Biostatistics 209
Homework #1

For Questions 1-2, use the dataset `pbc.dta`.

For Question 3, use the dataset `actg019.dta`.

Question 1 [5 points]: Fit a Cox proportional hazards model to the PBC data with terms for histology and bilirubin

> [2 points] Adjusting for bilirubin, does histology appear to be a predictor of risk of death? Also implement the likelihood ratio test to verify it and summarize the result of the test.
>
> [2 points] Calculate the **three** HRs and their confidence intervals of death: Grade **1** histology relative to Grade 2, Grade **2** relative to Grade 3, Grade **3** histology relative to Grade 4. Give a brief interpretation of the results
>
> [1 point] Perform a test for trend and interpret the result, providing direction of effect.

Question 2 [3 points]: In the same model as you used in Question 1

> [1 point] Similar to 1(a), implement the likelihood ratio test for the effect of bilirubin (adjusting for histology). How do the results compare to the Wald (aka Z test)?
>
> [1 point] Calculate the HR and its confidence interval of death for every standard deviation increase in bilirubin.
>
> [1 point] How many units (mg/dL) increase in bilirubin will result in a HR of death in the same magnitude as histology of Grade 2 compared to Grade 1?

Question 3 [5 points]: Taken from VGSM: problem 6.8 (new edition) / 7.6 (old edition).

Note that for parts a) and b) you do not need Stata, just give expressions.

For the ACTG 019 data set, the Cox model allowing for an interaction between ZDV treatment `rx` and the baseline CD4 cell count `cd4` is:

$h(\texttt{days} \mid \texttt{rx}, \texttt{cd4}, \texttt{interaction}) = h_0(\texttt{days}) * \exp(\beta_1 * \texttt{rx} + \beta_2 * \texttt{cd4} + \beta_3 * \texttt{interaction})$

a) [1 point] Express the test of the null hypothesis of no interaction between CD4 and treatment in terms of the parameters of the model. *Note: In this Cox model, the* ***parameters*** *of interest are* β_1, β_2, *and* β_3.

b) [1 point] Again based on the parameters of the model, determine (as an expression) the hazard ratio for a ZDV-treated subject with x CD4 cells compared with a placebo-treated subject with x CD4 cells?

c) [2 points] Fit the model. Does there appear to be an interaction between treatment and CD4 stratum? If so, what is the interpretation?

d) [1 point] What are the hazard ratios for ZDV as compared to placebo for patients with 500, 109, and 50 CD4 cells, respectively?