

# Time Series

## Exercise 1

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### Question 1

The provided code is ran in R. Summary statistics are generated (Table 1) and the data is plotted (Figure 1). It can be seen in Fig. 1 that there is seasonality in the data.

Spikes occur every 10 years, where for every 4 spikes, there is one large one. Large spikes occur with a period of roughly 40 years.

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
39.0	348.2	771.0	1538.0	2567.0	6991.0

Table 1: Summary statistics for the annual number of lynx trapped at Mackenzie River between 1821 and 1934.

### Question 2

In order to obtain a 95% confidence interval, we use the following formulation

$$\hat{y} \pm 1.96\sqrt{\sigma^2}, \quad (1)$$

here  $\hat{y}$  is the approximated average and  $\sigma^2$  the variance, both at time  $t = 2000$ . To estimate  $\hat{y}$ , a linear model is fitted to obtain an estimation for the mean  $\hat{y}$

$$\hat{y} = \hat{\alpha} + \hat{\beta}t, \quad \text{for } t = 2000. \quad (2)$$

$$\hat{\alpha} = \bar{X} - \hat{\beta}\bar{t}, \quad \hat{\beta} = \frac{\sum_{i=1}^n (X_i - \bar{X})(t_i - \bar{t})}{\sum_{i=1}^n (t_i - \bar{t})^2}. \quad (3)$$

From (2) and (3) we find  $\hat{y} = 34.1077$ .

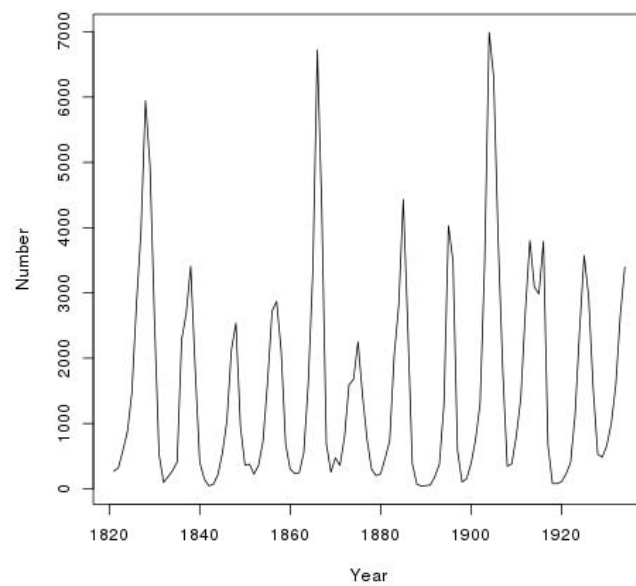


Figure 1: Annual number of lynx trapped at Mackenzie River between 1821 and 1934.