

Homework 6

ISyE 6420

Spring 2021

1. Airfreight Breakage. A substance used in biological and medical research is shipped by air freight to users in cartons of 5,000 ampules. The data below, involving ten shipments, were collected on the number of times a carton was transferred from one aircraft to another over the shipment route (X) and the number of ampules found to be broken upon arrival (Y).

X	NA	1	0	2	0	3	1	0	1	2	0	2
Y	18	16	9	17	12	22	13	8	15	19	11	NA

(a) Fit Y by Poisson regression, with X as a covariate. Report the deviance of your fit. Use noninformative priors.

(b) According to your model, how many packages on average are expected will be broken if the number of shipment routes is $X = 4$? What is 95% CS for your estimate.

(c) For a particular package sent from Shenzhen you learned that a shipment would involve $X = 4$ shipping routes. Predict the number of broken packages. What is here different from (b)?

(d) What are estimates for unobserved X_1 and Y_{12} ?

Hint. Note that for missing X , you need to specify the distribution. It could be any nonnegative valued distribution, but since X is discrete, a good choice is $\text{Poisson}(2)$, as in

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for(i in 1:n){  
  x[i] ~ dpois(2)}
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2. Exercise Stress Test. Campbell and Swinscow (2009) describe an experiment in which twenty patients, ten of normal weight and ten severely overweight underwent an exercise stress test. The patients had to lift a progressively increasing load for up to 12 minutes, but they were allowed to stop earlier if they could do no more. On two occasions the equipment malfunctioned before 12 minutes. The times (in minutes) achieved were:

Normal weigh	2, 4, 6, 8, 8**, 9, 10, 12*, 12*, 12*
Overweight	1, 3, 4, 5, 6, 7, 7**, 9, 11, 12*

Here, * means that the end of test was reached, and ** stands for equipment malfunction.

Assume that the equipment does not fail and test does not have 12 minutes time limit, that is, all subjects are to stop only if they could do no more.

Compare mean times to stopping for the two groups. Is the difference in mean times significant?

Hint. Propose a parametric model, use censoring, and set noninformative priors on all parameters. There is no a unique way to model this data.