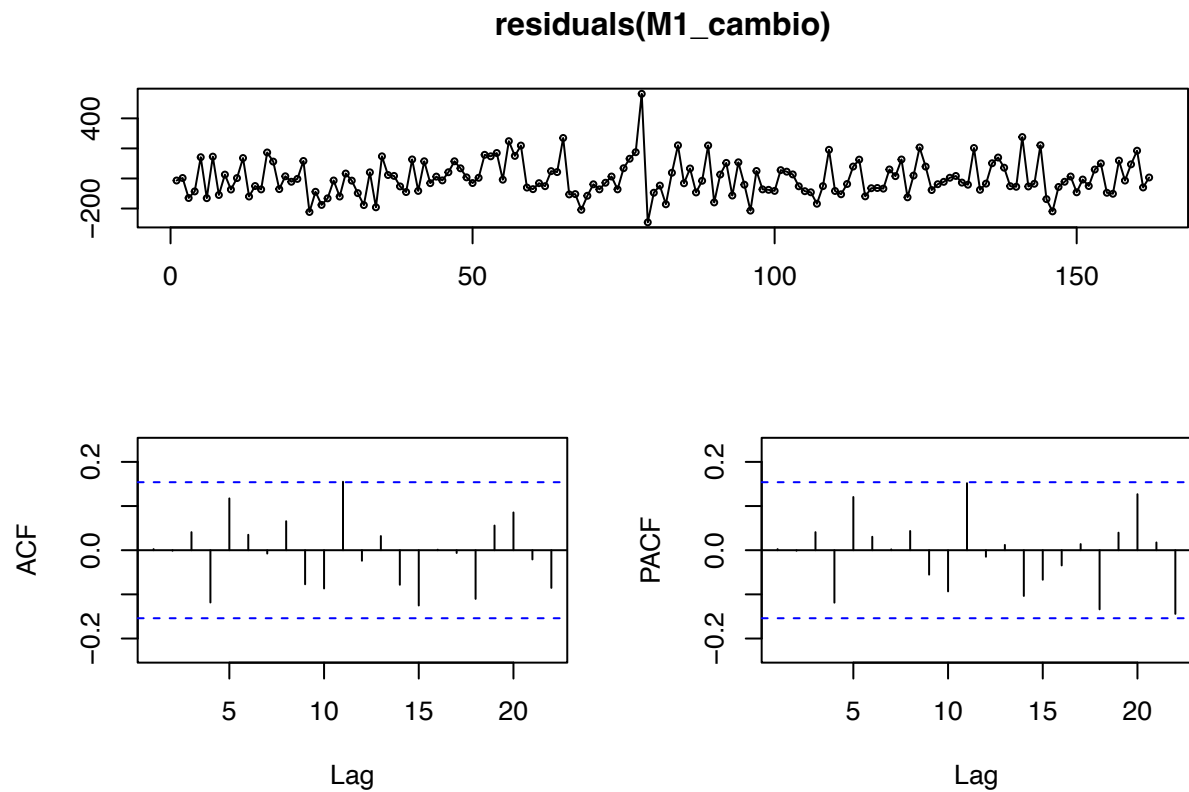
```
# Modelo SARMA(1,2)x(2,0)_06
M1_cambio <- Arima(cambio, order = c(1,0,2),
                    seasonal = list(order = c(2,0,0), period = 6),
                    include.mean = TRUE)
autoplot(M1_cambio) # Raízes inversas caem dentro do círculo unitário
```



