BIOSTATISTICS 667
Homework 4

1. Consider a linear mixed model (as in mixed1.pdf) with $n_i = 2$ observations per subject, a number of fixed effects (p), a random intercept b_i (i.e. $q = 1$), $R_i = \sigma^2 I_{2\times 2}$. Develop explicit expressions for $\mathrm{E}[b_i|Y_i]$ and $\mathrm{var}(b_i|Y_i)$.

2. Use the MIT Growth and Development Study data subset (fat160.dat) to fit a linear mixed model with intercept (β_1), a slope before menarche (β_2) and another slope after menarche (β_3). Include also random intercept and slopes before and after menarche ($q = 3$). Assume conditional independence within a subject, $R_i = \sigma_w^2 I_{n_i \times n_i}$. How many parameters are there in this model? Report all the parameter and standard error estimates. For subject with ID 14, report a table with 4 columns; the observation times (relative to menarche), the observed values, the fitted values and the subject-specific predicted values. Plot the three sets with joined line segments on one graph. Comment. For the same subject, report the estimated covariance matrix ($\hat{\Sigma}_i$) and the corresponding correlation matrix. Describe the latter matrix.

   Use REML estimation (this is just to make the grading uniform).