Biostatistics 209
Homework #1

Due **April 15, 2014** *hardcopy in class* or prior to class to Olivia De Leon

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

(a) [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.

(b) [2 points] Calculate the **three** HRs and their confidence intervals of death comparing Grade **1** histology to Grade 2, Grade **2** to Grade 3, Grade **3** histology to Grade 4. Give a brief interpretation of the results

(c) [1 point] Perform a test for trend and interpret the result.
Note: p. 88, Table 4.8 (new edition) or p. 82, Table 4.5 (old edition) of VGSM textbook gives the appropriate linear combination for the trend test.

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

(a) [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)?

(b) [1 point] Calculate the HR and its confidence interval of death for every standard deviation increase in bilirubin.

(c) [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).

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 using the parameters of the model, what is 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?