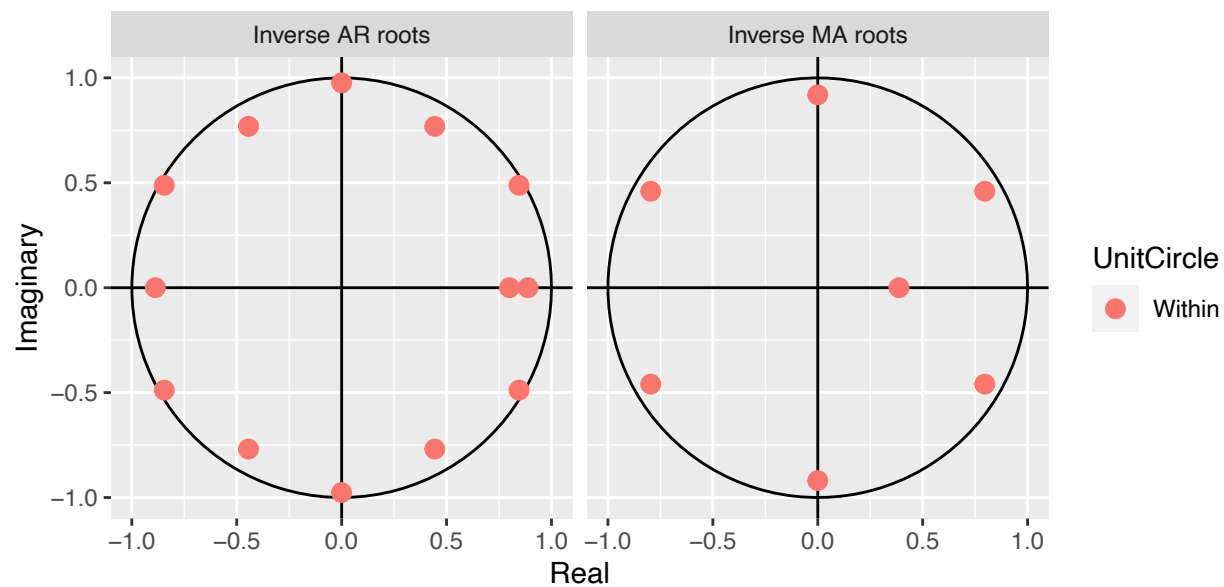
```
coeftest(M1_cambio) # Coeficientes são estatisticamente significantes
```

```
##
## z test of coefficients:
##
##           Estimate Std. Error z value Pr(>|z|)
## ar1         0.8352905  0.0827614 10.0928 < 2.2e-16 ***
## ma1        -0.4261543  0.1129231 -3.7738 0.0001608 ***
## ma2        -0.0079605  0.1036559 -0.0768 0.9387851
## sar1         0.1244974  0.0763155  1.6314 0.1028160
## sar2         0.3490941  0.0778668  4.4832 7.353e-06 ***
## intercept 796.4636273 56.1743810 14.1784 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
tsdisplay(residuals(M1_cambio)) # Resíduo é Ruído Branco
```



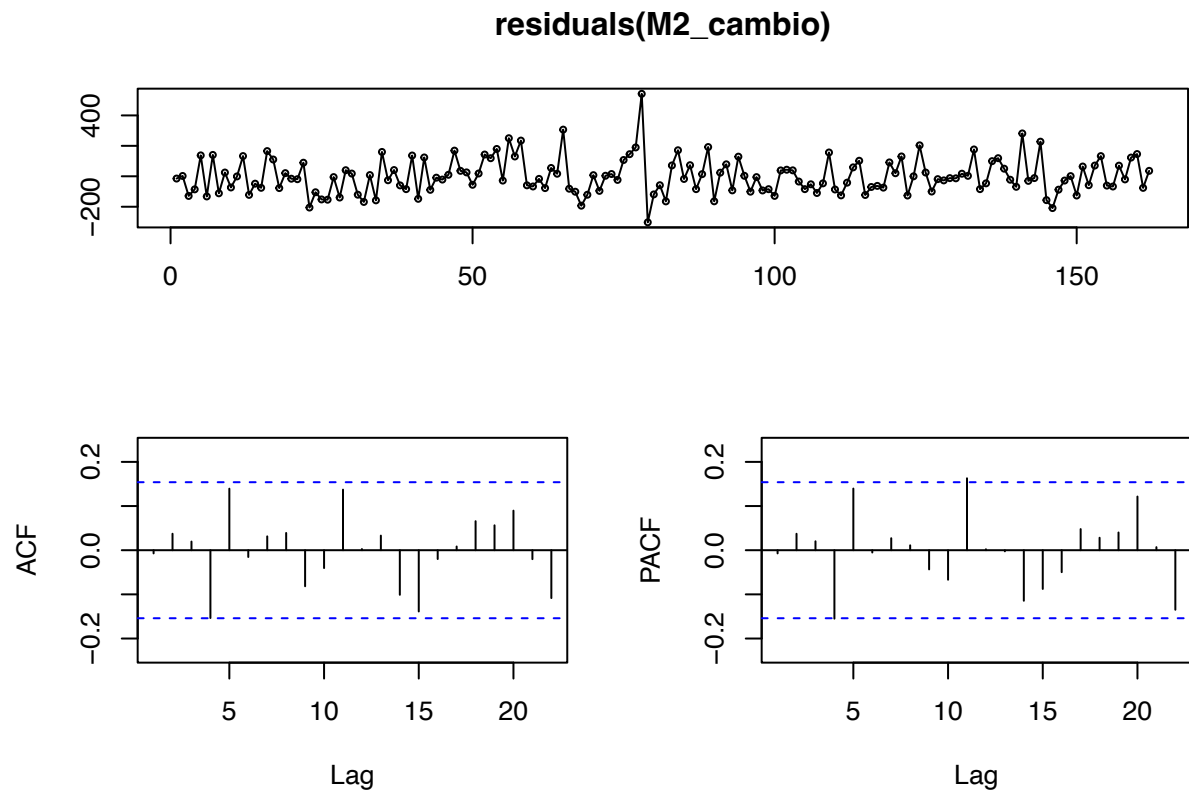
```
# Modelo SARMA(1,1)x(2,1)_06
M2_cambio <- Arima(cambio, order = c(1,0,1),
                    seasonal = list(order = c(2,0,1), period = 6),
                    include.mean = TRUE)
autoplot(M2_cambio) # Raízes inversas caem dentro do círculo unitário
```



