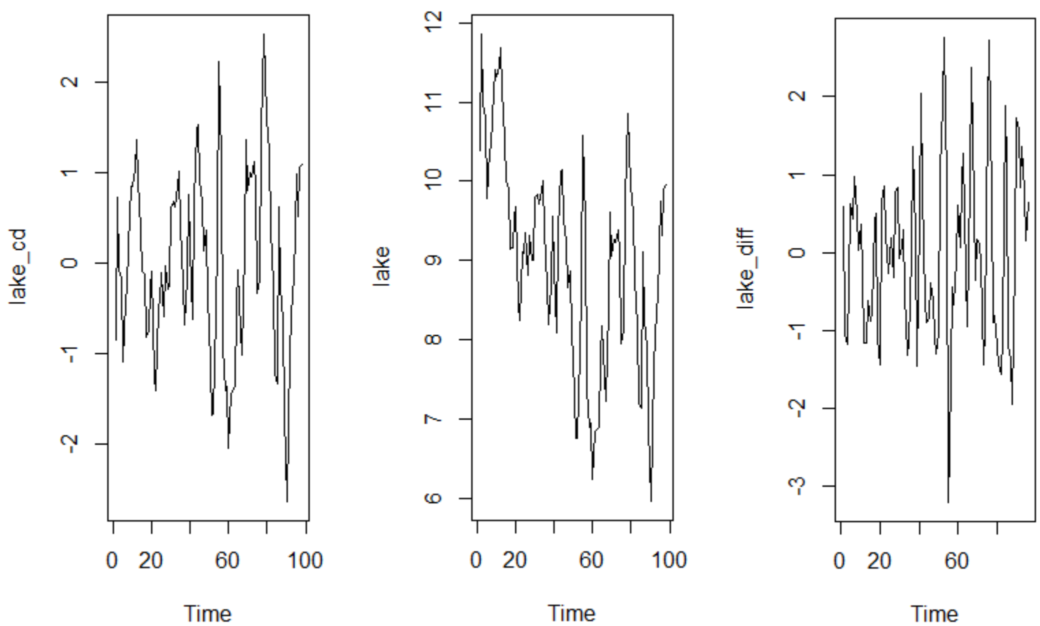
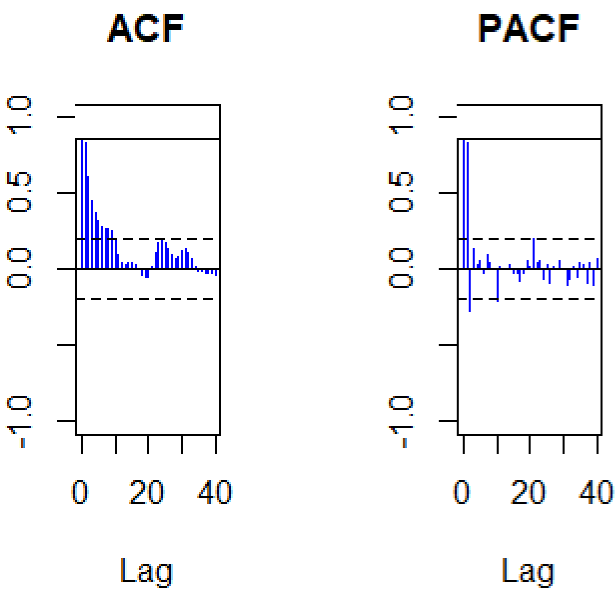
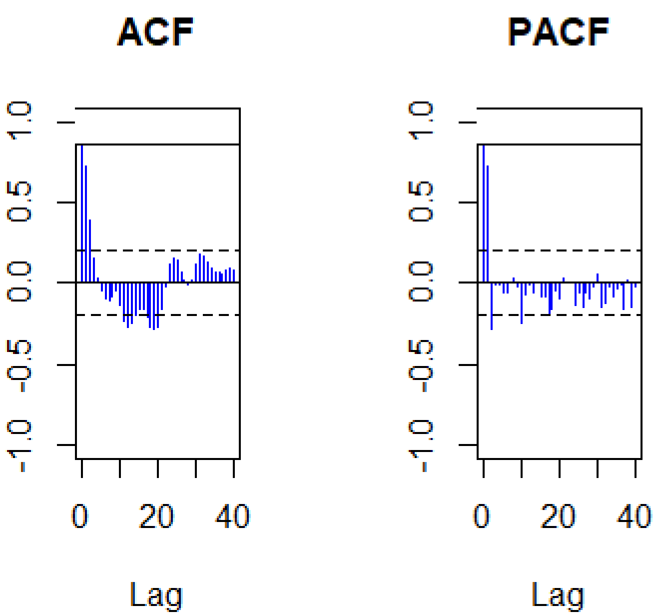
