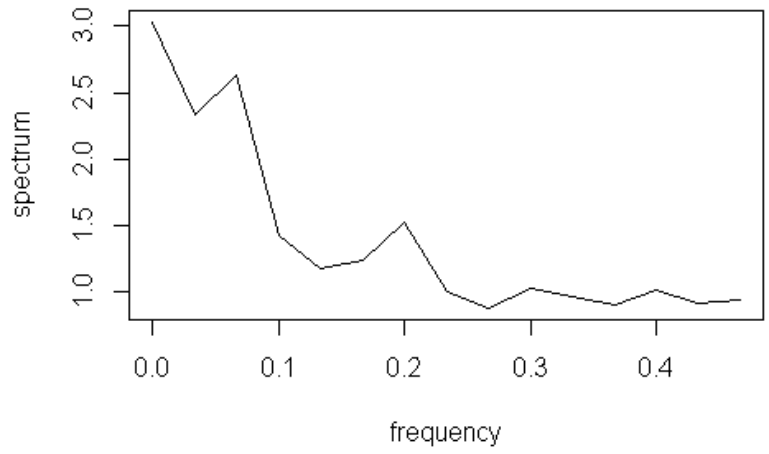
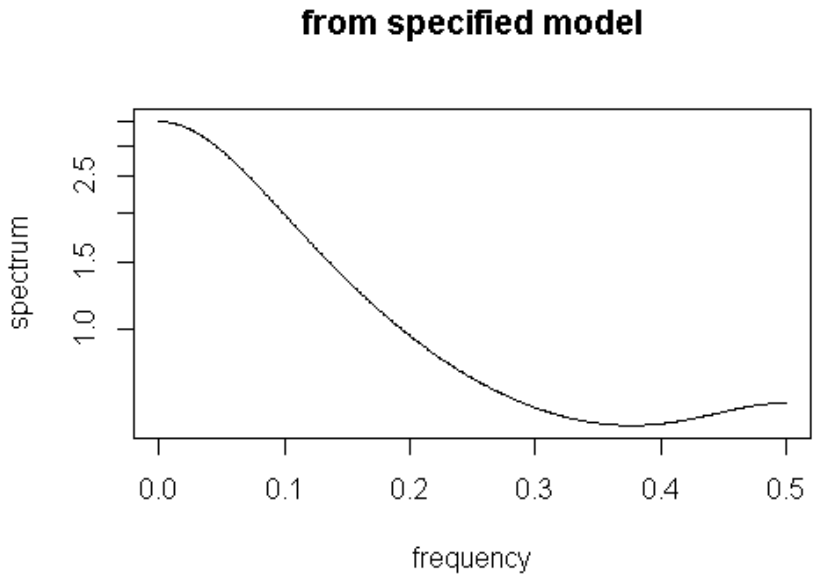
1)

```
vk<-arima.sim(n=1500,list(order(2,0,1),ar=c(0,0.25),ma=0.4))

#1
acvf_vk<-acf(vk,type="covariance")
fft_acvf<-(fft(acvf_vk$acf)+ fft(acvf_vk$acf,inverse= TRUE))/2
#2
vk1=arma.spec(ar=c(0,0.25),ma=0.4)
plot(vk1)

plot(acvf_vk$lag[1:15]/30,fft_acvf[1:15],'l',xlab='frequency',ylab='spectrum')
```