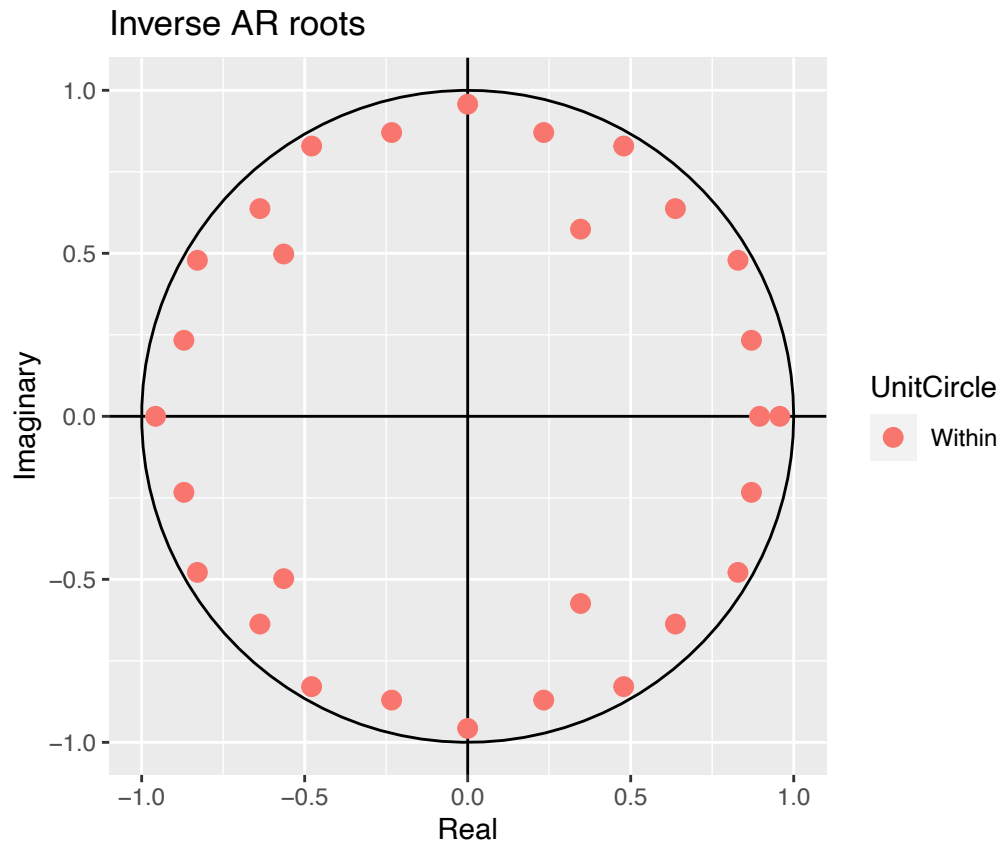
```
coeftest(M2_cambio) # Coeficientes são estatisticamente significantes
```

```
##
## z test of coefficients:
##
##           Estimate Std. Error z value Pr(>|z|)
## ar1         0.799781   0.077174 10.3633 < 2.2e-16 ***
## ma1        -0.387160   0.118460 -3.2683 0.0010820 **
## sar1        -0.375738   0.151711 -2.4767 0.0132617 *
## sar2         0.424126   0.072306  5.8657 4.473e-09 ***
## sma1         0.603185   0.169857  3.5511 0.0003836 ***
## intercept 797.841905  44.914248 17.7637 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
tsdisplay(residuals(M2_cambio)) # Resíduo é Ruído Branco
```



