Homework 8
BIOST 515
Due: March 9, 2004 **in class**
This assignment is worth 30 points.

1. Show how to obtain the proportional hazards estimates from the accelerated failure time estimates in the Weibull and exponential model. You will want to work with either $f(t)$ or $S(t)$.

2. The data from the Worcestor Heart Attack Study (WHAS) are available on the class website. Using the data from the WHAS for grouped cohort 1 (1975 and 1978), with the length of follow-up as the survival time variable and status at last follow-up as the censoring variable to answer the following questions.

   (a) Fit the Cox proportional hazards model containing age, sex, peak cardiac enzymes, left heart failure complications and MI order.

   (b) Assess the significance of the model using the partial likelihood ratio test.

   (c) Using the univariate Wald tests, which variables appear not to contribute to the model? Fit a reduced model and test for the significance of the variables removed using the partial likelihood ratio test.

   (d) Fit the reduced model in 2c using the Breslow, Efron and exact methods for tied survival times. Compare the estimates of the coefficients and standard errors for the three methods. Are the results similar or different?

   (e) Estimate the baseline hazard function for the model fit in 2c. Graph the estimated baseline hazard function versus time. What covariate pattern would a subject whose hazard is the baseline hazard have?

   (f) Repeat 2e using age centered at the median age of 65 years. Is the new baseline hazard different from the baseline hazard in 2e? If so, why?

3. Fit the same model you fit in 2c for grouped cohorts 2 and 3 (two separate models). Plot the estimated baseline hazards from these models on the same plot as the estimated hazard for grouped cohort 1. Does proportional hazards appear to hold between the groups? i.e. - is $h(t|YRGRP = 1)/h(t|YRGRP = 2)$ constant over time?

4. Using all the data from the WHAS (ignore cohort),

   (a) Fit the Cox PH model containing sex and estimate the hazard ratio and its 90% confidence interval. Interpret the point and interval estimates.

   (b) Is there a significant interaction between age and sex? (Use $\alpha = 0.10$ for this problem.)

   (c) Using the model fit in 4b, estimate the hazard ratio and its 90% confidence interval for gender at age 50, 60, 65, 70 and 80. Interpret.

   (d) Using the model fit in 4b, estimate the hazard ratio and its 90% confidence interval the hazard ratio for a 10 year increase in age for each gender. Interpret.