Math 485 HW 3 due Monday, March 5

1. Problem 4.1 of the textbook

2. Problem 4.2 of the textbook

3. Problem 4.4 of the textbook

4. Problem 4.11 of the textbook

5. For the Horseshoe Crab data discussed in class, the following table shows SAS output for a Poisson loglinear model fit using X = weight and Y = number of satellites.
   (a) Estimate $E(Y)$ for female crabs of average weight, 2.44 kg.
   (b) Use $\hat{\beta}$ to describe the weight effect. Show how to construct the reported confidence interval.
   (c) Construct a Wald's test that Y is independent of X. Interpret.
   (d) Can you conduct a likelihood-ratio test of this hypothesis? If not, what else do you need?

Criterion	DF	Value	Value/DF
Deviance	171	560.8664	3.2799
Pearson Chi-Square	171	535.8957	3.1339
Log Likelihood		71.9524	

Parameter	DF	Estimate	Standard Error	Wald 95% Confidence Limits		Chi-Square	Pr>ChiSq
Intercept	1	-0.4284	0.1789	-0.7791	-0.0777	5.73	0.0167
weight	1	0.5893	0.0650	0.4619	0.7167	82.15	<.0001

6. A group of children five years of age and younger who were free of respiratory problems were enrolled in a cohort study examining the relationship between parental smoking and the subsequent development of asthma. The association between maternal cigarette smoking status and a diagnosis of asthma before the age of twelve was examined separately for boys and for girls.

		Asthma Diagnosis		
Gender	Smoking Status	Yes	No	Total
Boys	$\geq$ 1/2 Pack/Day	17	63	80
	$<$ 1/2 Pack/Day	41	274	315
Girls	$\geq$ 1/2 Pack/Day	8	55	63
	$<$ 1/2 Pack/Day	20	261	281

(a) Estimate the odds ratio of developing asthma for boys whose mothers smoke at least one-half pack of cigarettes per day versus those whose mothers smoke less than this.
(b) Estimate the corresponding odds ratio for girls.
(c) Conduct a test of homogeneity to determine whether it is appropriate to have a common odds ratio. What do you conclude?
(d) If it makes sense to do so, find an estimate for the common odds ratio and construct a 95% confidence interval.
(e) Is asthma diagnosis conditionally independent of smoking status given the gender?

7. For the 23 space shuttle flights that occurred before Challenger mission disaster in 1986, the following table shows the temperature (°F) at the time of the flight and whether at least one primary O-ring suffered thermal distress.

Ft	Temp	TD	Ft	Temp	TD	Ft	Temp	TD
1	66	0	9	57	1	17	70	0
2	70	1	10	63	1	18	81	0
3	69	0	11	70	1	19	76	0
4	68	0	12	78	0	20	79	0
5	67	0	13	67	0	21	75	1
6	72	0	14	53	1	22	76	0
7	73	0	15	67	0	23	58	1
8	70	0	16	75	0			

(a) Use logistic regression to model the effect of temperature on the probability of the thermal distress. Interpret the model fit.
(b) Calculate the predicted probability of thermal distress at 31°, the temperature at the time of the Challenger flight. At what temperature does the predicted probability equal 0.5? At that temperature, give a linear approximation for the change in the predicted probability per degree increase in temperature.
(c) Interpret the effect of temperature on the odds of thermal distress. Test the hypothesis that temperature has no effect, using (i) the Wald test, (ii) the likelihood-ratio test.