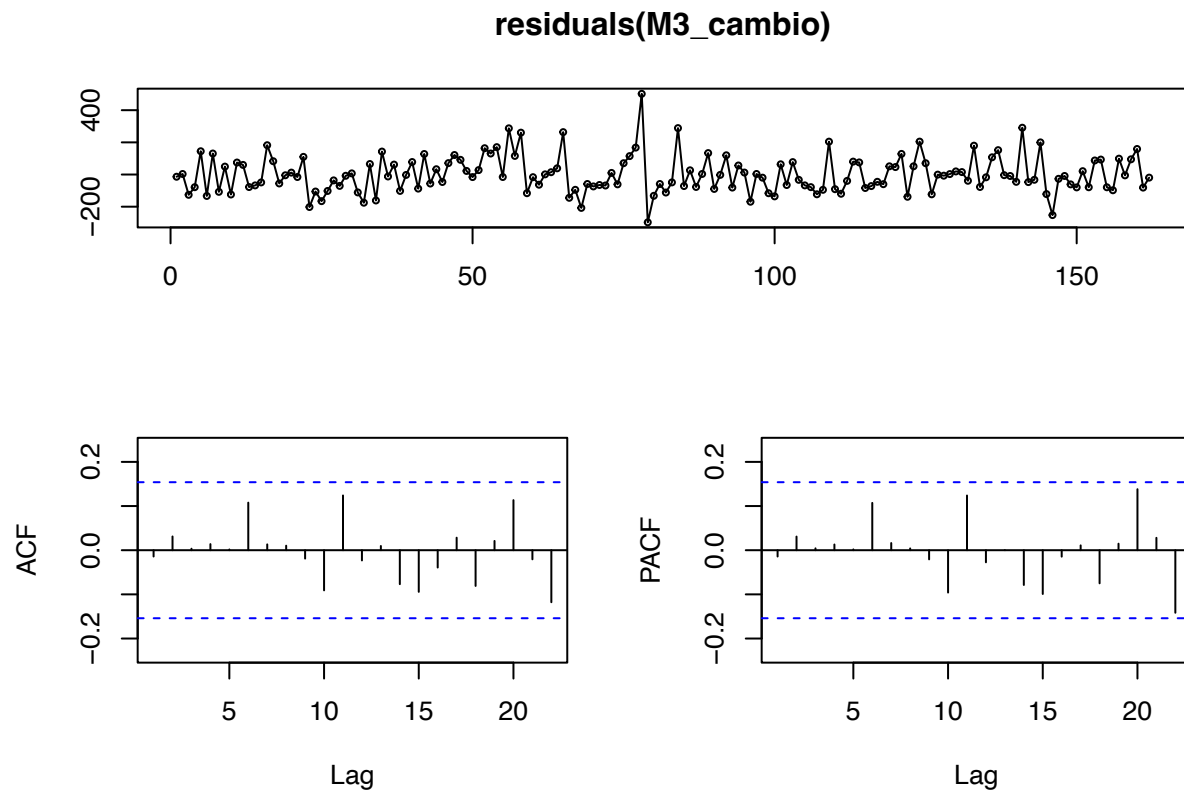
```
# Modelo SARMA(5,0)x(2,0)_12
M3_cambio <- Arima(cambio, order = c(5,0,0),
                    seasonal = list(order = c(2,0,0), period = 12),
                    include.mean = TRUE)
autoplot(M3_cambio) # Raízes inversas caem dentro do círculo unitário
```



```
coeftest(M3_cambio) # Coeficientes são estatisticamente significantes
```

```
##
## z test of coefficients:
##
##      Estimate Std. Error z value Pr(>|z|)
## ar1      0.459180   0.076864  5.9739 2.316e-09 ***
## ar2      0.156173   0.086506  1.8053 0.0710216 .
## ar3      0.094642   0.085324  1.1092 0.2673375
## ar4     -0.151535   0.086667 -1.7485 0.0803833 .
## ar5      0.227920   0.077514  2.9404 0.0032780 **
## sar1      0.305798   0.080880  3.7809 0.0001563 ***
## sar2      0.169748   0.083833  2.0248 0.0428835 *
## intercept 798.525841 71.432235 11.1788 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
tsdisplay(residuals(M3_cambio)) # Resíduo é Ruído Branco
```



