1. Vasoconstriction. The data give the presence or absence ($y_i = 1$ or 0) of vasoconstriction in the skin of the fingers following inhalation of a certain volume of air (v_i) at a certain average rate (r_i). Total number of records is 39. The candidate models for analyzing the relationship are the usual `logit`, `probit`, `cloglog`, `loglog`, and `cauchyit` models.

Data are given as follows.

```
y:1,1,1,1,1,1,0,0,0,0,0,0,0,1,1,1,1,1,
0,1,0,0,0,0,1,0,1,0,1,0,1,0,0,1,1,1,0,0,1

v:3.7, 3.5, 1.25, 0.75, 0.8, 0.7, 0.6, 1.1, 0.9, 0.9,
0.8, 0.55, 0.6, 1.4, 0.75, 2.3, 3.2, 0.85, 1.7, 1.8,
0.4, 0.95, 1.35, 1.5, 1.6, 0.6, 1.8, 0.95, 1.9, 1.6,
2.7, 2.35, 1.1, 1.1, 1.2, 0.8, 0.95, 0.75, 1.3

r:  0.825, 1.09, 2.5, 1.5, 3.2, 3.5, 0.75, 1.7, 0.75,
0.45, 0.57, 2.75, 3, 2.33, 3.75, 1.64, 1.6, 1.415,
1.06, 1.8, 2, 1.36, 1.35, 1.36, 1.78, 1.5, 1.5, 1.9,
0.95, 0.4, 0.75, 0.3, 1.83, 2.2, 2, 3.33, 1.9, 1.9, 1.625
```

(a) Transform covariates v and r as

$$x_1 = \log(10 \times v), \quad x_2 = \log(10 \times r).$$

(b) Estimate posterior means for coefficients in the logit model. Use noninformative priors on all coefficients.

(c) For a subject with $v = r = 1.5$, find the probability of vasoconstriction.

(d) Compare with the result of `probit` model. Which has smaller deviance?

2. Magnesium Ammonium Phosphate and Chrysanthemums. Walpole et al. (2007) provide data from a study on the effect of magnesium ammonium phosphate on the height of chrysanthemums, which was conducted at George Mason University in order to determine a possible optimum level of fertilization, based on the enhanced vertical growth response of the chrysanthemums. Forty chrysanthemum seedlings were assigned to 4 groups, each containing 10 plants. Each was planted in a similar pot containing a uniform growth medium. An increasing concentration of $MgNH_4PO_4$, measured in grams per bushel, was added to each plant. The 4 groups of plants were grown under uniform conditions in a greenhouse for a period of 4 weeks. The treatments and the respective changes in heights, measured in centimeters, are given in the following table:

Treatment			
50 g/bu	100 g/bu	200 g/bu	400 g/bu
13.2	16.0	7.8	21.0
12.4	12.6	14.4	14.8
12.8	14.8	20.0	19.1
17.2	13.0	15.8	15.8
13.0	14.0	17.0	18.0
14.0	23.6	27.0	26.0
14.2	14.0	19.6	21.1
21.6	17.0	18.0	22.0
15.0	22.2	20.2	25.0
20.0	24.4	23.2	18.2

Solve the problem as a Bayesian one-way ANOVA. Use STZ constraints on treatment effects.

(a) Do different concentrations of $MgNH_4PO_4$ affect the average attained height of chrysanthemums? Look at the 95% credible sets for the differences between treatment effects.

(b) Find the 95% credible set for the contrast $\mu_1 - \mu_2 - \mu_3 + \mu_4$.

3. Hocking–Pendleton Data. This popular data set was constructed by Hocking and Pendelton (1982) to illustrate influential and outlier observations in regression. The data are organized as a matrix of size 26×4; the predictors x_1, x_2, and x_3 are the first three columns, and the response y is the fourth column. The data are given in `hockpend.dat`.

(a) Fit the linear regression model with the three covariates, report the parameter estimates and Bayesian R^2 .

(b) Is any of the 26 observations influential or outlier (in the sense of CPO and `comulative`)?

(c) Find the mean response and prediction response for a new observation with covariates $x_1^* = 10, x_2^* = 5$, and $x_3^* = 5$. Report the corresponding 95% credible sets.