STA 2402 Generalized Linear Models

Assignment **Duration: 2 Weeks**

Attempt all the questions; For questions 5 and 6 use R.

Date: March 26, 2025

1. Discuss the commonalities in GLMs.
2. Describe the Exponential family of distributions
3. Show that the Gamma distribution given by $f(y_i; \mu_i, \nu) = \left(\frac{\nu}{\mu_i}\right)^{\nu} \frac{y_i^{\nu-1} e^{\frac{\nu y_i}{\mu_i}}}{\Gamma(\nu)}$ belongs to the exponential family of distributions.
4. Discuss the deviance statistic and derive an expression for determining the deviance of:
   (a) Binomial distribution
   (b) Gamma distribution
5. Consider the example on the new drug is thought to check the development of symptoms of a particular disease (on Page 43 of the notes) of a study on 338 patients who were already infected with the disease. Fit the model in R allowing for interaction between Race and Drug. Present and explain your output.
6. Consider the blood clotting times in seconds under different plasma concentration in two lots of thromboplastin data. Fit a gamma response model with inverse link function to explain the clotting times by the concentrations; write the fitted model; comment on the goodness of fit of the model parameters; comment on the goodness of fit of the model; discuss the implications of the results and give a conclusion.
7. Describe parameter fitting in Poisson regression
8. When should we use Hierarchical Linear Models?
9. What are the problems with hierarchical data as compared to data used in linear regression?
10. Using an example of your choice, describe the model building of a three level hierarchical linear model.
11. Write the assumptions in the three-level model framework.