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Week 2 Quiz

Back to Week 2

8/10 points earned (80%)

Quiz passed!

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1 / 1 points

1.

Which of the following statements is true of a probability mass function but not a probability density function?

- The probability that a random variable X is equal to a specific value x can be greater than zero.

Correct Response

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

- Identify the difference between a discrete and continuous random variable and define their corresponding probability functions

- The function takes on only non-negative values.
- The function sums to (or integrates to) one over its domain.
- The probability that a random variable X is between a and b is the area under the function between a and b.

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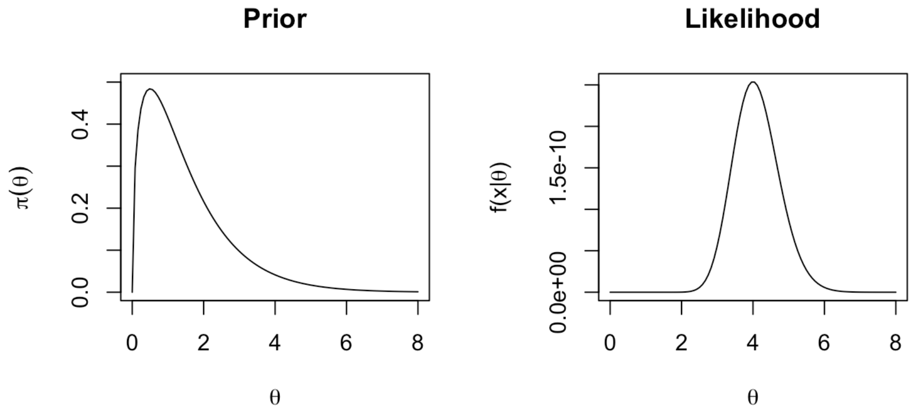
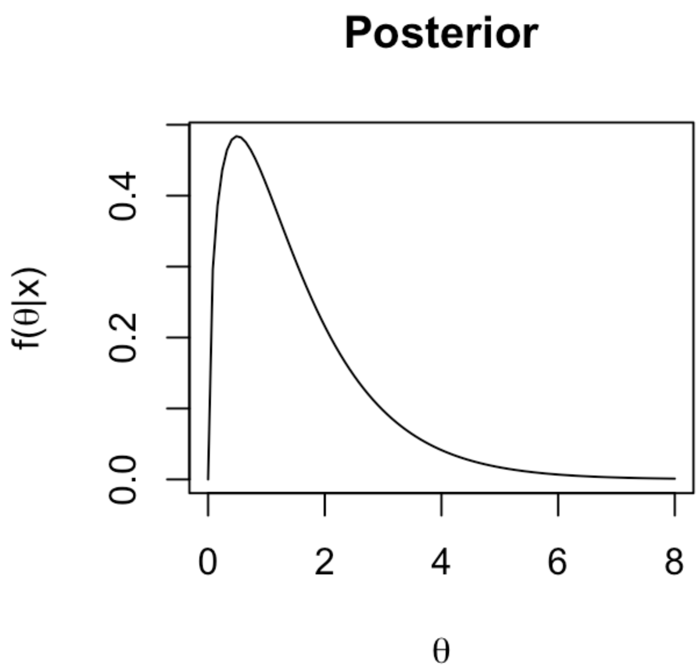
0 / 1 points

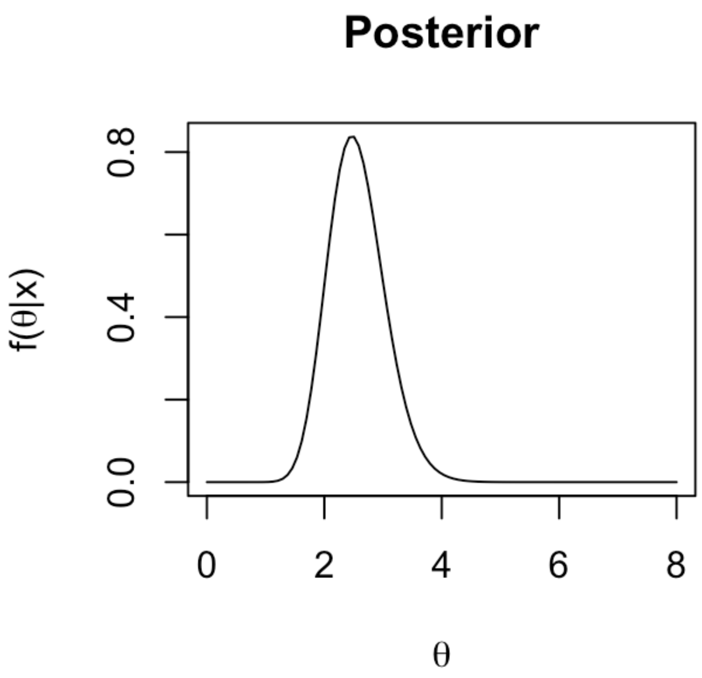
2.

