P8131 Spring 2024 Homework #2

Due on February 20 at 11:59 pm

1. (40%) The table below gives the data collected from a bioassay study in which X variable (treated as continuous variable) is the concentration level. At each of five different dose levels (0-4), 30 animals are tested and the number of dying are recorded.

Dose (X)	0	1	2	3	4
Number of dying	2	8	15	23	27

   Fit the model $g(P(\text{dying})) = \alpha + \beta X$, with logit, probit, and complementary log-log links.

   (a) Fill out the table and give comments.

Model	Estimate of β	CI for β	Deviance	$\hat{p}(\text{dying}\|x = 0.01)$
logit				
probit				
c-log-log				

   (b) Suppose that the dose level is in natural logarithm scale, estimate LD50 with 90% confidence interval based on the three models.

2. (60%) The table below contains the enrollment data of some MPH program in a year

   - Amount: one-time two-year scholarship
   - Offer: the number of offers made with the corresponding scholarship
   - Enrolls: the number of offer accepted

Amount (in thousand dollars)	Offers	Enrolls
10	4	0
15	6	2
20	10	4
25	12	2
30	39	12
35	36	14
40	22	10
45	14	7
50	10	5
55	12	5
60	8	3
65	9	5
70	3	2
75	1	0
80	5	4
85	2	2
90	1	1

Please analyze the data using a logistic regression and answer the following questions:

(a) How does the model fit the data?

(b) How do you interpret the relationship between the scholarship amount and enrollment rate? What is 95% CI?

(c) How much scholarship should we provide to get 40% yield rate (the percentage of admitted students who enroll?) What is the 95% CI?