

cross correlation function

Cross correlation function

Compare uncorrelated and correlated times series with the cross correlation function:

First simulate correlated and uncorrelated time series data as follows:

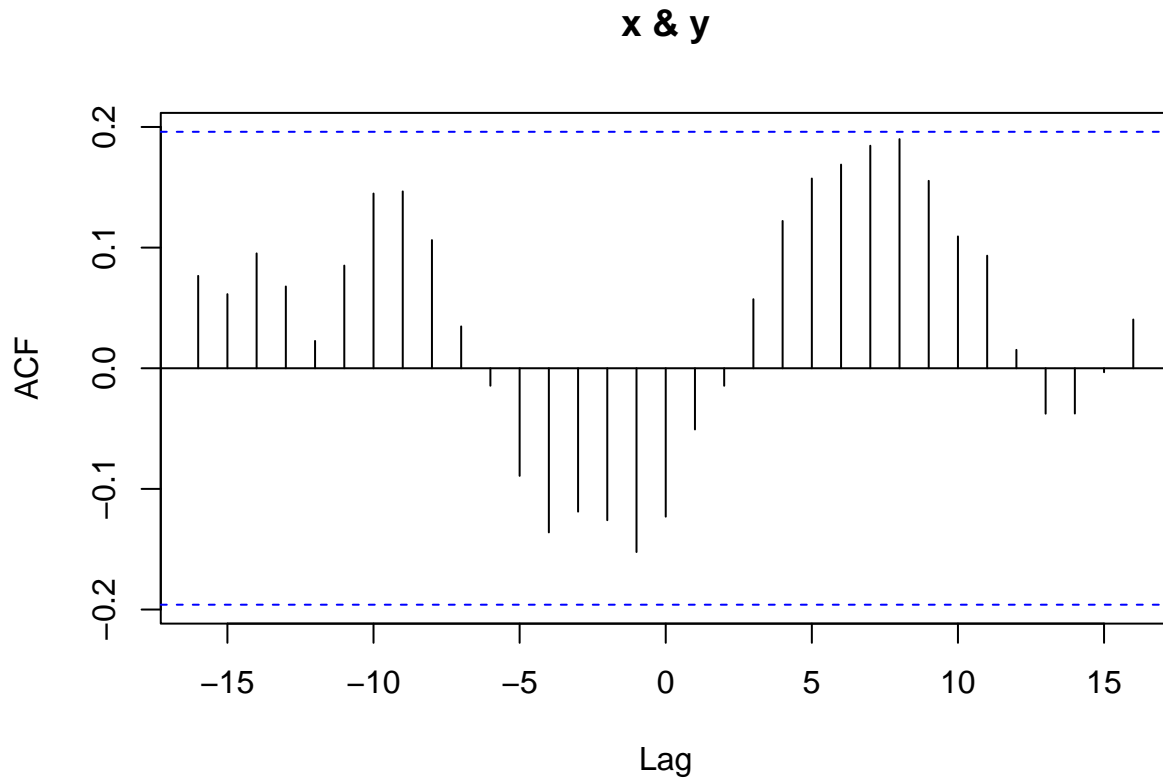
- Simulate x and y as two independent ARMA processes. Then create $z = x - y$

```
x = arima.sim(model=list(ar=0.8),n=100)
y = arima.sim(model=list(ar=0.8),n=100)
z = x-y
```

