STA 6934 – Fall 2002 – Quiz 5

Print Name: **SSN:**

1) A health care provider would like to determine whether the plan a customer has chosen is associated with the probability they have elective cosmetic surgery. Plan A has the customer pay a hefty premium, and all procedures are paid fully by the health care provider. Plan B has the customer pay a lower premium, but customer has to pay 25% on any procedures they use. The firm's analyst has selected 200 customers (100 from Plan A and 100 from Plan B), and obtained all the records for each of the 200 customers. She observes the following variables:

- Y – 1 if customer had elective cosmetic surgery in past year, 0 if not

- X_1 – 1 if customer has Plan A, 0 if Plan B

- X_2 – 1 if female, 0 if male

- X_3 – 1 if over 40 years old, 0 if not

She fits a (multiple) logistic regression model, obtaining the following regression coefficients and standard errors:

Variable	$\hat{\beta}$	$\hat{\sigma}_{\hat{\beta}}$
Intercept	-1.0	0.5
X_1	1.0	0.4
X_2	0.5	0.5
X_3	0.8	0.2

a) Test whether the probability of having had elected cosmetic surgery differs for customers of the two plans, controlling for age and gender ($\alpha = 0.05$ significance level). Clearly state all elements of test and sketch the P-value. Hint: the appropriate test statistic can take on only positive values.

b) Give the estimated probability of having had elective cosmetic surgery for females over 40 who have chosen Plan A.

c) Give the estimated odds ratio of having elective cosmetic surgery for customers on Plan A (relative to customers on Plan B), controlling for gender and age.

2) Nonlinear regression curves are often fit in pharmacokinetic and pharmacodynamic (PK/PD) applications because:
   a) the responses are often interval scale (quantitative)
   b) of theoretical/biological considerations
   c) the responses are often categorical
   d) the times of measurement (PK) and doses (PD) are not evenly spaced

3) A group of 8 friends who recently received Pharm.D. degrees have been recruited by Walgreen's and Eckerd's (4 by each firm). All 8 stay with their original firms for their entire careers, and are treated as random samples from all newly hired Pharm.D.'s for the two firms. Of interest is the amount of time it takes to move from the rank of Assistant to Associate Pharmacist. For the four Walgreen's employees, the times are 6, 8, 12, and 15 months, respectively. For the four Eckerd's employees, the times are 10, 13, 15, and 20 months, respectively. Identify the survival functions for the two firms in the following graph. (Note that this represents "survival" in the rank of assistant pharmacist).

4) The time until death from beginning of treatment has been obtained for a group of heart patients. Each patient has been randomly assigned to receive either a new drug or a standard drug that has been in use for years ($X_1 = 1$ if the patient received the new drug, $X_1 = 0$ if (s)he received the standard drug). Other demographic/risk factors included:

- $X_2 - 1$ if age over 60, 0 if under 60

- $X_3 - 1$ if male, 0 if female

- $X_4 - 1$ if current or previous smoker, 0 if never smoker

- $X_5 - 1$ if current or previous drinker, 0 if never drinker

A proportional hazards (relative risk regression) model is fit based on over 2000 patients, with the main goal for testing for a new drug effect (relative to standard drug), while controlling for demographic/risk factors that are believed to be associated with risk of death. The following estimates and standard errors were obtained:

Variable	$\hat{\beta}_i$	$\hat{\sigma}_{\hat{\beta}_i}$
X_1	-1.50	0.30
X_2	1.00	0.25
X_3	0.50	0.30
X_4	1.40	0.35
X_5	0.80	0.60

a) Give a 95% confidence interval for β_1, the population regression coefficient corresponding to new drug effect (relative to standard).

b) Give an estimate and 95% confidence interval for the relative risk of death (new drug relative to standard)

c) Based on b), what statement best describes the results at the $\alpha = 0.05$ significance level?

i) Controlling for age, gender, smoking, and drinking, the new drug raises risk of death relative to standard
ii) Controlling for age, gender, smoking, and drinking, the new drug lowers risk of death relative to standard
iii) Controlling for age, gender, smoking, and drinking, the new drug has equal risk of death as standard

d) Which of the four demographic/risk factors are significantly associated with risk of death at $\alpha = 0.05$ significance level, controlling for all other factors?

5) The authors of a study comparing two survival functions, conduct the log-rank test (with null hypothesis that the two population survival functions are identical). They report a P-value of .0203. Based on this result and a significance level of $\alpha = 0.05$, what do they conclude?

6) Briefly describe your role in your in-class presentation (as well as topic). If you did not participate in one, you need to hand in a journal article identifying results, and which section/topic it makes use of).

Have a fun and safe semester break!!!!