b. Utilizando os 3 melhores modelos candidatos ao DGP de cada série, calcule as previsões para  $l = 1, 2, 3$  e 4 passos à frente.

Série Inadimplência

```
(P1_inad <- forecast(M1_inad, h = 4)) # Modelo SARMA(2,1)x(2,0)_12
```

##	Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
## 123	2.196938	2.098443	2.295433	2.046304	2.347573
## 124	2.038390	1.887897	2.188883	1.808231	2.268549
## 125	2.051488	1.854690	2.248285	1.750512	2.352464
## 126	2.034084	1.793997	2.274170	1.666903	2.401264

```
(P2_inad <- forecast(M2_inad, h = 4)) # Modelo SARMA(2,1)x(2,0)_06
```

##	Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
## 123	2.184051	2.084589	2.283514	2.031936	2.336166
## 124	2.038039	1.886691	2.189388	1.806572	2.269507
## 125	2.047744	1.851248	2.244241	1.747229	2.348260
## 126	2.080492	1.843069	2.317915	1.717385	2.443599

```
(P3_inad <- forecast(M3_inad, h = 4)) # Modelo SARMA(4,0)x(2,0)_06
```

	Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
## 123	2.201471	2.101907	2.301035	2.049201	2.353741
## 124	2.051355	1.897197	2.205513	1.815591	2.287120
## 125	2.058350	1.857261	2.259439	1.750811	2.365889
## 126	2.092450	1.841210	2.343689	1.708212	2.476687

## Série Câmbio Contratado

```
(P1_cambio <- forecast(M1_cambio, h = 4)) # Modelo SARMA(1,2)x(2,0)_06
```

	Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
## 163	844.8848	690.2665	999.5031	608.4165	1081.353
## 164	777.8655	610.8067	944.9243	522.3711	1033.360
## 165	866.8151	691.9660	1041.6642	599.4065	1134.224
## 166	887.7021	707.6172	1067.7871	612.2860	1163.118

```
(P2_cambio <- forecast(M2_cambio, h = 4)) # Modelo SARMA(1,1)x(2,1)_06
```

	Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
## 163	832.7577	680.5975	984.9180	600.0487	1065.467
## 164	812.7758	648.1712	977.3803	561.0349	1064.517
## 165	913.6567	741.5634	1085.7499	650.4628	1176.851
## 166	901.4072	724.6901	1078.1243	631.1418	1171.673

```
(P3_cambio <- forecast(M3_cambio, h = 4)) # Modelo SARMA(5,0)x(2,0)_12
```

	Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
## 163	808.6744	657.6436	959.7051	577.6928	1039.656
## 164	751.6787	585.4868	917.8706	497.5101	1005.847
## 165	918.7409	743.5485	1093.9333	650.8072	1186.675
## 166	862.0333	679.6862	1044.3804	583.1574	1140.909

c. Crie um gráfico utilizando o R para comparar os valores das previsões de cada modelo com os valores reais observados de cada série.

