

Homework 6

ISyE 6420

Fall 2020

1. Potato Leafhopper. Length of developmental period (in days) of potato leafhopper, *Empoasca fabae*, from egg to adult seem to be dependent on the temperature. The original data were weighted means, but for purpose of this analysis we shall consider them as though they were single observed values. Also we omitted one temperature (Temp) and two developmental periods (Develop), and treat them as missing data.

Temp°F	59.8	67.6	70.0	NA	74.0	75.3	78.0	80.4	81.4	83.2	88.4	91.4	92.5
Develop(days)	58.1	27.3	26.8	26.3	19.1	NA	16.5	15.9	14.8	14.2	14.4	NA	15.3

(a) Fit linear regression where variable Develop is predicted by the Temp. Use standard noninformative priors on all parameters.

(b) Estimate all missing values and find 90% credible sets.

2. Dukes' C Colorectal Cancer and Diet Treatment. Colorectal cancer is a common cause of death. In the advanced stage of disease, when the disease is first diagnosed in many patients, surgery is the only treatment. Cytotoxic drugs, when given as an adjunct to surgery, do not prevent relapse and do not increase the survival in patients with advanced disease.

Interest has been shown, at least by patients, in a nutritional approach to treatment, where diet plays a critical role in the disease management program.

In a controlled clinical trial, McIlmurray and Turkie (1987) evaluated the diet treatment in patients with Dukes' C colorectal cancer, because the residual tumour mass is small after operation, the relapse rate is high, and no other effective treatment is available. The diet treatment consisted of linolenic acid, an oil extract of the seed from the evening primrose plant *Onagraceae Oenothera biennis* and vitamin E.

The data for the treatment and control patients are given below:

Treatment	Survival time (months)
Linoleic acid ($n_1 = 25$)	1+, 5+, 6, 6, 9+, 10, 10, 10+, 12, 12, 12, 12, 12+, 13+, 15+, 16+, 20+, 24, 24+, 27+, 32, 34+, 36+, 36+, 44+
Control ($n_2 = 24$)	3+, 6, 6, 6, 6, 8, 8, 12, 12, 12+, 15+, 16+, 18+, 18+, 20, 22+, 24, 28+, 28+, 28+, 30, 30+, 33+, 42

Fit the data with Weibull distribution, taking the treatment/control (1/0) as a covariate. Place noninformative priors on all parameters. Is the linoleic acid treatment beneficial? Comment.