Lab 4B: Gompertz

Chiatse Wang
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Gompertz Function

$$g(t) = Ae^{-be^{-ct}}$$

where A, b, c are positive parameters.

Data

Suppose we have data $(t_i, z_i), i = 1, \ldots, m$

$$\log(z_i) \approx (\log A) - b\, e^{-c\, t_i}$$

Let $y_i = \log z_i$ and $a = \log A$. Define a function **f** whose components are

$$f_i(a, b, c) = a - b\, e^{-c\, t_i} - y_i$$

Fit Data

We are going to minimize $\|\boldsymbol{f}\|_2$ as a function of **a**, **b**, **c** which can combine together as the column vector **x**.

This is a nonlinear least squares problem that can be solved by the **Levenberg iteration.**

Hands On

Provide Files

1. levenburg.m
   https://github.com/tobydriscoll/fnc-extras/blob/master/fnc/levenberg.m

Define Function gomp

Let $y_i = \log z_i$ and $a = \log A$. Define a function **f** whose components are

$$f_i(a, b, c) = a - b\, e^{-c\, t_i} - y_i$$

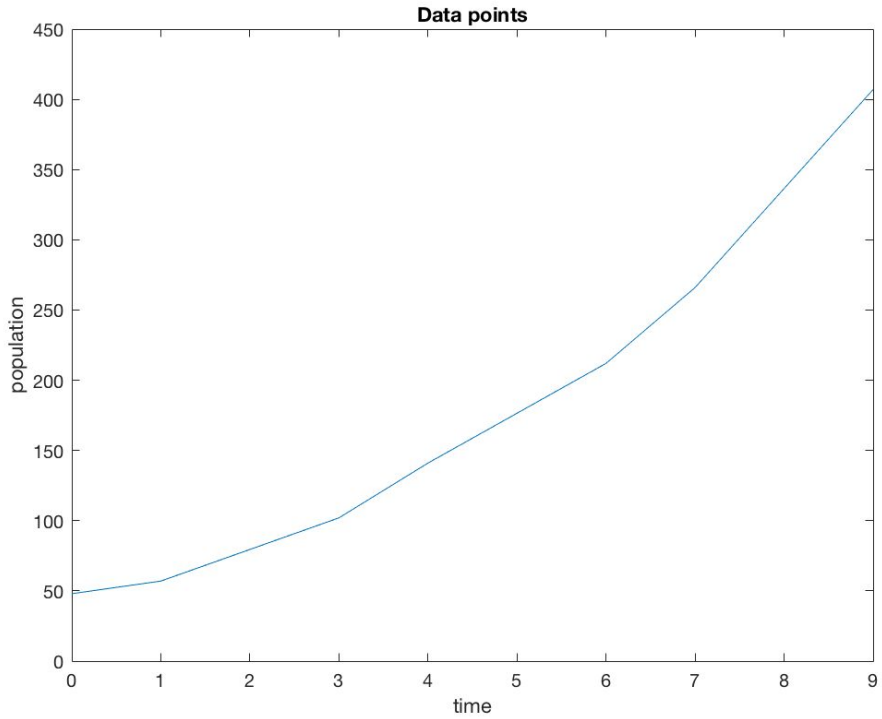
Load Population Data

Create two column vectors **t** and **z** from the following table.

t	z
0	48
1	57
3	102
4	141
6	212
7	266
9	407

http://www.mathcs.emory.edu/~fox/NewCCS/ModuleIII/ModIIIP3.html

Population Data



Find Best Fitting by Levenberg Iterations

- Passing extra parameters https://www.mathworks.com/help/optim/ug/passing-extra-parameters.html
- levenburg.m https://github.com/tobydriscoll/fnc-extras/blob/master/fnc/levenberg.m

What We Learned?

Nonlinear Least Squares Problem

- Find the best fitting curve
- Solve by the Levenberg iteration