SYMMETRIC AND ASYMMETRIC DATA FITTING

Due date: 3/22/2018, 9am

In class we covered least squares fitting in detail, so you should be proficient with the basic idea. :) Thus, get cracking!

1. The table below contains clinical data of iodine concentration in blood. Using a simple exponential model, determine the rate of purification.

t=0s	13753	4472	3013	.	2361
80s	10426	4198	2978	.	2323
160s	8268	3898	2819	.	2311
.	7416	3758	2796	t=2160s	2175
.	6557	3555	2638		
.	5745	3463	2538		
.	5257	3276	2407		
.	4690	3154	2484		

   Linearize the model using substitution. Attempt to fit the following function: $f(t) \propto \exp(-\lambda\sqrt{t})$ – this functional form is derived from a more complicated compartmental model. Does the fit improve if t is taken at mid-range?

2. Does adding an additive constant help? The physical analog for this would be the background level of iodine. Note that you cannot linearize the model anymore, so solve this by the brute force method.

3. Legendre polynomials appear in the solution of the Laplace equation in spherical coordinates:

$$\nabla^2 f(r) = 0; \qquad f(r) = \sum_n \left(A_n r^n + B_n r^{-(n+1)}\right) P_n(\cos\theta).$$

   For the given boundary conditions, $f(r)$ can be solved for coefficients A_n and B_n. A convenient way to generate polynomials P_n is by the following recursion formula:

$$(n+1)P_{n+1} = (2n+1)xP_n - nP_{n-1}, \quad P_0 = 1.$$

   Legendre polynomials are a very good choice for fitting non-oscillatory data because of their orthogonality.

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Using sigma-clipping, find the continuum of the absorption spectrum by fitting it with a Legendre series. You can either use your own spectrum or download one from the course homepage.