✖

Week 1 Quiz

✖ **6/10** points earned (60%)

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

0 / 1
points

1.
A New York City cab was involved in a hit-and-run accident last night. Five witnesses reported the incident, four of whom said that the cab was green and one of whom said that the cab was yellow. Assume each witness correctly identifies the color of a cab with probability 2/3. It is known that 85% of registered cabs in New York City are yellow and 15% are green. Based on this information, what is the probability that the cab was green?

- 41.5%

Incorrect Response
We are trying to find the probability that the cab was green, not yellow.

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

- Work with the discrete form of Bayes' rule

- 58.5%
- 15.0%
- 88.9%

0 / 1

points

2.

Suppose ten people are sampled from the population and their heights are recorded. Further suppose their heights are distributed normally, with unknown mean μ and unknown variance σ^2 . Which of the following statements best describes the likelihood of the data Y in this situation?

- The probability of observing heights with a mean at least as extreme as $\bar{Y}$, given μ and σ^2.
- The probability of observing the data, given μ , σ^2, and the prior.
- The probability of observing the data, given μ, σ^2.
- The probability of observing the data, given the prior beliefs about the distribution of μ and σ^2 .

Incorrect Response

Recall the definition of likelihood, which is the probability of the data given the unknown parameters.

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

- Define the concepts of prior, likelihood, and posterior probability and identify how they relate to one another

0 / 1
points

3.

Recall the probability distribution of a Poisson random variable X:

$$P(X = x) = \frac{\lambda^x e^{-\lambda}}{x!}$$

where λ is the rate parameter that equals the expected value of X .

John is analyzing traffic patterns on a country road. He believes that the number of cars that come during a given hour follows a Poisson distribution with rate λ. Further, he believes that either $\lambda = 1$, $\lambda = 2$, or $\lambda = 4$ and assigns equiprobable beliefs to each of the possible values of λ. He observes traffic for one hour and records a total of three cars passing.

Consider the following hypotheses:

H0: $\lambda < 2$

H1: $\lambda = 2$

H2: $\lambda > 2$

Which of the hypotheses has the greatest posterior probability?

- ( ) H_0

Incorrect Response
Since each value of _ is equiprobable, the prior probability that λ takes on each of the three values is 1/3. Use the probability mass function of the Poisson distribution as the likelihood.

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

- Use Bayes' rule to compare multiple hypotheses about a discrete random variable: Work with the discrete form of Bayes' rule

- ( ) H_1
- ( ) H_2

---

1 / 1
points

4.
Suppose you are given a coin and told that it is either a fair coin or a trick coin. You do not know whether the coin is fair (p = 0.5) or whether it always comes up heads (p = 1) and assign an initial prior probability q that your coin is a trick coin. In terms of q and assuming q < 0.95, how many heads in a row N need to come up for the posterior probability of a trick coin to be greater than 0.95?

- $N > -\log_2(\frac{1-q}{19q})$
- $N > -\log_2(\frac{q}{19(1-q)})$

Correct Response

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

- Update prior probabilities through an iterative process of data collection

- $N > -\log_2(\frac{1-q}{20q})$
- $N > -\log_2(\frac{q}{20(1-q)})$

---

1 / 1
points

5.

Which of the following corresponds to a Frequentist interpretation of the statement “the probability of rain tomorrow is 30 percent”?

- A degree of belief of 0.3, where 0 means rain is impossible and 1 means rain is certain.
- If we predicted rain tomorrow, we would be 30% confident in our prediction.
- If conditions identical to tomorrow occurred an infinite number of times, we would observe rain on 30 percent of those days.

Correct Response

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

- Understand the differences between Frequentist and Bayesian definitions of probability and how they apply to inference

- Under similar conditions, it has rained 30 percent of the time in the past.