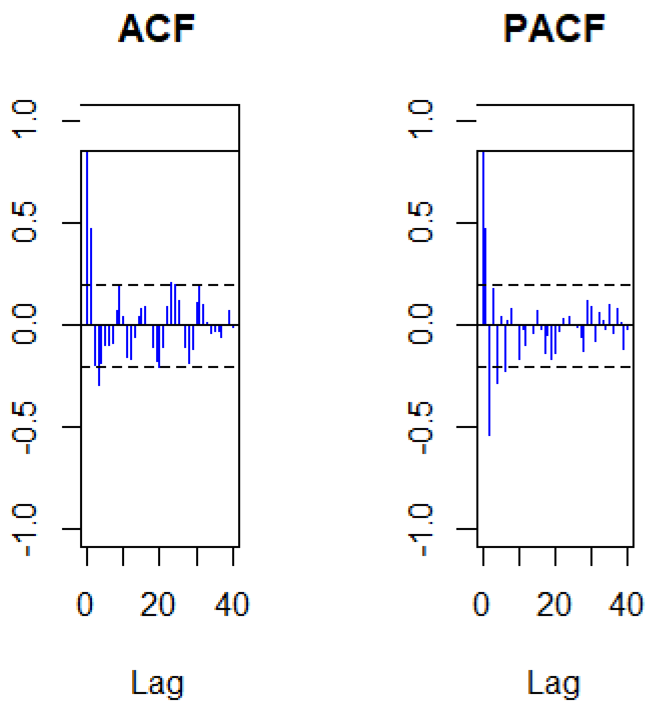
#Plot the original time series and the transformed time series (obtained by methods (a) and (b) above).