## Série Inadimplência

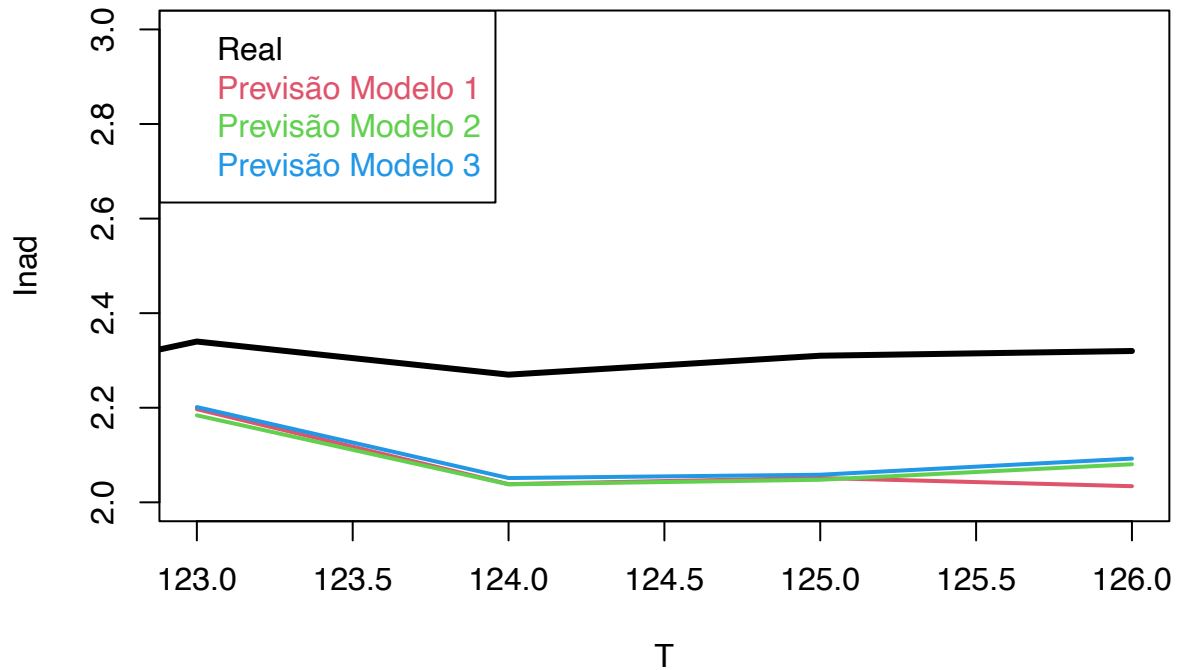
```
inad_reais <- read_xls("./Dados/Series/Inad_Credito2011.03.xls",
                      col_names = FALSE)$...1
plot(seq(1:126),inad_reais, type = "l", xlim = c(123, 126), ylim = c(2,3),
     lwd = 3, col = 1, xlab = "T", ylab = "Inad")
lines(P1_inad$mean, lwd = 2, col = 2)
```



```

lines(P2_inad$mean, lwd = 2, col = 3)
lines(P3_inad$mean, lwd = 2, col = 4)
legend("topleft", legend =
      c("Real", "Previsão Modelo 1", "Previsão Modelo 2", "Previsão Modelo 3"),
      text.col = c(1, 2, 3, 4))

