Week 3 Quiz

5/10 points earned (50%)

You haven't passed yet. You need at least 80% to pass.
Review the material and try again! You have 3 attempts every 8 hours.

Review Related Lesson

1 / 1 points

1.
For which of the following situations would a quadratic loss function make the most sense?

- Your prediction as to whether it will rain tomorrow.
- A doctor's estimate for the life expectancy of a terminally ill patient.

Correct
Correct Answer. Large mistakes in estimating life expectancy would particularly painful for both the patient and their family.

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

- Understand the concept of loss functions and how they relate to Bayesian decision making.

- Your prediction for the number of bikes sold this year by a local bike shop.
- Your answer choice on a Coursera multiple choice quiz.

1 / 1
points

2.
Fill in the blank: Under a **linear loss function**, the summary statistic that minimizes the posterior expected loss is the ________ of the posterior.

Mean

Median

Correct
Correct Answer. The median is the summary statistic that minimizes the posterior expected loss under the linear loss function.

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

- Understand the concept of loss functions and how they relate to Bayesian decision making.

Mode

---

0 / 1
points

3.
You are employed in the Human Resources department of a company and are asked to predict the number of employees that will quit their jobs in the coming year. Based on a Bayesian analysis of historical data, you determine the posterior predictive distribution of the number of quitters to follow a Poisson($\lambda = 10$) distribution. Given a **quadratic** loss function, what is the prediction that minimizes posterior expected loss?

a. 9

b. 10

c. 11

This should not be selected
11 is not the posterior mean of Poisson($\lambda = 10$). Since the loss function is quadratic, the mean of the posterior distribution minimizes the posterior expected loss.

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

- Make optimal decisions given a posterior distribution and a loss function.

d. Either a or b

0 / 1 points

4.
Suppose that you are trying to decide whether a coin is biased towards heads ($p = 0.75$) or tails ($p = 0.25$). If you decide incorrectly, you incur a loss of 10. Flipping another coin incurs a cost of 1. If your current posterior probability of a head-biased coin is 0.6, should you make the decision now or flip another coin and then decide?

Flip another coin, since the minimum posterior expected loss of making the decision now is 4, while the minimum posterior expected loss of making the decision after seeing another coin flip is between 2 and 3.

This should not be selected

Using Bayes rule and the prior, if you observe tails, you should predict a tails bias and if you observe heads, you should predict a heads bias. Use that decision rule to find the posterior expected loss.

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

- Decide between hypotheses given a loss function: Make optimal decisions given a posterior distribution and a loss function.

Flip another coin, since the minimum posterior expected loss of making the decision now is 4, while the minimum posterior expected loss of making the decision after seeing another coin flip is between 3 and 4.

Make the decision now, since the minimum posterior expected loss of making the decision now is 4, while the minimum posterior expected loss of making the decision after seeing another coin flip is between 4 and 5.

Make the decision now, since the minimum posterior expected loss of making the decision now is 4, while the minimum posterior expected loss of making the decision after seeing another coin flip is between 5 and 6.

0 / 1
points

5.
You are testing a hypothesis H_1 against an alternative hypothesis H_2 using Bayes Factors. You calculate $BF[H_1 : H_2]$ to be 0.427. According to guidelines first given by Jeffreys (and presented in the lecture), what conclusion can be drawn from the data?

- The data provides significant evidence against H_1.
- The data provides strong evidence against H_1.
- The data provides strong evidence against H_2.

This should not be selected

Refer to lecture "Posterior probabilities of hypotheses and Bayes factors" to review interpretation of Bayes Factors. The greater $BF[H_1 : H_2]$, the stronger the evidence against H_2.

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

- Compare multiple hypotheses using Bayes Factors.

- The data provides little to no evidence against H_1.

---

0 / 1
points

6.
Suppose that you are trying to estimate the true proportion p of male births in the United States. Starting with a uniform prior (Beta(1,1)) on p, you randomly sample 10,000 birth certificates, observing 5029 males and 4971 females. What is the posterior probability that p is less than or equal to 0.5?

- 0.27
- 0.28
- 0.29

This should not be selected

Recall the conjugacy of the Beta-Binomial model. Use the pbeta function in R to calculate the posterior probability that p is less than 0.5.

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

- Conceptualize Lindley's paradox and how the Bayes Factor depends on prior elicitation
- Make inferences about a proportion using a conjugate Beta prior.

0.30

---

0 / 1
points

7.
True or False: A Bayesian hypothesis test for a mean $\mu = 0$ using a concentrated prior on μ will yield nearly identical results to a hypothesis test with a high-variance prior μ?

True

This should not be selected
When testing hypotheses using Bayes Factors, prior specification is highly important. If the prior puts most of its mass on implausible values, the null model will be disproportionately favored.

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

- Conceptualize Lindley's paradox and how the Bayes Factor depends on prior elicitation
- Compare multiple hypotheses using Bayes Factors.

False

---

1 / 1
points

8.

Suppose you are trying to infer the difference in the proportion of yellow M&Ms between two bags of M&Ms. Each bag is estimated to contain roughly 30 M&Ms. To make inferences about the proportion, you draw 10 M&Ms from each bag **with** replacement and record the number of yellow M&Ms in each bag.

Is there a problem with the experimental design? If so, what is it?

- Yes, the probability of drawing a yellow M&M is not independent between groups.
- Yes, the probability of drawing a yellow M&M is not independent within groups.
- There is no problem with the experimental design.

Correct

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

- Identify assumptions relating to a statistical inference.

---

1 / 1 points

9.

Suppose that when testing $H_0 : p = 0.5$ versus $H_1 : p \neq 0.5$ using Bayes Factors, we get the posterior probability $P(H_0 \mid \text{data}) = 0.25$. Conditional on H_1, the posterior mean of p is 0.6. Under **quadratic** loss, what is the point estimate for p that minimizes expected posterior loss?

- 0.5
- 0.55
- 0.575

Correct

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

- Create point estimates and credible intervals by averaging over multiple hypotheses
- Make optimal decisions given a posterior distribution and a loss function.

0.6

1 / 1 points

10.
True or False: The use of the reference prior $Beta(1/2, 1/2)$ has little bearing on the results of a hypothesis test comparing $p = 0.5$ versus $p \neq 0.5$, provided that the sample size is sufficiently large.

True

False

Correct

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

- Conceptualize Lindley's paradox and how the Bayes Factor depends on prior elicitation.