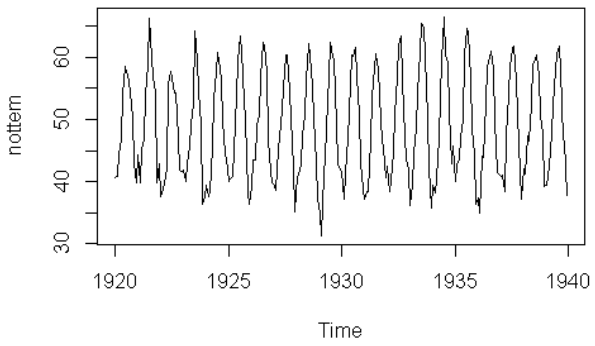


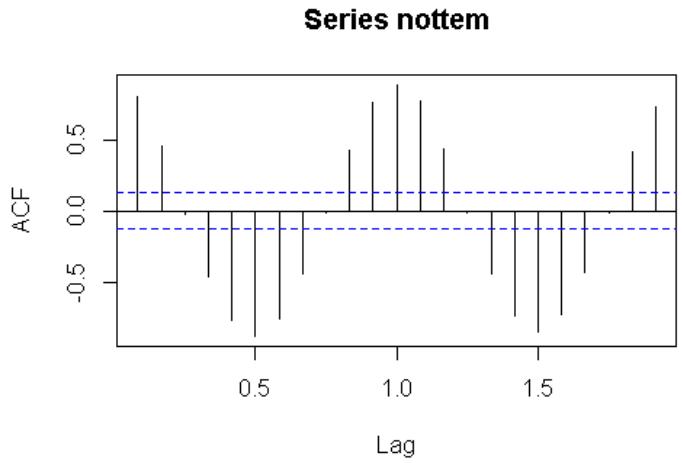
4)

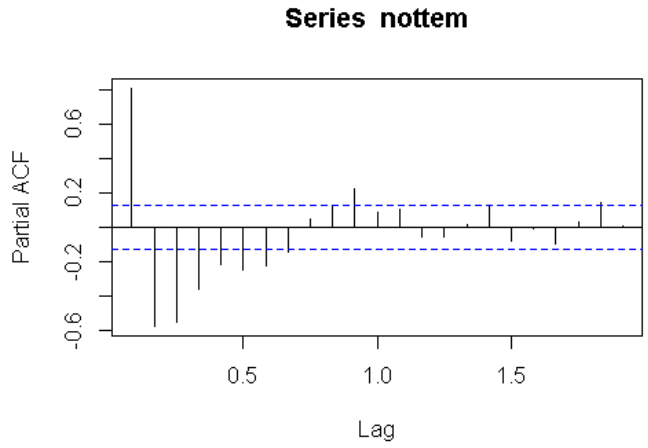
```
ave=1:1000
for (i in 1:1000)
{
xk<-arima.sim(n=1000,list(order(0,0,1),ma=0.4))
acvf_xk<-acf(xk,type="covariance")
sum=0
for (l in 2:31)
{
  sum=sum+(1-l/1000)*acvf_xk$acf[l]

}
sum=sum*2
var_xbar=(acvf_xk$acf[1]+sum)/1000
ave[i]=var_xbar
}

var_xbar_monte=mean(ave)
```

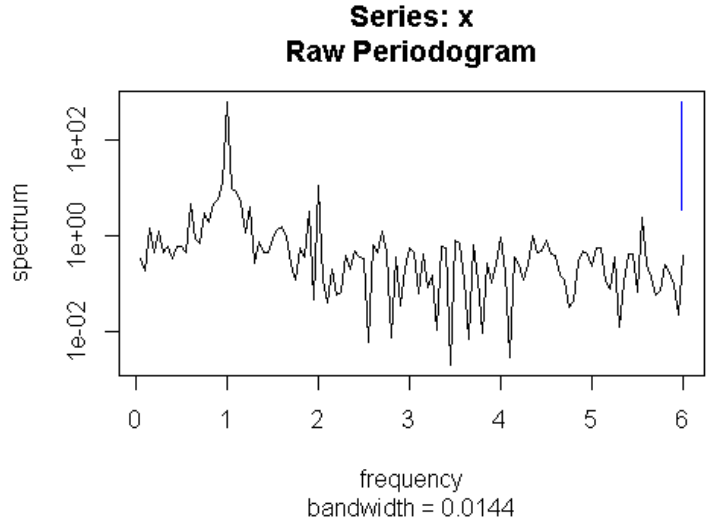
3)