#Plot the autocorrelations (ACF) and the partial autocorrelations (PACF) of the transformed time series (obtained by methods (a) and (b) above).


ACF
PACF
1.0
0.5
0.0
-1.0
0
20
40
Lag


ACF
PACF
1.0
0.5
0.0
-0.5
-1.0
0
20
40
Lag



ACF
PACF
1.0
0.5
0.0
-0.5
-1.0
0
20
40
Lag

```
$phi
[1]  1.0726245 -0.3634421  0.1127770

$theta
[1] 0

$sigma2
[1] 0.4727809

$aicc
[1] 214.5074

$se.phi
[1] 0.09902332 0.14141246 0.09902332

$se.theta
[1] 0


$phi
[1]  0.9497421 -0.3044418

$theta
[1] 0

$sigma2
[1] 0.4339304

$aicc
[1] 203.4997

$se.phi
[1] 0.09521511 0.09521511

$se.theta
[1] 0


$phi
[1]  0.8540729 -0.7024455  0.2064804

$theta
[1] 0

$sigma2
[1] 0.6429137

$aicc
[1] 239.5773

$se.phi
[1] 0.09876044 0.11031833 0.09876044

$se.theta
```

```
$se.theta
[1] 0


$phi
[1]  1.0538249 -0.2667516

$theta
[1] 0

$sigma2
[1] 0.4790562

$aicc
[1] 213.5709

$se.phi
[1] 0.097355 0.097355

$se.theta
[1] 0


$phi
[1]  0.9206804 -0.2765911

$theta
[1] 0

$sigma2
[1] 0.4347255

$aicc
[1] 203.6227

$se.phi
[1] 0.09707442 0.09707442

$se.theta
[1] 0
```

```
$phi
[1]  0.8297486 -0.6700653  0.1825892

$theta
[1] 0

$sigma2
[1] 0.6439204

$aicc
[1] 239.6562

$se.phi
[1] 0.1003463 0.1120898 0.1003463

$se.theta
[1] 0


$phi
[1] 0.7448993

$theta
[1] 0.3205891

$sigma2
[1] 0.4750447

$aicc
[1] 212.7675

$se.phi
[1] 0.07765066

$se.theta
[1] 0.1135295


$phi
[1]  0.9541393 -0.3074418

$theta
[1] 0

$sigma2
[1] 0.4338805

$aicc
[1] 203.4977

$se.phi
[1] 0.09754420 0.09796247

$se.theta
```

```
$se.theta
[1] 0


$phi
[1]  0.1795393 -0.2273004

$theta
[1] 0.9638015

$sigma2
[1] 0.5312353

$aicc
[1] 223.5719

$se.phi
[1] 0.1040764 0.1033121

$se.theta
[1] 0.04509966


$phi
[1] 0.7448993

$theta
[1] 0.3205891

$sigma2
[1] 0.4750447

$aicc
[1] 212.7675

$se.phi
[1] 0.07765066

$se.theta
[1] 0.1135295


$phi
[1]  0.9541393 -0.3074418

$theta
[1] 0
```

```
$sigma2
[1] 0.4338805

$aicc
[1] 203.4977

$se.phi
[1] 0.09754420 0.09796247

$se.theta
[1] 0
```

```
$phi
[1] 0.6764564

$theta
[1]  0.3189545 -0.9810337 -0.3379075

$sigma2
[1] 0.4763428

$aicc
[1] 218.1815

$se.phi
[1] 0.0955887

$se.theta
[1] 0.12356409 0.06048707 0.11430098

> |
```

Identify the optimal model (e.g. by using the AICC criterion).

We identify the optimal model with the help of AICC, the smaller the AIC value, the better the model fit. Here the optimal model is lacecd_arma and lakecd_burg with AICC 203.4977 .

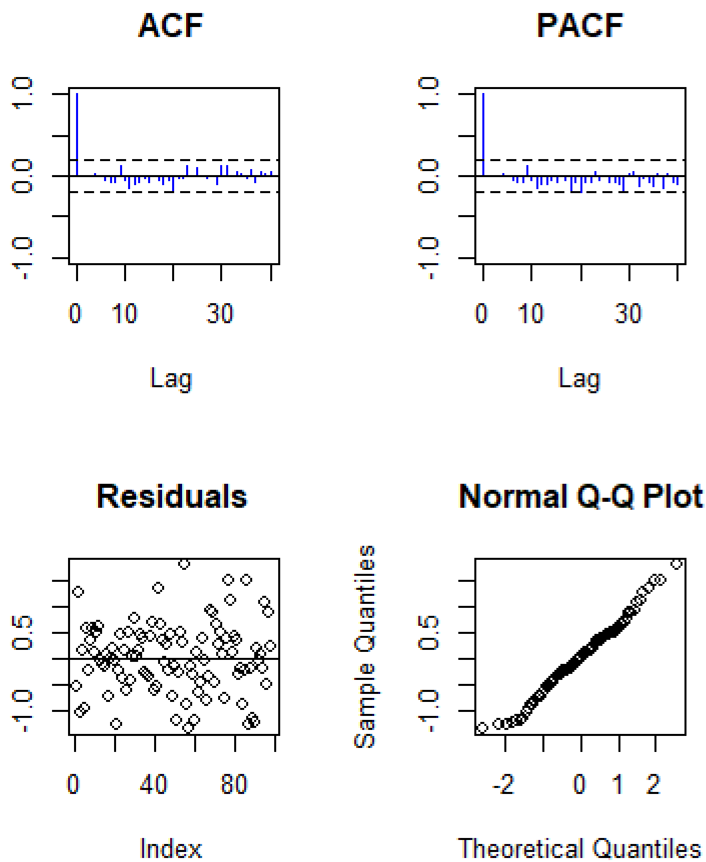
equation :

