Stat 215B (Spring 2005): Lab 5

GSI: Victor Panaretos
victor@stat.berkeley.edu

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In this lab, we will continue our investigation of the life of blood cells. Suppose that in addition to the previous data set, we now we have a second sample of similarly analysed blood, from a different individual. The data set contains three variables/columns: the first is the time elapsed after re-injection (in days), the second column contains the counts from the previous lab and the third column is a new series of counts.

We will now use a slightly different model. First, assume that the background radiation level has been measured and assumed to be zero - this should seem in agreement with the results of the previous lab. Also, assume that conditionally on time, the counts are independent Poisson variables with expected value given by the model

$$\mathbb{E}\left[N_t^{(1)}\right] = \beta_1 \exp\left(-\gamma_1 t\right) \quad \text{and} \quad \mathbb{E}\left[N_t^{(2)}\right] = \beta_2 \exp\left(-\gamma_2 t\right)$$

where $\{N_t^{(1)}\}$ are the counts for the first sample and $\{N_t^{(2)}\}$ are the counts for the second sample. Prepare a report that addresses the following:

1. Propose a model within the GLM framework taking into account the probabilistic assumptions made above. Be careful to state the assumptions of your model clearly and to explain how the model is fit.

2. Estimate the parameters β_1, β_2, γ_1, and γ_2, within the framework of your model. Also give relevant standard errors and correlations for the estimator. Discuss the results of your analysis.

3. Test the following pair of hypotheses and comment on the result:

$$\begin{cases} H_0 : (\beta_1, \gamma_1) = (\beta_2, \gamma_2) \\ H_A : (\beta_1, \gamma_1) \neq (\beta_2, \gamma_2) \end{cases}$$

   Explain analytically how you tested these hypotheses: what is the underlying theory, what is the test statistic and its distribution?

Note: The data are contained in the file `lab5.txt` on the lab section webpage.