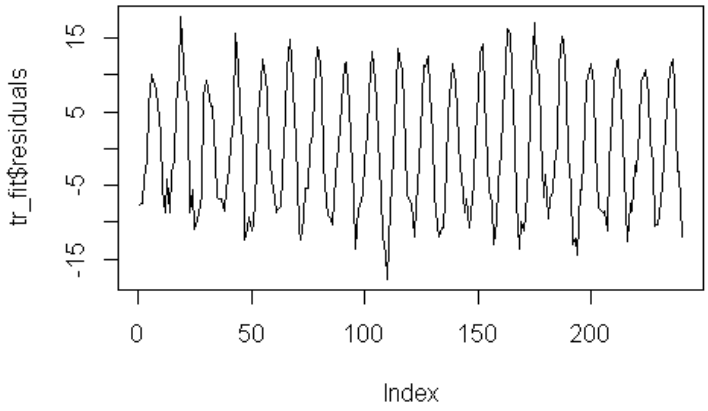
```
nottem=nottem
plot(nottem)
acf(nottem) #Periodic for every lag (MA(1)
pacf(nottem)#AR(5)
psd=spectrum(nottem)
t=1:240
tr_fit<-lm(nottem~t)
plot(tr_fit$residuals,type='l')
acf(tr_fit$residuals)
pacf(tr_fit$residuals)
plot(psd)
arma_a<-arma(tr_fit$residuals,order=(c(5,1)))
plot(arma_a)
```

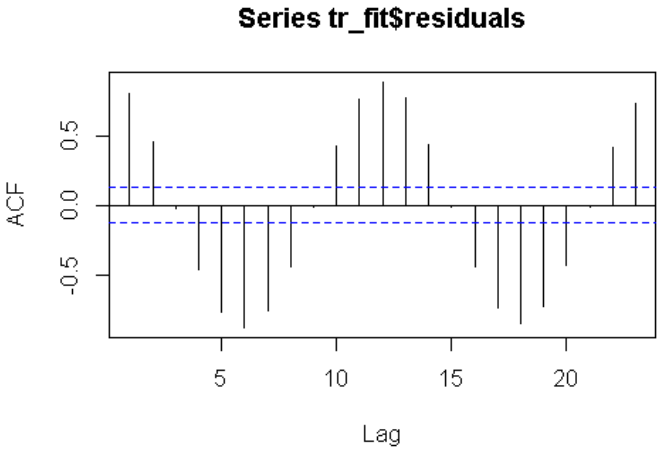


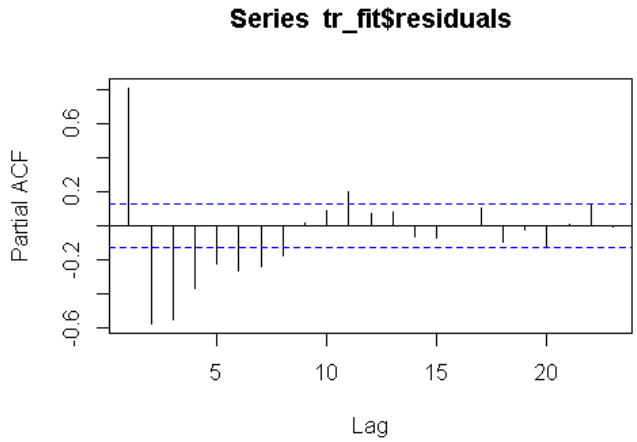

Series nottem
ACF
0.5
0.0
-0.5
0.5
1.0
1.5
Lag


Series nottem
Partial ACF
0.6
0.2
-0.2
-0.6
0.5
1.0
1.5
Lag


Series: x
Raw Periodogram
spectrum
1e+02
1e+00
1e-02
0
1
2
3
4
5
6
frequency
bandwidth = 0.0144


tr_fit$residuals
15
5
-5
-15
0
50
100
150
200
Index


Series tr_fit$residuals
ACF
0.5
0.0
-0.5
5
10
15
20
Lag


Series tr_fit$residuals
Partial ACF
0.6
0.2
-0.2
-0.6
5
10
15
20
Lag