HOMEWORK 2
BIOSTATISTICS 755
DUE FEBRUARY 3RD, 2023

1. The longitudinal data from an insulin study contain 36 rabbits where 12 rabbits were randomly assigned to each of 3 groups: group 1 rabbits received the standard insulin mixture, group 2 rabbits received a mixture containing 1% less protamine than the standard, and group 3 rabbits received a mixture containing 5% less protamine. Rabbits were injected with the assigned mixture at time 0, and blood sugar measurements taken on each rabbit at the time of injection (time 0) and 0.5, 1.0, 1.5, 2.0, 2.5, and 3.0 hours post-injection.

   The data file *"insulin"* is on the course website. The variables appearing in columns are: (1) rabbit id, (2) insulin group, and (3-9) response (blood sugar level) at 7 time points.

   (a) **(10 points)** Create a spaghetti plot of the data with separate panels for each group. Comment on the heterogeneity in the data.

   (b) **(10 points)** Create a plot that has the groups means over time on the same plot with different colors (if you'll print/submit in color) or line-types (if you print/submit in black and white).

   Comment on what time trends might be appropriate (e.g., profile, linear, quadratic, etc.)?

   (c) **(10 points)** Fit a full interaction model using a **profile analysis** with the following covariance matrices. Hand in the estimates of the covariance matrices and model fit statistics (AIC and BIC) for each. Nothing else.

      i. Unstructured
      ii. Compound Symmetry
      iii. Heterogeneous Compound Symmetry.

   (d) **(10 points)** Based on the estimated covariance matrices what do you think is best based on the estimated covariance and correlation matrix for the unstructured model? Do not use model fit criteria (AIC/BIC) for this question.

   (e) **(10 points)** For the models that were fit in (c), which model has the best fit according to AIC and BIC?

   (f) **(10 points)** Complete a likelihood ratio test between the following structures. To each of the results coincide with the results from AIC and BIC?

      i. Unstructured and Heterogeneous Compound Symmetry

   (g) **(10 points)** Using the model that fit best from (c), test whether the time profiles of means are different in the groups.

   (h) **(10 points)** Does time have a significant impact on the response (this *may* require you to fit another model)?

(i) **(10 points)** Using the model that fit best from (c), test and give an estimate of the difference in the mean response level at 0.5 hour from baseline (0 hour) in group 1.

(j) **(10 points)** Using the model that fit best from (c), interpret at least two of the parameters in context of the problem. Have one of the parameters you interpret be from an interaction.