

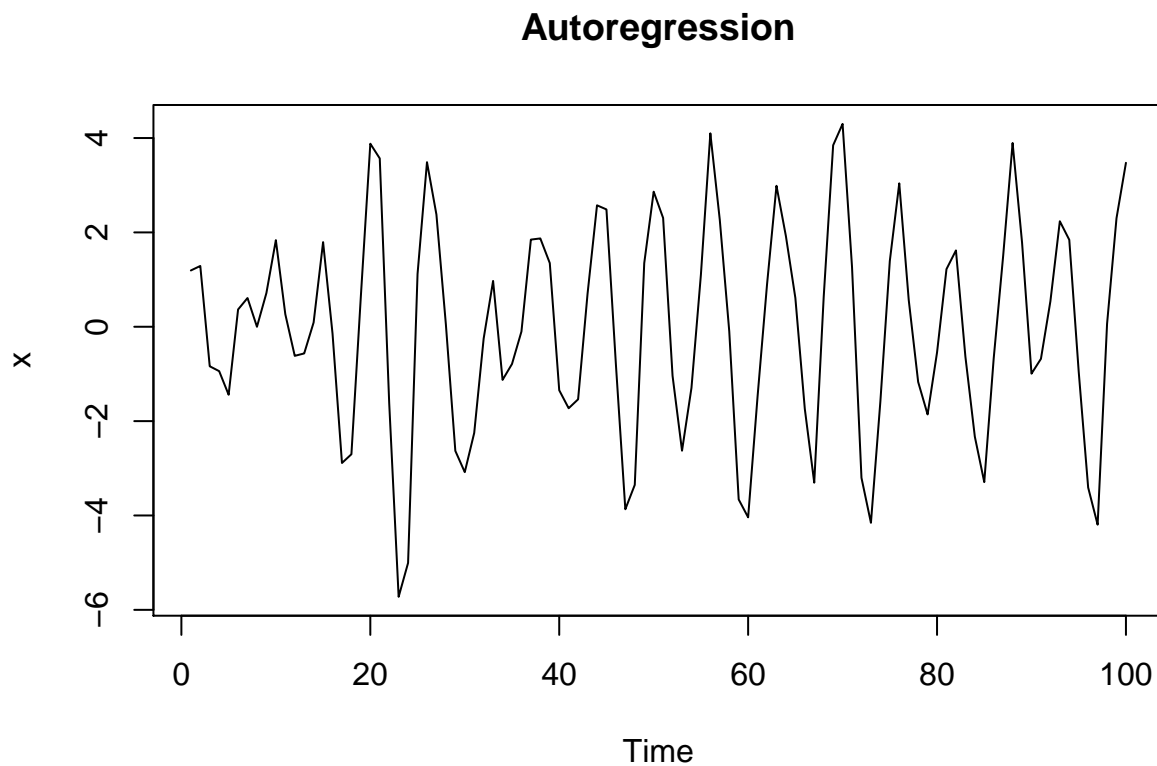
Chapter 1 Problem 3

Andira Putri

This problem studies white noise, moving average filters, and autoregression.

- (a) Generate $n = 100$ observations from the autoregression $x_t = -.9x_{t-1} + w_t$ with $\sigma_w = 1$, using the method described in Example 1.10, page 13. Next, apply the moving average filter $v_t = (x_t + x_{t-1} + x_{t-2} + x_{t-3})/4$ to x_t , the data you generated. Now, plot x_t as a line and superimpose v_t as a dashed line. Comment on the behavior of x_t and how applying the moving average filter changes that behavior.

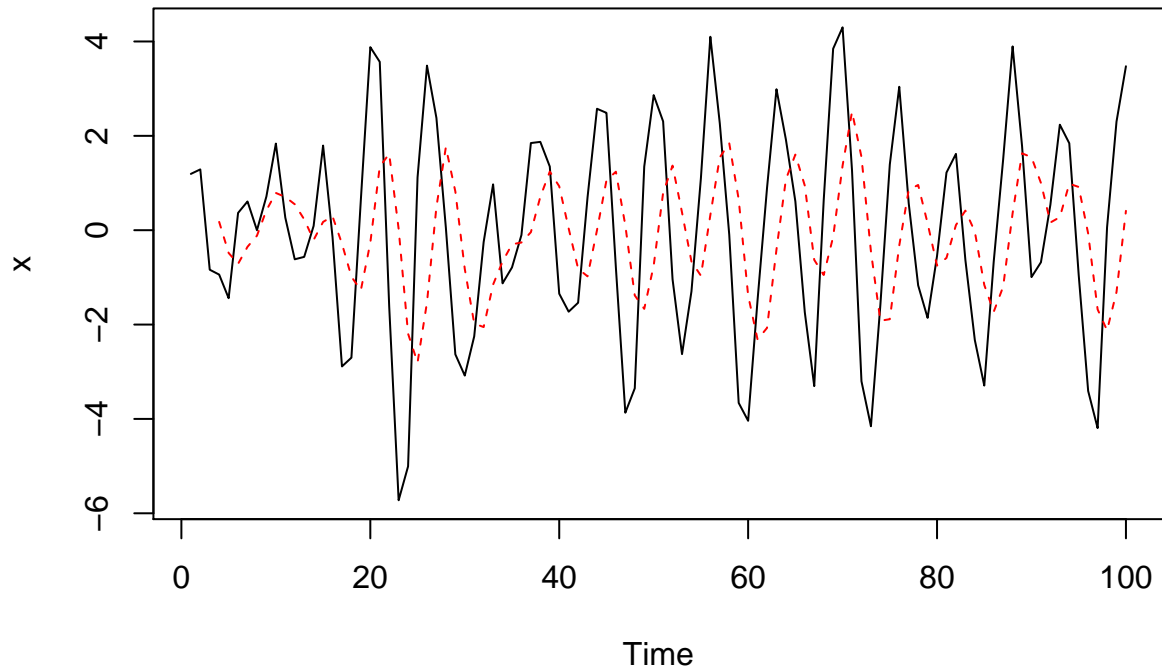
```
set.seed(89)
w=rnorm(150) #50 extra to avoid startup problems
x=filter(w,filter=c(1,-0.9),method="recursive")[-(1:50)]
plot.ts(x,main="Autoregression")
```



