

Lab Worksheet #2: MATH 495

Materials: This worksheet accompanies the m-files found on the web site, which you should download into a directory on your computer.

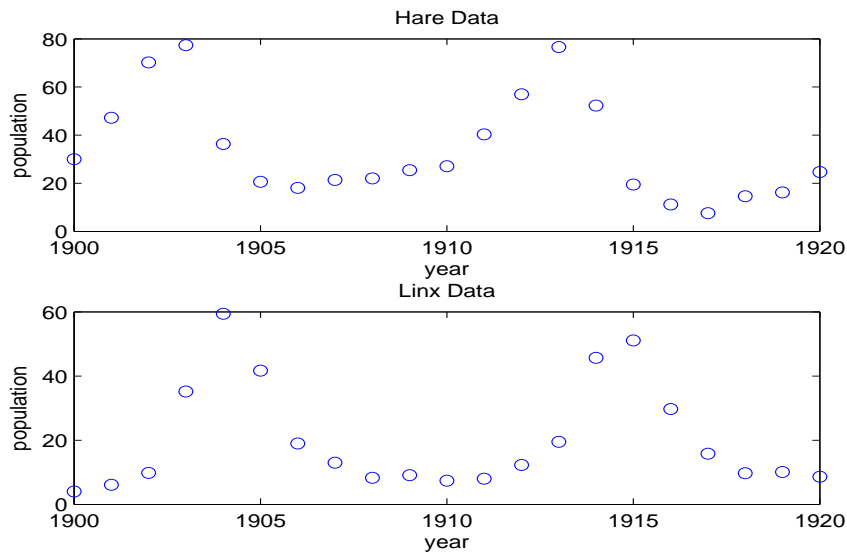


Figure 1: *Hudson Bay Lynx-Hare Data 1900-1920.*

1. (a) First implement the parameter estimation and sampling approach that you've been using up to this point on the Lynx-Hare data plotted in Figure 1. To do this, simply type

```
>> LynxHare
```

and prepare to wait for a while. In the mean time, let's have a look at the codes.

- (b) Modify `LynxHare.m` so that it implements residual bootstrapping instead.

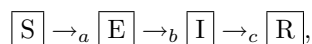
2. **(Problem on the next homework)** Modify `LynxHare.m` so that it instead implements the parameter estimation/sampling approach on the following British boarding school data (British Medical Journal, March 4, 1978, p. 587) where the infected are taken to be the boys confined to bed and the total number of individuals is $N = 763$:

days	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Infected	1	3	7	25	72	222	282	256	233	189	123	70	25	11	4

Report your parameter estimates, and 95% confidence intervals. Interpret the meaning of each parameter. Perform the same test using bootstrapping of the residuals (as you did in the last homework) and compare your results. Use the SIR ODE model to fit the data:

$$\begin{aligned} \frac{dS}{dt} &= -aIS, & S(0) &= S_0, \\ \frac{dI}{dt} &= aIS - bI, & I(0) &= I_0. \end{aligned}$$

3. Write down the SEIR ODE model for the schematic



where S denotes susceptible individuals, E infected but not infectious individuals, I infectious individuals, and R recovered individuals. Let N be the total number of individuals and t the time in days. Now have a look at the Ebola project on the web site.