

# Hw6 STAT153

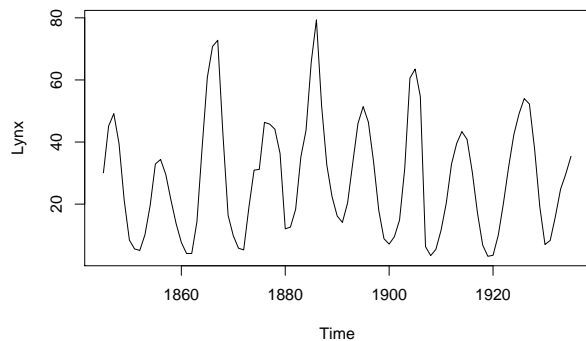
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12/3/2021

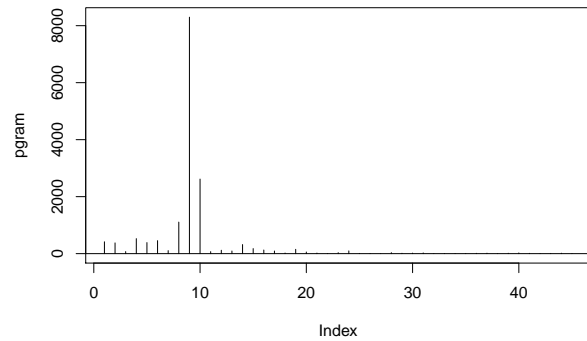
## Question 1

- (a) Yes. This looks like something we could model with sinusoids.
- (b) The three highest spikes on the periodogram are for  $j=8,9,10$ . It is more likely a linkage due to the presence of a sinusoid at a non-Fourier frequency.
- (c) The figure is plot below.
- (d) Based on the spectrum density, there are 2 hills around the linkage  $j=8,9,10$ . So it's likely that 2 sinusoids created the three significant periodogram spikes.

```
rm(list = ls())  
library(astsa)  
library(TSA)  
  
plot.ts(Lynx)
```



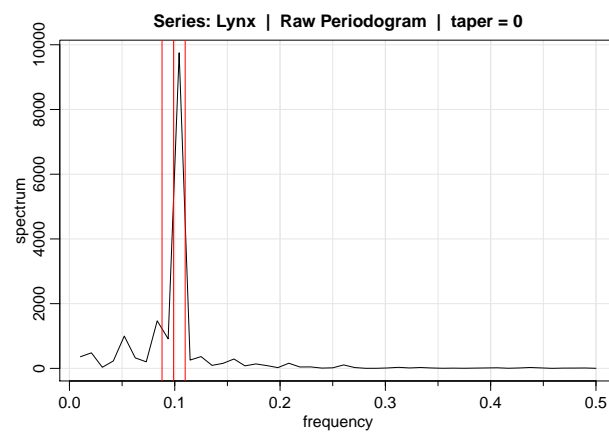
```
pgram = function(x){  
  m = floor(length(x)/2)  
  pgram = abs(fft(x)[2:(m+1)])^2/length(x)  
  plot(pgram, type = "h")  
  abline(h=0)  
  return(pgram)  
}  
  
pgram(Lynx)
```



```

mvspec(Lynx)
abline(v=8/91,col='red')
abline(v=9/91,col='red')
abline(v=10/91,col='red')

```



## Question 2

### 2 a

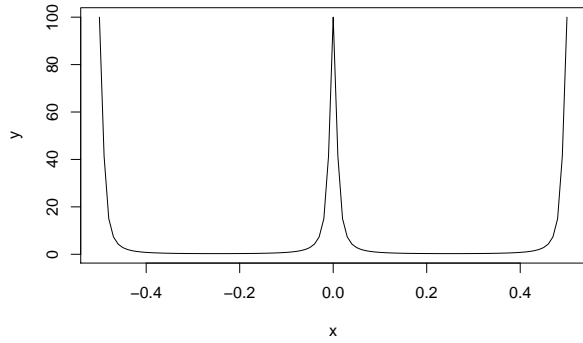
Compute the transfer and power transfer functions associated with the AR polynomial:

power transfer functions  $|A(\lambda)| = 1 - 0.9e^{-4\pi i\lambda}$

spectral density  $|f(\lambda)| = \frac{\sigma_w^2}{1.81 - 1.8\cos 4\pi\lambda}$

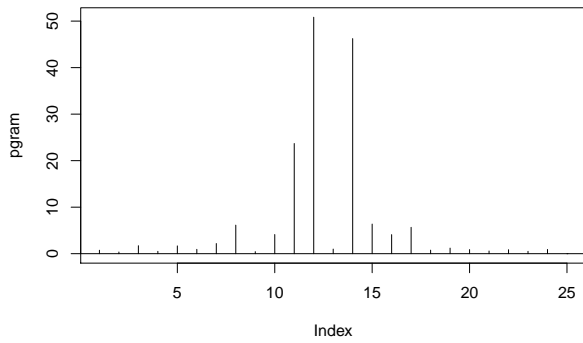
### 2 b

I think  $X_t$  will oscillate in a period of 2.



### 2 c

Yes, the pgram show that the spike appear around  $h = 12.5$ , which means a period of  $50/12.5 = 4$ .

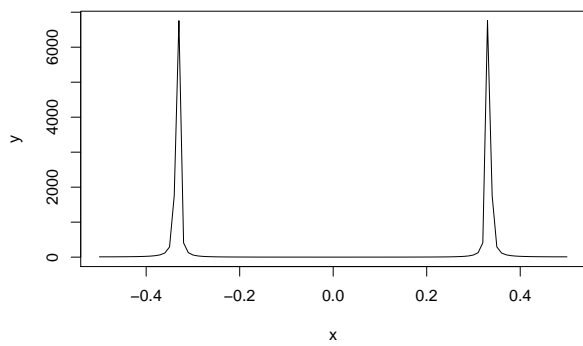


### 2 d

transfer function/filter :  $X_t = 1/3(W_{t+1} + W_t + W_{t-1})$  power transfer function  $= A(\lambda) = 2/3 * \cos(2\pi\lambda) + 1/3$   
spectral density  $= f(\lambda) = \frac{9}{(2 * \cos(2\pi\lambda) + 1)^2}$

**2 e**

I think  $X_t$  will oscillate in a period of 3.



## 2 f

Yes, the pgram show that the spike appear around  $h = 11.5$ , which means a period of  $50/11.5 = 4$ , consistant with 2 d.

