

Please note the due date, Thursday, June 4. Question 4 for PhD students only.
 Collaboration among students is not permitted.

1. GLM 4.26.

2. The following data were collected in a food-tasting experiment, with four packaged food mixes presented as pairs in various orders. Analyze the data and give a brief summary of your conclusions. Comment on the magnitude of the order effect relative to difference between the four food types.

Pair (s, t)	Order	Frequency of response			Total
		Prefer s	No preference	Prefer t	
1, 2	1, 2	23	8	11	42
	2, 1	6	8	29	43
1, 3	1, 3	27	5	11	43
	3, 1	14	6	22	42
1, 4	1, 4	35	1	6	42
	4, 1	11	4	27	42
2, 3	2, 3	34	1	6	41
	3, 2	16	3	23	42
2, 4	2, 4	29	2	9	40
	4, 2	15	5	22	42
3, 4	3, 4	26	5	11	42
	4, 3	14	5	24	43

Explain why the assumption of independence of observations is not tenable for these data. Explain also why the assumption of independence is unlikely to lead to misleading conclusions regarding the estimated effects.

You may assume for simplicity that all observations are independent. To construct a model, assume that the quality of each food type is characterized by a real-valued parameter α , such that the probability of a being preferred to b is governed by the difference in qualities $\alpha_a - \alpha_b$.

3. For model (11.2) applied to the data in Table 11.4, plot the profile residual deviance as a function of θ . Hence obtain a 90% confidence interval for the relative potency of insulin to A1-B29 insulin.

4. The observations Y_{ij} in a square table of order k are independent, and normally distributed with equal variance. For each $0 \leq \theta < \pi$, the linear model

$$E(Y_{ij}) = \alpha_i \cos \theta + \alpha_j \sin \theta$$

is fitted. Show that the residual sum of squares $RSS(\theta)$ has the form

$$RSS(\theta) = a + b \cos(2\theta - 2\hat{\theta})$$

Find expressions for a and b .

Does this result hold if the diagonal entries are missing? Explain.