Now, we implement the moving average filter and superimpose it on the autoregression graph.

```
v=filter(x,sides=1,rep(1/4,4))
#sides=1 b/c we are only looking at past values
#rep(1/4,4) b/c we are averaging with 4 points
plot.ts(x,main="Autoregression with Moving Average Filter")
lines(v,col="red",lty="dashed")
```

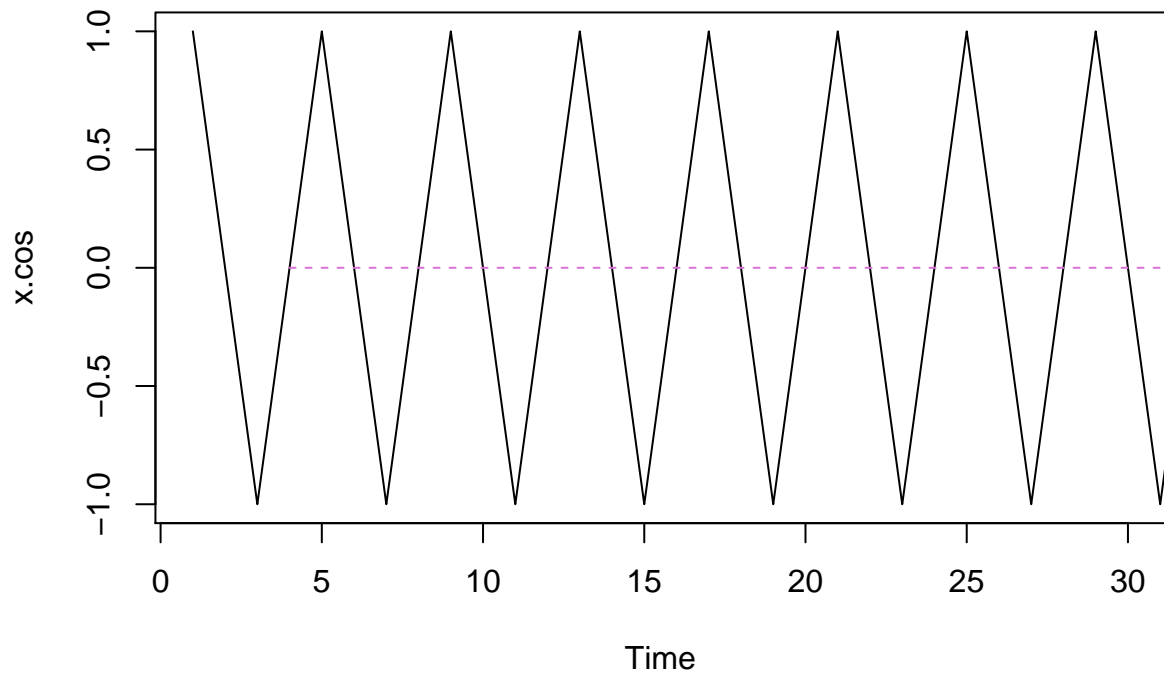
Autoregression with Moving Average Filter



(b) Repeat but with $x_t = \cos(2\pi t/4)$.

```
x.cos=ts(cos(2*pi*0:150/4))
v.cos=filter(x.cos,sides=1,rep(1/4,4))
plot.ts(x.cos,main="Autoregression",xlim=c(1,30))
lines(v.cos,col="orchid",lty="dashed")
```

Autoregression



- (c) Repeat but with added $N(0,1)$ white noise; $x_t = \cos(2\pi t/4) + w_t$.
- (d) Compare and contrast the models above.