Xt − ϕXt-1 = Zt + θZt-1 (1)

where {Zt} ∼ WN(0, σ2) and ϕ + θ ≠ 0.

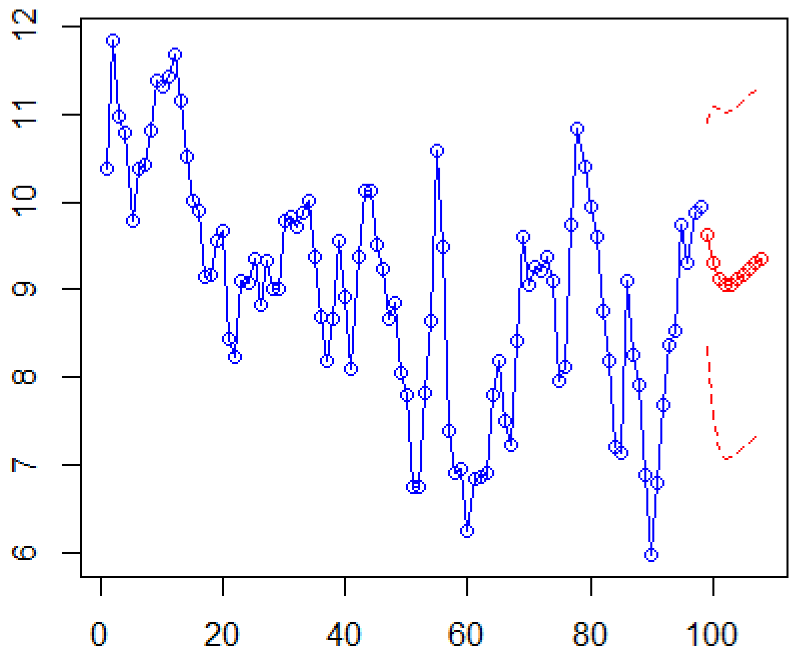
Check for stationarity of the residuals of the optimal model (by using test() in itsmr).

```
Null hypothesis: Residuals are iid noise.
Test                        Distribution Statistic   p-value
Ljung-Box Q                Q ~ chisq(20)     13.17      0.87
McLeod-Li Q                Q ~ chisq(20)     21.09    0.3918
Turning points T     (T-64)/4.1 ~ N(0,1)        67    0.4682
Diff signs S         (S-48.5)/2.9 ~ N(0,1)      47    0.6015
Rank P          (P-2376.5)/162.9 ~ N(0,1)     2349    0.8659
```



Use “forecast()” (in itsmr) to forecast the future 10 values of the time series.

```
> forecast(lake, M, lakecd_arma)
 Step     Prediction     sqrt(MSE)   Lower Bound   Upper Bound
    1        9.62898     0.6586961      8.337959         10.92
    2       9.307392     0.9104271      7.522988       11.0918
    3       9.118572     0.9932819      7.171775      11.06537
    4       9.054008      1.010495      7.073475      11.03454
    5       9.067661      1.011996      7.084185      11.05114
    6       9.118218      1.012006      7.134723      11.10171
    7       9.180419      1.012229      7.196487      11.16435
    8        9.24286      1.012405      7.258582      11.22714
    9       9.302428      1.012471      7.318022      11.28683
   10       9.359658      1.012484      7.375227      11.34409
```



12
11
10
9
8
7
6
0
20
40
60
80
100