

2. Consider the data in file Alba.txt.

	Dose	Herbicide	DryMatter
1	1	Glyphosate	4.7
2	1	Glyphosate	4.6
3	1	Glyphosate	4.1
4	1	Glyphosate	4.4

Data are from an experiment, comparing the potency of the two herbicides glyphosate and bentazone in white mustard *Sinapis alba*.

Dose - a numeric vector containing the dose in g/ha.

Herbicide - a factor with levels Bentazone Glyphosate (the two herbicides applied).

DryMatter - a numeric vector containing the response (dry matter in g/pot).

Christensen, M. G. and Teicher, H. B., and Streibig, J. C. (2003)

Linking fluorescence induction curve and biomass in herbicide screening, Pest Management Science, 59, 1303-1310.

Denote the variables as  $Y = \text{DryMatter}$ ,  $X_1 = \text{Dose}$ , and  $X_2 = \text{Herbicide}$ .

- (a) Let us assume  $Y_i \sim \text{Gamma}(\mu_i, \phi)$ . Consider modeling the expected value  $\mu_i$  of the response variable  $Y = \text{DryMatter}$  by the following model

$$\mathcal{M}: \quad \frac{1}{\mu_i} = \beta_0 + \beta_1 x_{i1} + \alpha_j + \gamma_j x_{i1},$$

where index  $j$  is related to the categories of  $X_2$ . Calculate the maximum likelihood estimate for the expected value  $\mu_{i*}$  when  $X_1 = 50$  and  $X_2 = \text{Glyphosate}$ .

- (b) Let us continue to assume  $Y_i \sim \text{Gamma}(\mu_i, \phi)$ , and let us continue to model the expected value  $\mu_i$  by the model

$$\mathcal{M}: \quad \frac{1}{\mu_i} = \beta_0 + \beta_1 x_{i1} + \alpha_j + \gamma_j x_{i1},$$

Create 80 % prediction interval for new observation  $y_f$ , when  $X_1 = 50$  and  $X_2 = \text{Glyphosate}$ . Particularly, what is your estimate for lowerbound of the prediction interval?

- (c) Let us assume  $Y_i \sim \text{IG}(\mu_i, \phi)$ . Consider modeling the expected value  $\mu_i$  of the response variable  $Y = \text{DryMatter}$  by the following model

$$\mathcal{M}: \quad \frac{1}{\mu_i^2} = \beta_0 + \beta_1 x_{i1} + \alpha_j + \gamma_j x_{i1},$$

where index  $j$  is related to the categories of  $X_2$ . Calculate the 95% confidence interval estimate for the expected value  $\mu_{i*}$  when  $X_1 = 50$  and  $X_2 = \text{Glyphosate}$ . Particularly, what is your estimate for lowerbound of the confidence interval?