

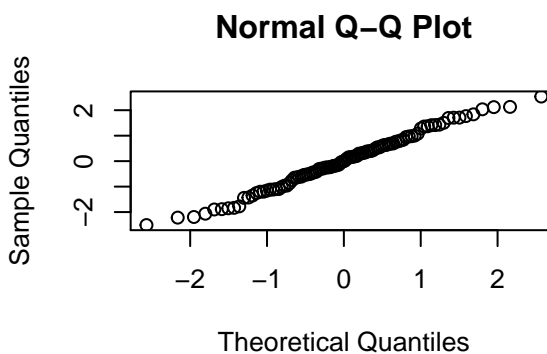
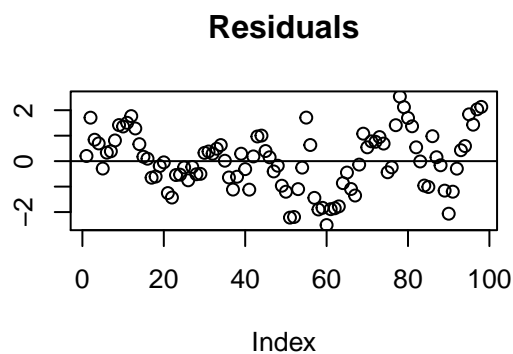
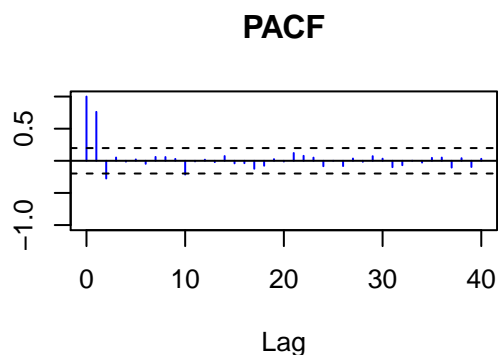
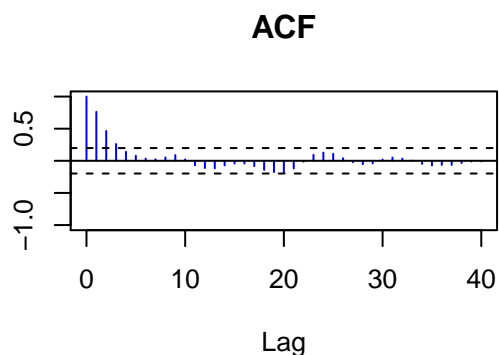
Ch1-Test of randomness

Test of randomness

You can perform formal test to see whether they are IID errors. Here we consider like Huron data after detrending by simple linear regression.

```
library(itsmr)
load("huron.Rdata")
test(out.lm$residuals)
```

```
## Null hypothesis: Residuals are iid noise.
## Test      Distribution Statistic p-value
## Ljung-Box Q      Q ~ chisq(20)    107.83      0 *
## McLeod-Li Q      Q ~ chisq(20)    68.71      0 *
## Turning points T  (T-64)/4.1 ~ N(0,1)    40      0 *
## Diff signs S      (S-48.5)/2.9 ~ N(0,1)    50      0.6015
## Rank P          (P-2376.5)/162.9 ~ N(0,1) 2344      0.8419
```



```
# without using itsmr we can perform Box-pierce
# and Ljung-Box
Box.test(out.lm$residuals, 20)
```

```
##  
## Box-Pierce test  
##  
## data: out.lm$residuals  
## X-squared = 101.44, df = 20, p-value = 6.967e-13
```

```
Box.test(out.lm$residuals, 20, type="Ljung")
```