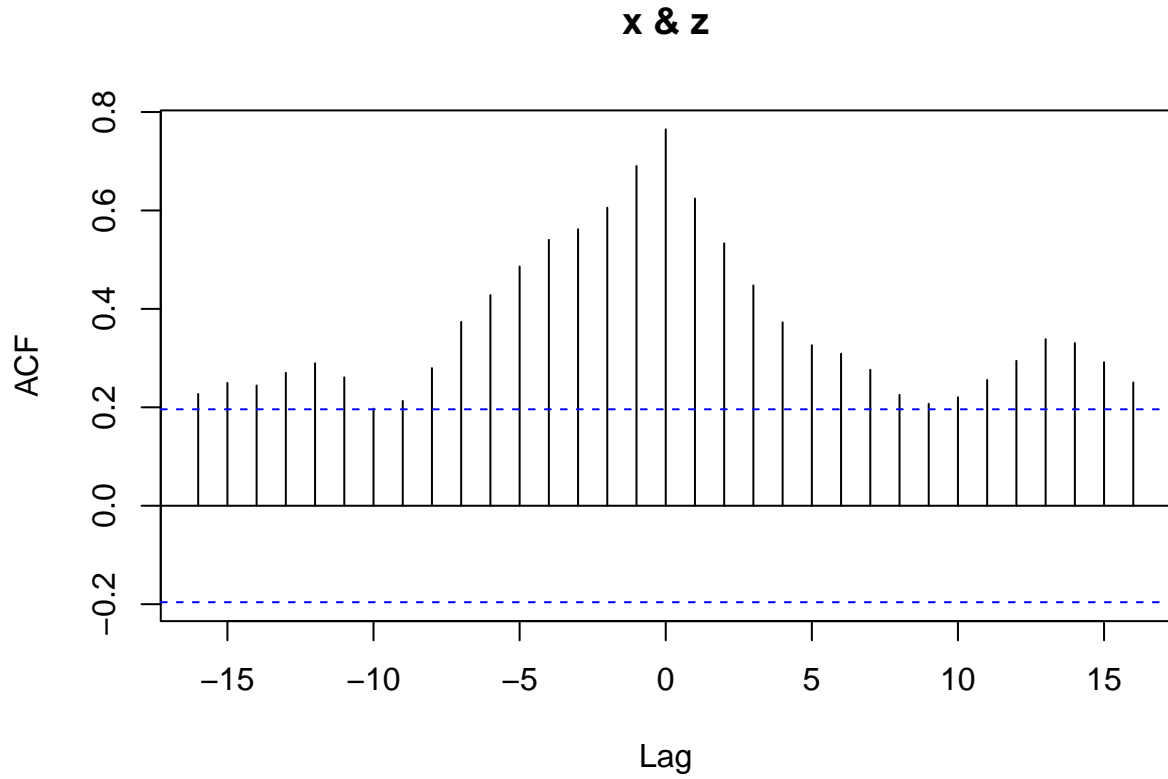
Then x and y are uncorrelated, but z is correlated with both x and y.

- Make cross correlation plots comparing the processes, and inverpret.