Below are plots of the prior distribution for a parameter θ and the likelihood as a function of θ based on 10 observed data points.



which of the following is most likely to be the posterior distribution of θ?

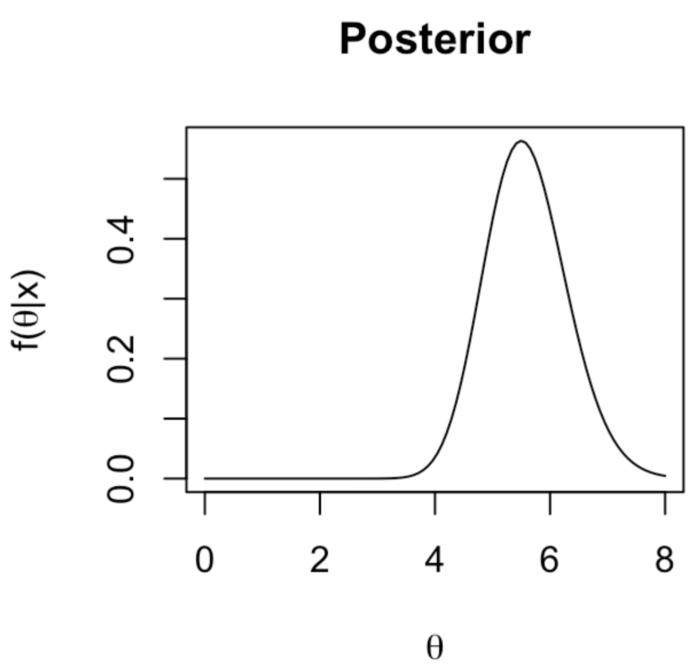


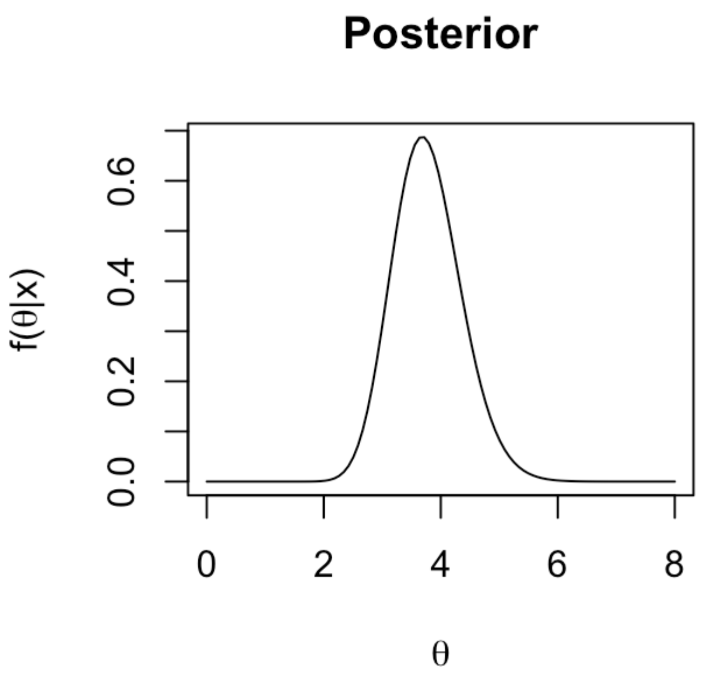


Incorrect Response
The posterior is a mixture of prior and the likelihood - as we collect data we expect the likelihood will be favored over the prior. In this case with 10 observed data points we would expect the posterior to shift further from the prior.

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





1 / 1
points

3.
You are trying to model the number of fireworks that go off per minute during a fireworks show. You decide to model this with a Poisson distribution with rate λ, imposing a Gamma prior on λ for conjugacy. You want the prior to have mean equal to 3 and standard deviation equal to 1. Which of the following priors represents your beliefs?