```

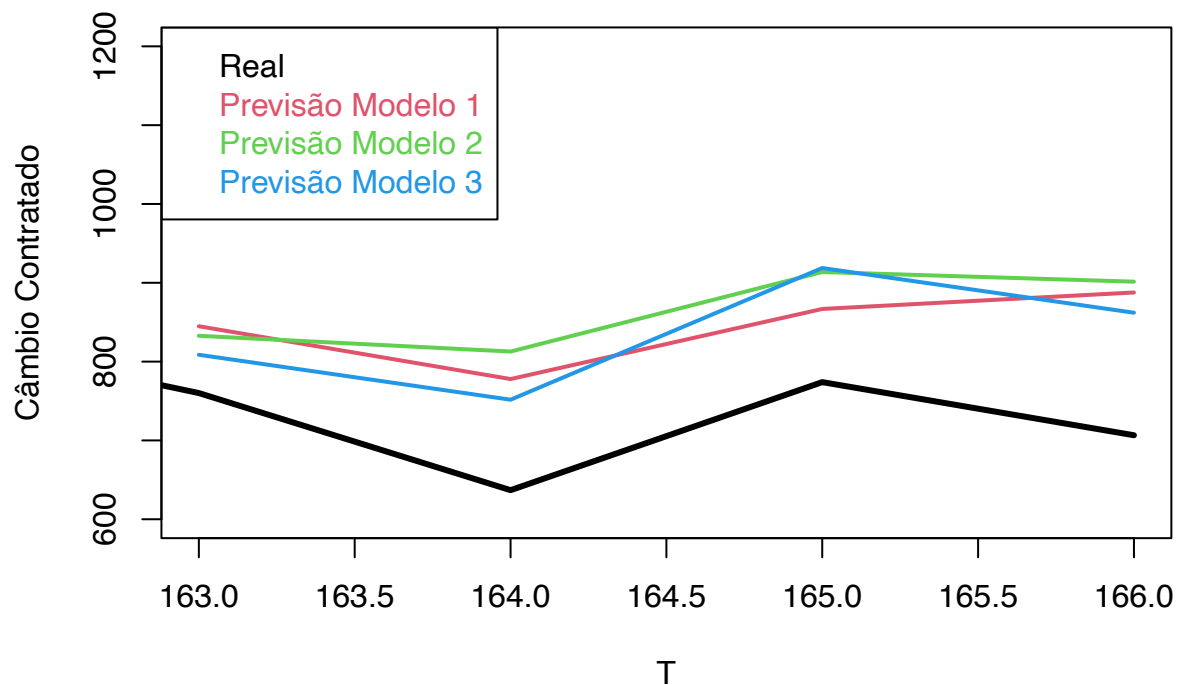


## Série Câmbio Contratado

```

cambio_reais <- scan("./Dados/Series/Cambio_Contratado_2005.01.csv")
plot(seq(1:166), cambio_reais, type = "l", xlim = c(163, 166), ylim = c(600, 1200),
     lwd = 3, col = 1, xlab = "T", ylab = "Câmbio Contratado")
lines(P1_cambio$mean, lwd = 2, col = 2)
lines(P2_cambio$mean, lwd = 2, col = 3)
lines(P3_cambio$mean, lwd = 2, col = 4)
legend("topleft", legend =
      c("Real", "Previsão Modelo 1", "Previsão Modelo 2", "Previsão Modelo 3"),
      text.col = c(1, 2, 3, 4))

```



d. Utilizando a estatística Erro Quadrático Médio (EQM) indique qual foi o melhor modelo para prever os valores das séries. Verifique se o melhor modelo previsor é o mesmo modelo que seria escolhido na Etapa III da Escolha do algoritmo de modelagem baseado nas estatísticas AIC e BIC e no critério da parcimônia. Comente os resultados.

Série Inadimplência

```
cat("SARMA(2,1)x(2,0)_12: AIC",M1_inad$aic, "| BIC",M1_inad$bic,"\n")
```

```
## SARMA(2,1)x(2,0)_12: AIC -260.8079 | BIC -241.1797
```

```
cat("SARMA(2,1)x(2,0)_06: AIC",M2_inad$aic, "| BIC",M2_inad$bic,"\n")
```

```
## SARMA(2,1)x(2,0)_06: AIC -261.4592 | BIC -241.8311
```

```
cat("SARMA(4,0)x(2,0)_06: AIC",M3_inad$aic, "| BIC",M3_inad$bic,"\n")
```

```
## SARMA(4,0)x(2,0)_06: AIC -260.554 | BIC -238.1219
```

## Série Câmbio Contratado

```
cat("SARMA(1,2)x(2,0)_06: AIC",M1_cambio$aic, "| BIC",M1_cambio$bic,"\n")
```

```
## SARMA(1,2)x(2,0)_06: AIC 2022.975 | BIC 2044.588
```

```
cat("SARMA(1,1)x(2,1)_06: AIC",M2_cambio$aic, "| BIC",M2_cambio$bic,"\n")
```

```
## SARMA(1,1)x(2,1)_06: AIC 2018.592 | BIC 2040.205
```

```
cat("SARMA(5,0)x(2,0)_12: AIC",M3_cambio$aic, "| BIC",M3_cambio$bic,"\n")
```

```
## SARMA(5,0)x(2,0)_12: AIC 2018.345 | BIC 2046.133
```