

1. True or False: If the  $R^2$  value is low (less than 0.2), then the model assumptions in Bayesian regression are violated.

1 / 1 point

- ☐ True
- ☒ False

✓ **Correct**

A low  $R^2$  does not inherently violate any model assumptions. However, this depends on application. In physics, a low  $R^2$  implies poor model specification, while in economics or biology, a low  $R^2$  often comes with the territory.

This question refers to the following learning objective(s):

- Identify the assumptions of linear regression and assess when a model may need to be improved.

2. Suppose we want to set a level  $k$  such that if we observe a data point more than  $k$  standard deviations away from the mean, we deem it an outlier. If the number of observations is 100, what is the probability that we observe at least one outlier that is at least 3 standard deviations away from its predicted value?

1 / 1 point

- ☐ 0.006
- ☒ 0.237
- ☐ 0.763
- ☐ 0.933

✓ **Correct**

As the sample size increases, the expected number of points that deviate by  $k$  standard deviations also increases. Hint - remember that residuals are normally distributed and hence we can use the command  $(1 - 2 * \text{pnorm}(-k))^N$  to find the probability that all  $N$  points are within  $k$  standard deviations of their predicted value.

This question refers to the following learning objective(s):

- Check the assumptions of a linear model
- Identify outliers and high leverage points in a linear model.

3. True or False: The Bayesian Information Criterion (BIC) penalizes the number of parameters used by a constant penalty  $k$  (usually  $k = 2$ ).

1 / 1 point

- ☐ True
- ☒ False

✓ **Correct**

The procedure above describes AIC, or Akaike's Information Criterion, which is similar to BIC. The penalty for BIC is the log of the sample size.

$$\text{AIC} = 2k - 2 \log(L)$$

$$\text{BIC} = -2L + \log(n)k$$

Notation:  $L$  corresponds to the maximum value of the log-likelihood;  $n$  is the sample size, and  $k$  is the number of parameters in the model.

This question refers to the following learning objective(s):

- Use principled statistical methods to select a single parsimonious model.

4. In Bayesian regression, what will happen if the priors on the regression coefficients  $\beta$  are not normal?

1 / 1 point

- ☐ The assumptions underlying Bayesian regression are violated, so we cannot do Bayesian regression anymore.
- ☒ The posterior distribution will not be conjugate, and Monte Carlo methods will need to be used to estimate the parameters.
- ☐ The posterior distribution will still be conjugate, and we can calculate everything by hand as before.

✓ **Correct**

This question refers to the following learning objective(s):

- Deduce how wrong model assumptions affect model results.

5. True or False: When selecting a single model after conducting an analysis with Bayesian model averaging, the model with the highest posterior model probability should be chosen.

**1 / 1 point**☐ True☒ False**Correct**

This question refers to the following learning objective(s):

- Implement Bayesian model averaging for both prediction and variable selection.