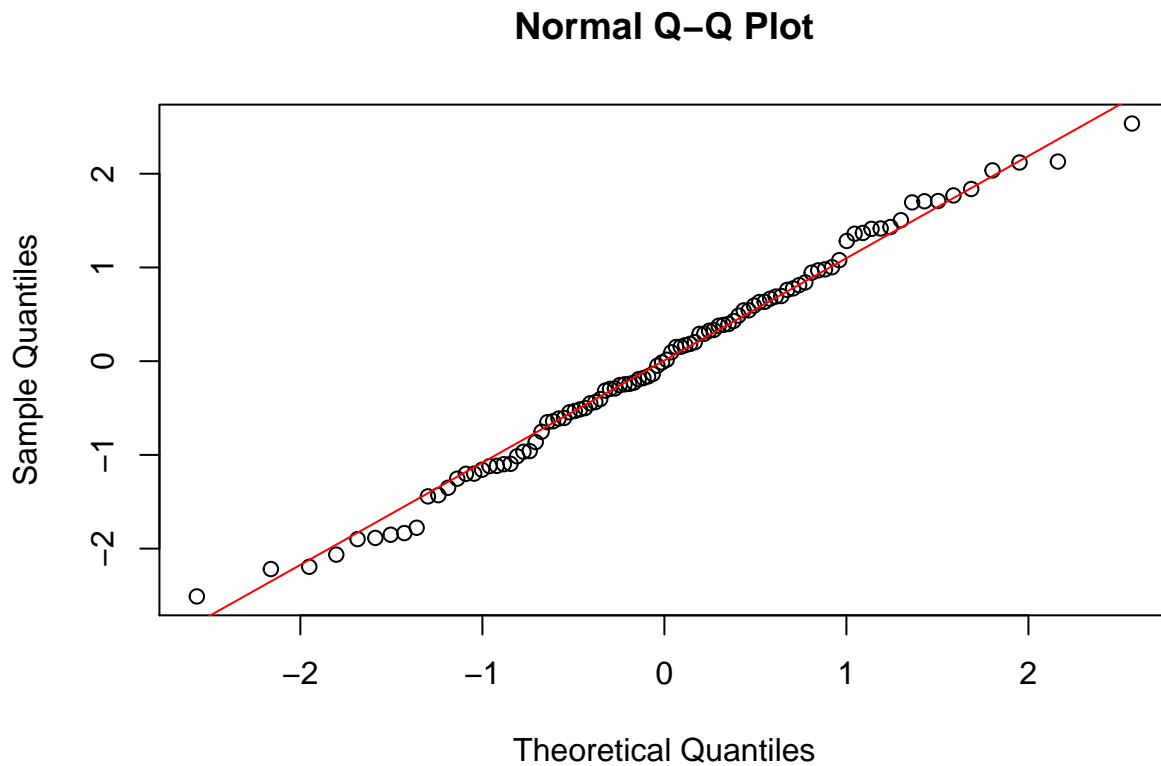
```
##  
## Box-Ljung test  
##  
## data: out.lm$residuals  
## X-squared = 107.83, df = 20, p-value = 4.885e-14
```

What can be said about the test results?

Practice: Do the test of randomness for residuals obtained after detrending by MA(33)

If you further interest in cheking Gaussianity of the residuals, perform the following.

```
qqnorm(out.lm$residuals)
qqline(out.lm$residuals, col="red")
```



```
shapiro.test(out.lm$residuals)
```

```
##
##  Shapiro-Wilk normality test
##
## data:  out.lm$residuals
## W = 0.99042, p-value = 0.711
```

Other normality test can be done from “nortest” package

```
library(nortest)
ad.test(out.lm$residuals)
```

```
##
##  Anderson-Darling normality test
##
## data:  out.lm$residuals
## A = 0.17846, p-value = 0.9165
```

```
cvm.test(out.lm$residuals)
```

```
##  
## Cramer-von Mises normality test  
##  
## data: out.lm$residuals  
## W = 0.020179, p-value = 0.9661
```

```
lillie.test(out.lm$residuals)
```

```
##  
## Lilliefors (Kolmogorov-Smirnov) normality test  
##  
## data: out.lm$residuals  
## D = 0.039819, p-value = 0.9645
```

```
# For Jacque-bera test  
library(tseries)
```

```
##  
## Attaching package: 'tseries'  
  
## The following object is masked from 'package:itsmr':  
##  
## arma
```

```
jarque.bera.test(out.lm$residuals)
```

```
##  
## Jarque Bera Test  
##  
## data: out.lm$residuals  
## X-squared = 1.2738, df = 2, p-value = 0.5289
```

Practice: Do the test of randomness/normality for residuals obtained after apply classical decomposition on Accidental data.