- $Gamma(k = 3, \theta = 1)$
- $Gamma(k = 1/3, \theta = 9)$
- $Gamma(k = 9, \theta = 1/3)$

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

- Elicit prior beliefs about a parameter in terms of a Beta, Gamma, or Normal distribution

- $Gamma(k = 1, \theta = 3)$

0 / 1
points

4.
If John is trying to perform a Bayesian analysis to make inferences about the proportion of defective electric toothbrushes, which of the following distributions represents the a conjugate prior for the proportion p ?

- Beta
- Poisson
- Normal
- Gamma

Incorrect Response
Since the likelihood is binomial, the conjugate prior is a Beta distribution, as presented in the lectures.

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

- Understand the concept of conjugacy and know the Beta-Binomial, Poisson-Gamma, and Normal-Normal conjugate families

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1 / 1
points

5.
You are hired as a data analyst by politician A. She wants to know the proportion of people in Metrocity who favor her over politician B. From previous poll numbers, you place a Beta(40,60) prior on the proportion. From polling 200 randomly sampled people in Metrocity, you find that 103 people prefer politician A to politician B. What is the posterior distribution of the proportion of voters who favor politician A?

- Beta(163, 137)
- Beta(142, 156)
- Beta(143, 157)

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

- Make inferences about a proportion using a conjugate Beta prior

- [ ] Beta(103, 97)

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1 / 1
points

6.
A young meteorologist is trying to estimate the expected number of tropical cyclones that occur in a given year. He assumes that the number of observed tropical cyclones in a year follows a Poisson distribution with rate λ that is consistent across years. Because the meteorologist is inexperienced, he assigns a relatively uninformative $Gamma(k = .5, \theta = 2)$ prior distribution to λ. During his first five years, he observes a total of 49 cyclones. If he were to collect more data about tropical cyclones in future years, what should his prior be?

- [ ] $Gamma(k = 49, \theta = 7)$
- [x] $Gamma(k = 49.5, \theta = 2/11)$

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

- Make inferences about a proportion using a conjugate Beta prior
- Make inferences about a rate of arrival using a conjugate Gamma prior
- Update prior probabilities through an iterative process of data collection

- [ ] $Gamma(k = 49.5, \theta = 7)$
- [ ] $Gamma(k = 49.5, \theta = 2/21)$

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1 / 1
points

7.
Suppose that the number of fish that Hans catches in an hour follows a Poisson distribution with rate λ. If the prior on λ is Gamma(1,1) and Hans catches no fish in five hours, what is the posterior distribution for λ?

- [ ] $Gamma(k = 2, \theta = 1/5)$

- $Gamma(k = 2, \theta = 1/6)$
- $Gamma(k = 1, \theta = 1/5)$
- $Gamma(k = 1, \theta = 1/6)$

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

- Make inferences about a rate of arrival using a conjugate Gamma prior

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1 / 1 points

8.
Suppose that a miner finds a gold nugget and wants to know the weight of the nuggets in order to assess its value. The miner believes the nugget to be roughly 200 grams, although she is uncertain about this quantity, so she puts a standard deviation of 50 grams on her estimate. She weighs the nuggets on a scale which is known to weigh items with standard deviation 2 grams. The scale measures the nugget at 149.3 grams. What distribution summarizes the posterior beliefs of the miner?

- $Normal(151.25, 1.387^2)$
- $Normal(149.56, 1.998^2)$
- $Normal(149.38, 1.998^2)$

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

- Make inferences about the mean of a normal distribution when the variance is known

- $Normal(149.3, 2^2)$

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1 / 1 points

9.

A scientist is interested in estimating the average weight of male golden hamsters. They decide to use a Bayesian approach to estimate μ by creating a credible interval using a weakly informative prior. The posterior distribution gives a 95% credible interval spanning 3.3 - 4.0 oz. According to this model, what is the probability that μ does **not** fall within this range?

- 2.5%
- 5%

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

- Articulate the differences between a Frequentist confidence interval and a Bayesian credible interval

- 95%
- Either 0 or 1 since μ is fixed, and must either be inside or outside the interval

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1 / 1
points

10.
Suppose you are given a coin and told that the die is either biased towards heads (p = 0.75) or biased towards tails (p = 0.25). Since you have no prior knowledge abou the bias of the coin, you place a prior probability of 0.5 on the outcome that the coin is biased towards heads. You flip the coin twice and it comes up tails both times. What is the posterior probability that your next flip will be heads?

- 3/10

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

- Derive the posterior predictive distribution for very simple experiments
- Work with the discrete form of Bayes' rule

- 2/5
- 1/3