

STAT153 Lab0

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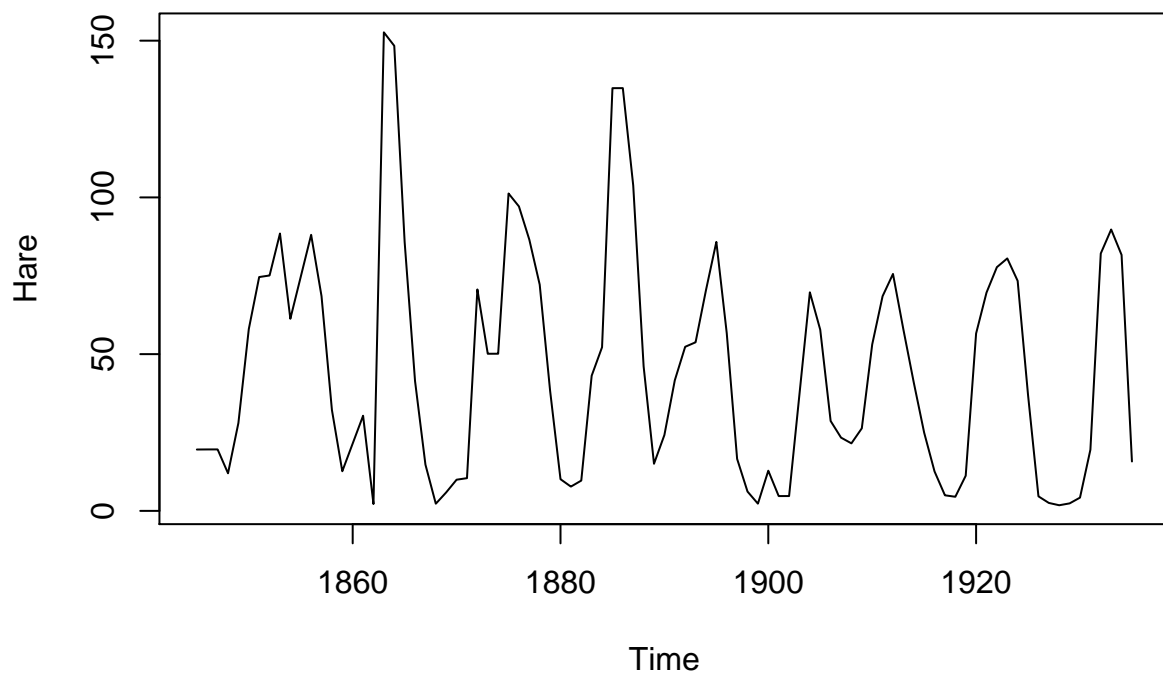
1. Computer exercises:

- (a) Install the book's package "astsa".

```
#install.packages("astsa")
```

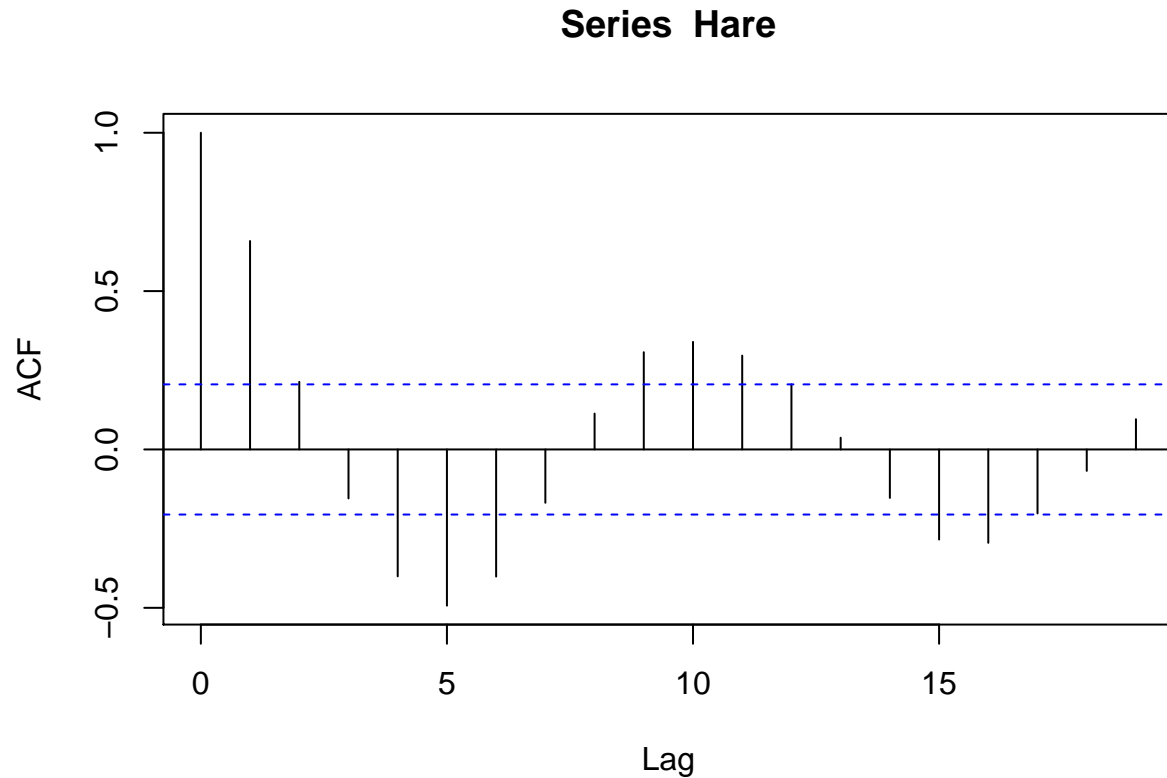
- (b) Load the astsa package into R.
(c) Plot the Hare time series.

```
library(astsa)  
data(Hare)  
ts.plot(Hare)
```



(d) Plot the ACF correlogram of “Hare”.

```
data(Hare)
acf(Hare)
```



(e) Describe what you see in the time series plot and ACF plot.

Seasonality: In the time series plot, there is a seasonality about 10 years, which will be more clearly seen in the acf plot. The acf plot shows acf of 5 years lag is about -0.5, which means numbers of hare is negative auto-correlated with numbers 5 years ago. The acf plot shows acf of 10 years lag is outlier, which means numbers of hare is positive auto-correlated with numbers 5 years ago

Long-term Trend: Long term trend is not obvious in time series plot and acf plot.

Theoretical exercises

$X \sim N(1, 3)$, i.e. $E(X) = 1$ and $\text{Var}(X) = 3$.

(a) $E(5X + 1) = 6$

(b) $E(X^2) = (EX)^2 + \text{Var}(X) = 4$, $E(5X^2 + 1) = 5E(X^2) + 1 = 5 \times 4 + 1 = 21$

(c) $\text{Var}(5X + 1) = 25\text{Var}(X) = 75$

(d) $\text{Cov}(5X + 1, 0.5X) = \text{Cov}(5X, 0.5X) = 3$

(e) Now suppose $\text{Cov}(X, Y) = \gamma$. What is $\text{Cov}(5X + 1, -2Y)$ in terms of γ ?

$\text{Cov}(5X + 1, -2Y) = -5 * 2\text{Cov}(X, Y) = -10\gamma$