---

1 / 1
points

6.
Sander runs a controlled experiment to test the hypothesis that rats treated with 10 mg of Vitamin A have higher mortality rates than rats not given Vitamin A. After every death, he checks to see whether the p-value under the null hypothesis of no difference is below 0.05. If the p-value is greater than 0.05, he keeps collecting data. Otherwise, he stops collecting data and reports his results. If, after 10,000 deaths, he does not get significant results, he stops. Under a **Bayesian** framework, what is the problem with Sander's experimental design?

- The posterior distribution will be biased, since Sander was intent on getting a specific result before the experiment began

- There is no problem with Sander's design; the posterior only depends on the entirety of the data and the prior beliefs before the experiment.

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

- Understand the differences between Frequentist and Bayesian definitions of probability and how they apply to inference

- By making a stopping rule that was dependent on his results, he made it more probable that he would get results suggesting Vitamin A increases rat mortality rates.

- Sander excluded the possibility of getting a p-value larger than 0.05 by stopping the experiment prematurely

---

0 / 1
points

7.
Hearing about your brilliant success in working with M&Ms, Mars Inc. transfers you over to the Skittles department. They recently have had complaints about tropical Skittles being mixed in with original Skittles. You decide to conduct a frequentist analysis. Although you are confident that the quality control measures result in less than 1% of all regular Skittles accidentally being tropical Skittles, you understand that things need to change if the complaints are true, so you set the significance level $\alpha = 0.1$. Randomly sampling 300 supposedly original Skittles, you find that five of them are tropical. What are your findings? Hint- $H_0 : p \leq 0.01$ and $H_1 : p > 0.01$.

- Reject H_0, since the p-value is equal to 0.027, which is less than $\alpha = 0.1$

Fail to reject H_0, since the p-value is equal to 0.184, which is greater than $\alpha = 0.1$

Fail to reject H_0, since the p-value is equal to 0.101, which is greater than $\alpha = 0.1$

Incorrect Response

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

- Conduct both a Bayesian and Frequentist analysis of data to make inferences about a proportion

Fail to reject H_0, since the p-value is equal to 0.245, which is greater than $\alpha = 0.1$

---

1 / 1
points

8.
In the NFL, a professional American football league, there are 32 teams, of which 12 make the playoffs. In a typical season, 20 teams (the ones that don't make the playoffs) play 16 games, 4 teams play 17 games, 6 teams play 18 games, and 2 teams play 19 games. At the beginning of each game, a coin is flipped to determine who gets the football first. You are told that an unknown team won ten of its coin flips last season. Given this information, what is the posterior probability that the team did not make the playoffs (i.e. played 16 games)?

0.556

Correct Response

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

- Conduct both a Bayesian and Frequentist analysis of data to make inferences about a proportion

0.589

0.612

0.625

---

1 / 1

points

9.

You are testing dice for a casino to make sure that sixes do not come up more frequently than expected. Because you do not want to manually roll dice all day, you design a machine to roll a die repeatedly and record the number of sixes that come face up. In order to do a Bayesian analysis to test the hypothesis that p = 1/6 versus p = .175 , you set the machine to roll the die 6000 times. When you come back at the end of the day, you discover to your horror that the machine was unable to count higher than 999. The machine says that 999 sixes occurred. Given a prior probability of 0.8 placed on the hypothesis p = 1/6 , what is the posterior probability that the die is fair, given the censored data? Hint - to find the probability that at least x sixes occurred in N trials with proportion p (which is the likelihood in this problem), use the R command :

```
1-pbinom(x-1,N,p)
```

- 0.500
- 0.684

Correct Response

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

- Use Bayes’ rule to compare multiple hypotheses about a discrete random variable
- Work with the discrete form of Bayes’ rule

- 0.800
- 0.881

1 / 1
points

10.

Which of the following statements is **false**?

- If we were modeling a coin flip, the likelihood would be based on a Binomial Distribution.
- In general, the prior becomes less influential as the sample size increases.

Bayesian inferences are made using both the prior and the posterior distributions.

Correct Response

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

- Define the concepts of prior, likelihood, and posterior probability and identify how they relate to one another

No matter the likelihood, a prior probability of zero ensures that the posterior probability is also zero.