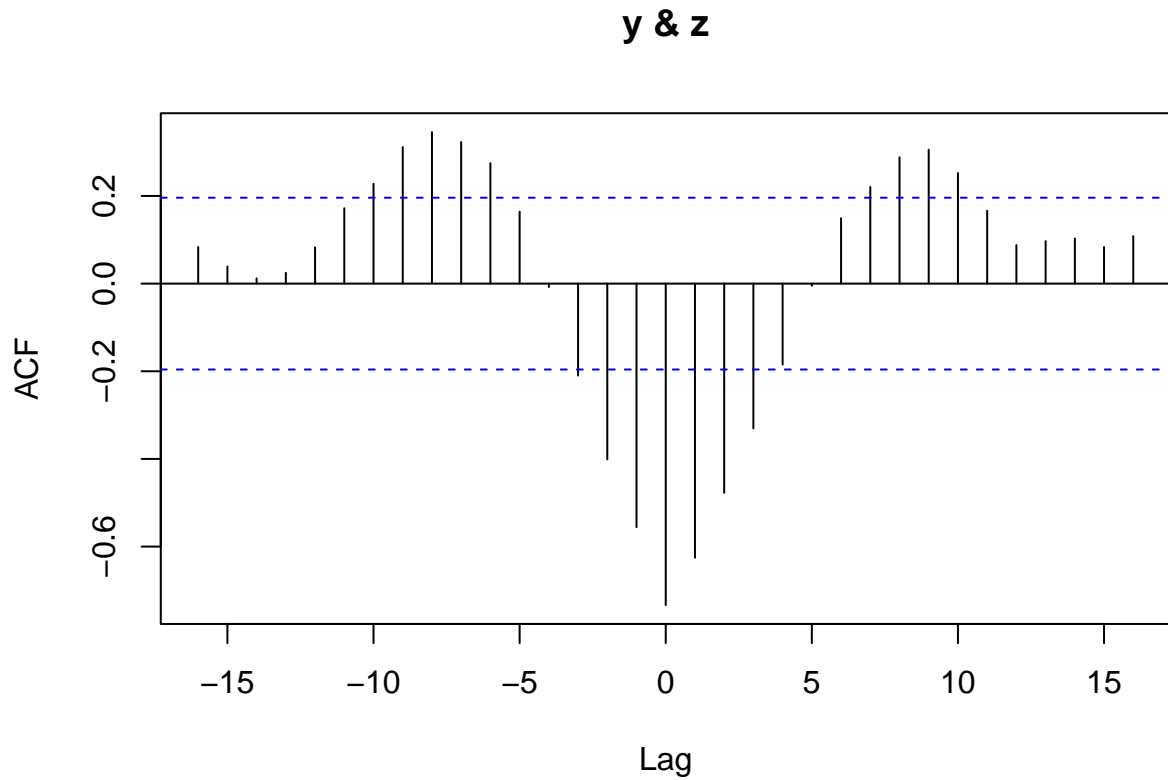
```
ccf(x,y)
```



`ccf(x,z)`



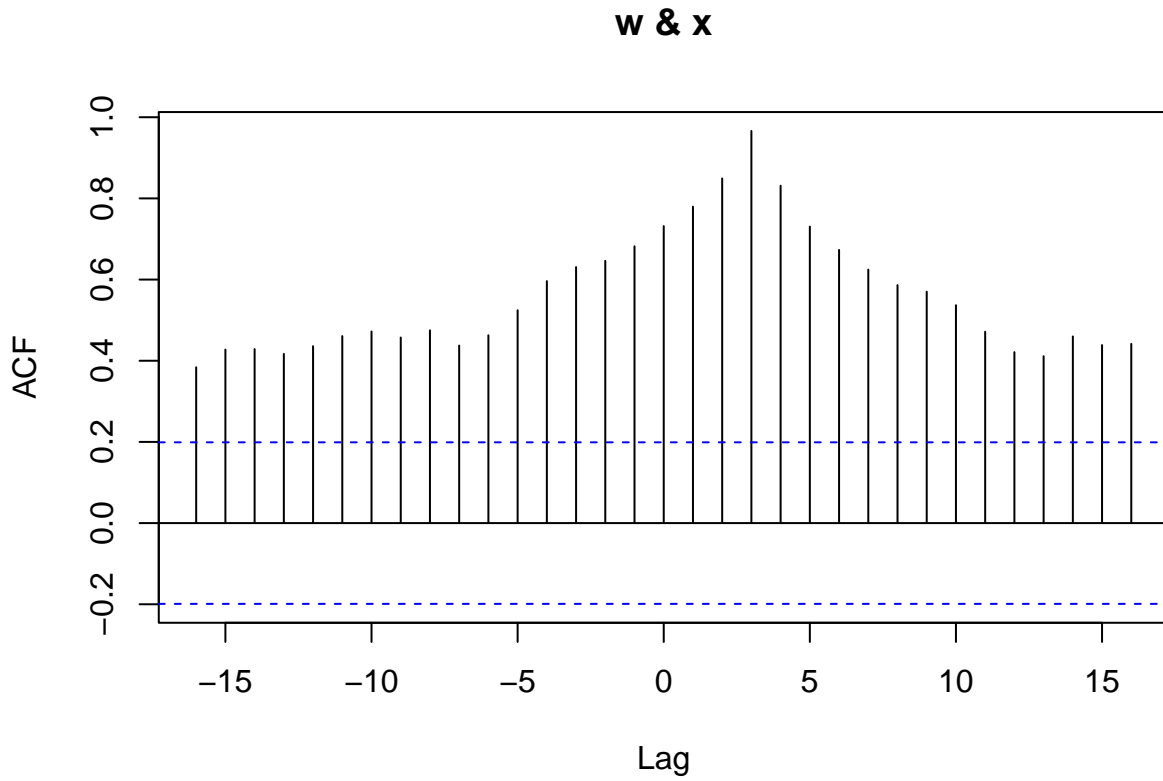
`ccf(y,z)`



- Construct a new process w as a delayed version of x .

