

# Bayes, HW 5, Due March 2

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# 1. Looking at the Hierarchical Means Posterior

In class we looked at code to run the hierarchical normal means problem using the math test scores data.

We look looked at the posterior means of the  $\theta_j$  and compared them to the  $\bar{y}_j$ .

Suppose you were an administrator that wanted to asses the overall performance of the schools.

Given the model,

$$\theta_j \sim N(\mu_\theta, \sigma_\theta^2)$$

Overall, what the the “average” test scores from diffent schools like ?

How much variation is there from school to school in mean test scores ?

It seems like looking at the posteriors of  $\mu_\theta$  and  $\sigma_\theta$  address

## 2. Inference for a Missing School

Suppose there is another school for which we have no data.

Let  $\theta_M$  denote the mean test score for that school ( $M$  for “missing”).

Under our hierarchical means model, what is the distribution of the unknown  $\theta_M$  given the data on the other schools?

### 3. The Zagat Data Regression

The data for this question is in the file `zagat.csv`. The data is from the Zagat restaurant guide.

There are 114 observations and each observation corresponds to a restaurant.

There are 4 variables:

price: the price of a typical meal

food: the zagat rating for the quality of food.

service: the zagat rating for the quality of service.

decor: the zagat rating for the quality of the decor.

We want to see how the price of a meal relates the quality characteristics of the restaurant experience as measured by the variables food, service, and decor.

We will use the normal error regression model:

## 4. Testing the Common Coefficient Model

It would be nice if  $\beta_1 = \beta_2 = \beta_3$  because then the price would be related to the average of the three quality measures.

For each draw from the posterior of  $\beta$  compute

$$\beta_j^d = \beta_j - \bar{\beta}$$

where

$$\bar{\beta} = \frac{\beta_1 + \beta_2 + \beta_3}{3}$$

What do these marginal posteriors tell us about the hypothesis of equal coefficients?