Common models and multiple factor ANOVA

5/5 points (100%)

Quiz, 5 questions

✔ **Congratulations! You passed!**

<div style="border:1px solid blue; display:inline-block; padding:10px">Next Item</div>

✔ 1 / 1
points

1.
For Questions 1 and 2, consider the Anscombe data from the `car` package in R which we analyzed in the quizzes for Lesson 7.

In the original model, we used normal priors for the three regression coefficients. Here we will consider using Laplace priors centered on 0. The parameterization used in JAGS for the Laplace (double exponential) distribution has an inverse scale parameter τ. This is related to the variance v of the prior in the following way: $v = 2/\tau^2$. Suppose we want the Laplace prior to have variance $v = 2$. What value of τ should we use in the JAGS code?

1

Correct Response
Alternatively, we could place an informative prior on τ and learn it along with other parameters.

✔ 1 / 1
points

2.

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When using an informative variable selection prior like the Laplace, we typically center and scale the data:

```
1   library("car")
2   data("Anscombe")
3   head(Anscombe)
4   ?Anscombe
5
6   Xc = scale(Anscombe, center=TRUE, scale=TRUE)
7   str(Xc)
8
9   data_jags = as.list(data.frame(Xc))
```

Because we subtracted the mean from all (continuous) variables including the response, this is a rare case where we do not need an intercept. Fit the model in JAGS using the Laplace prior with variance 2 for each of the three coefficients, and an inverse gamma prior for the observation variance with effective sample size 1 and prior guess 1.

How do the inferences for the coefficients compare to the original model fit in the quiz for Lesson 7 (besides that their scale has changed due to scaling the data)?

○ The inferences are similar, with one exception. The first two coefficients (for income and percentage youth) are significantly positive and the percent urban coefficient's posterior looks like the Laplace prior, with a spike near 0. This indicates that the percent urban "effect" is very weak.

○ The inferences are vastly different. The marginal posterior for all three coefficients look like their Laplace priors, with a spike near 0. This indicates that the "effect" associated with each covariate is very weak.

○ Inexplicably, the signs of all coefficients have changed (from positive to negative and from negative to positive).

◉ The inferences are essentially unchanged. The first two coefficients (for income and percentage youth) are significantly positive and the percent urban coefficient is still negative.

Correct

✔ 1 / 1
points

3.

Consider an ANOVA model for subjects' responses to three experimental factor variables related to a proposed health supplement: dose, frequency, and physical activity. Dose has two levels: 100mg and 200mg. Frequency has three levels: "daily," "twice-weekly," and "weekly." Physical activity has two levels: "low" and "high." If these are the only covariates available and we assume that responses are iid normally distributed, what is the maximum number of parameters we could potentially use to uniquely describe the mean response?

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Correct Response

There are $2 \times 3 \times 2$ total treatment combinations. If not every treatment combination is observed, then a model with fewer parameters would be necessary.

✔ 1 / 1
    points

4.

If we have both categorical *and* continuous covariates, then it is common to use the linear model parameterization instead of the cell means model. If it is unclear how to set it up, you can use the `model.matrix` function in R as we have in the lessons.

Suppose that in addition to the experimental factors in the previous question, we have two continuous covariates: weight in kg and resting heart rate in beats per minute. If we use 100mg dose, daily frequency, and low physical activity as the baseline group, which of the following gives the linear model parameterization for an additive model with no interactions?

○ $\mathrm{E}(y_i) = \beta_0 + \beta_1 I_{\mathrm{dose}_i=200} + \beta_2 I_{\mathrm{freq}_i=\texttt{twice weekly}} + \beta_3 I_{\mathrm{freq}_i=\texttt{weekly}} + \cdots$
      $\cdots + \beta_4 I_{\mathrm{phys}_i=\texttt{high}} + \beta_5 \texttt{weight}_i + \beta_6 \texttt{heart}_i$

▲

Correct

○ $\mathrm{E}(y_i) = \mu_{g_i} + \beta_1 \texttt{weight}_i + \beta_2 \texttt{heart}_i$ for $g_i \in \{1, 2, \ldots, 12\}$

○ $\mathrm{E}(y_i) = \beta_0 + \beta_1 I_{\mathrm{dose}_i=100} + \beta_2 I_{\mathrm{freq}_i=\texttt{daily}} + \beta_3 I_{\mathrm{phys}_i=\texttt{low}} + \cdots$
      $\cdots + \beta_4 \texttt{weight}_i + \beta_5 \texttt{heart}_i$

○ $\mathrm{E}(y_i) = \mu_{g_i} + \beta_1 \texttt{weight}_i + \beta_2 \texttt{heart}_i$ for $g_i \in \{1, 2, \ldots, 7\}$

✔ 1 / 1
    points

5.

The reading in this honors section describes an analysis of the warp breaks data. Of the

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we did not assess whether constant observation variance across all groups was appropriate. Re-fit the model with a separate variance for each group. For each variance, use an Inverse-Gamma(1/2, 1/2) prior, corresponding to prior sample size 1 and prior guess 1 for each variance.

Report the DIC value for this model, rounded to the nearest whole number.

> 75

Correct Response

The DIC for this model is much higher than for the other models, suggesting that separate variances does not improve predictive accuracy in this model. However, the variance for the last group does appear to be smaller than the others, which may affect our inferences for the mean of the last group.