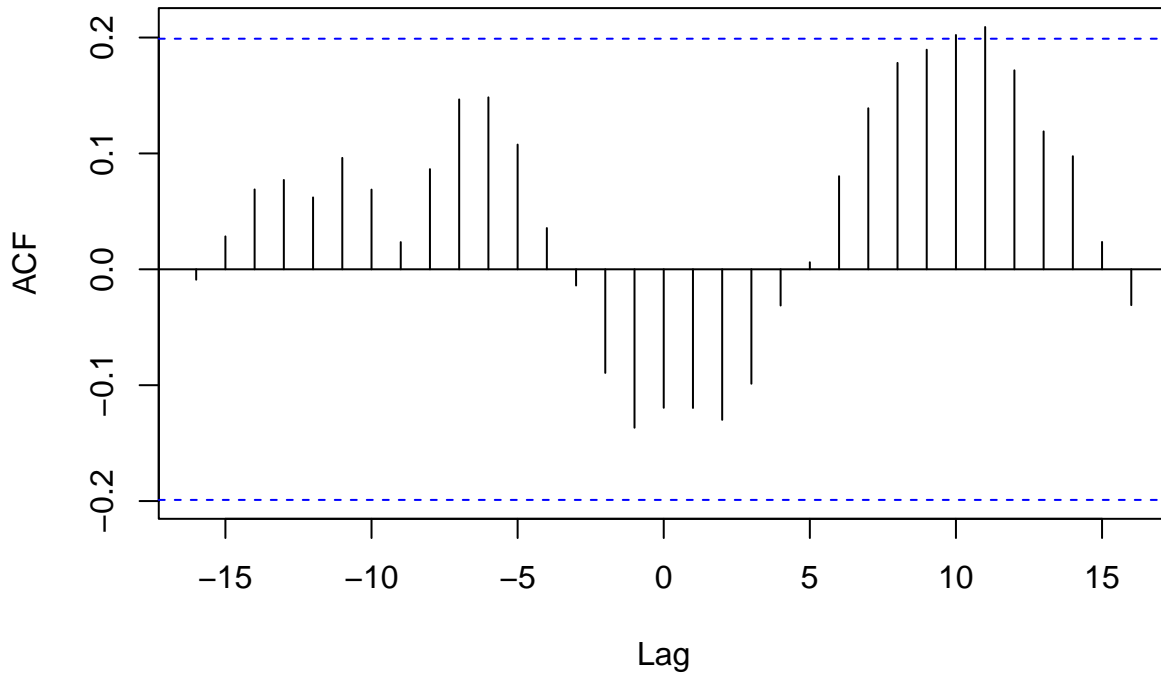
- Draw the cross-correlation plots comparing w with x,y and z, respectively. Can you identify the delay from the ccf?

```
w = lag(x, -3)  
ccf(w, x)
```



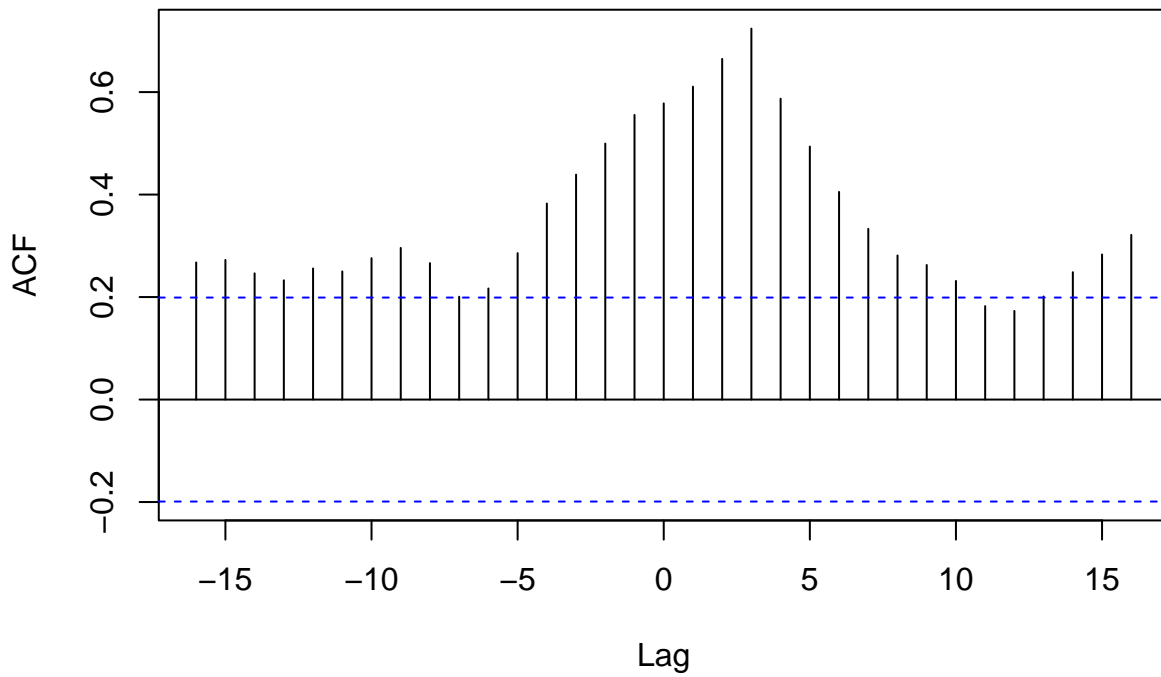
```
ccf(w, y)
```

w & y



`ccf(w,z)`

w & z



The largest ccf appears at lag 3 for both x and z. x is independent of y, hence so is y. Therefore, we do not see the lag in the ccf.