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# AirPassengers
data(AirPassengers)
AP = AirPassengers
AP

class(AP)
start(AP);end(AP);frequency(AP)

x11()
plot(AP, ylab = "Passengers (1000's)")

# mod1
temps = time(AP)
mod1=lm(AP~temps)
summary(mod1)
shapiro.test(residuals(mod1))

par(mfcol=c(3,3))
plot(mod1,which=1)
plot(residuals(mod1),type="l");abline(h=0,col="red")
plot(mod1,which=2)

# mod2
mod2=lm(log(AP)~temps)
summary(mod2)
shapiro.test(residuals(mod2))

plot(mod2,which=1)
plot(residuals(mod2),type="l");abline(h=0,col="red")
plot(mod2,which=2)

# mod3
temps = time(AP)
t=(temps-mean(temps))^2
mod3=lm(log(AP)~temps+t)

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summary(mod3)
shapiro.test(residuals(mod3))

plot(mod3,which=1)
plot(residuals(mod3),type="l");abline(h=0,col="red")
plot(mod3,which=2)

# Month plot
x11()
monthplot(AP, main="Month plot du trafic")

# Lag plot
x11()
lag.plot(AP,set.lags=1:12,main="Lag plot du
trafic",
asp=1,diag =TRUE,
diag.col="red",type="p",do.lines=FALSE)

# mod4
vm = matrix(0,nr = length(AP), nc = 12)
for(i in 1:12) {
  v = rep(0,12)
  v[i] = 1
  vm[,i] = rep(v,12)
}

mod4=lm(log(AP)~temps+t+vm[,1]+vm[,2]+vm[,3]+vm[,
4]+vm[,5]+vm[,6]+vm[,7]+vm[,8]+vm[,9]+vm[,10]+vm[,
11]+vm[,12])
summary(mod4)
shapiro.test(residuals(mod4))

par(mfrow=c(1,2))
plot(mod4,which=1)
plot(mod4,which=2)

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plot(residuals(mod4),type="l");abline(h=0,col="red
")
lag.plot(residuals(mod4),set.lags=1:12,main="Lag
plot du résidu de trafic",
asp=1,diag =TRUE,
diag.col="red",type="p",do.lines=FALSE)

# Vérification
n=length(AP)
Z=cbind(rep(1,n),temps,t,vm);Z[1:10,]
Y=matrix(log(AP),nrow=n,ncol=1);Y[1:10]
solve(t(Z)%*%Z)%*%(t(Z)%*%Y)
solve(t(Z)%*%Z)

Z=cbind(rep(1,n),temps,t,vm[,1:11]);Z[1:10,]
solve(t(Z)%*%Z)%*%(t(Z)%*%Y)

# mod5
st=step(mod4)
summary(st)

mod5=lm(log(AP)~temps+t+vm[,3]+vm[,4]+vm[,5]+vm[,
6]+vm[,7]+vm[,8]+vm[,9]+vm[,10]+vm[,11])
summary(mod5)
extractAIC(mod5)

mod6=lm(log(AP)~temps+t+vm[,3]+vm[,4]+vm[,5]+vm[,
6]+vm[,7]+vm[,8]+vm[,9]+vm[,11])
summary(mod6)
extractAIC(mod6)

library("MASS")
sta=stepAIC(mod4)
summary(sta)

# colinéarité statistique
y=c(21.99,21.37,24.72,27.16,30.60,31.52,33.35,38.2

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1, 33.55, 40.29)  
x1=c(10, 11, 12, 13, 14, 15, 16, 17, 18, 19)  
x2=c(12, 11, 12, 13, 16, 15, 16, 17, 18, 21)  
cor(x1, x2)
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reg=lm(y~x1+x2)  
summary(reg)  
summary(stepAIC(reg))
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cor(x1, y)  
cor(x2, y)
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