Week 2 Quiz

Quiz, 10 questions

8/10 points (80%)

✔ Congratulations! You passed!

Next Item

1 / 1
points

1.
An obesity researcher is trying to estimate the probability that a random male between the ages of 35 and 44 weighs more than 270 pounds. In this analysis, weight is:

- A discrete random variable, since the number of men who weigh more than 270 pounds can take on only integer values.
- A discrete random varible, since weights are often measured to the nearest pound.
- A continuous random variable, since the prior probability that a random male between the ages of 35 and 44 weighs more than 270 pounds gives non-zero probability to all values between 0 and 1.
- A continuous random variable, since weight can theoretically take on any non-negative value in an interval.

Correct
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

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0 / 1
points

2.

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

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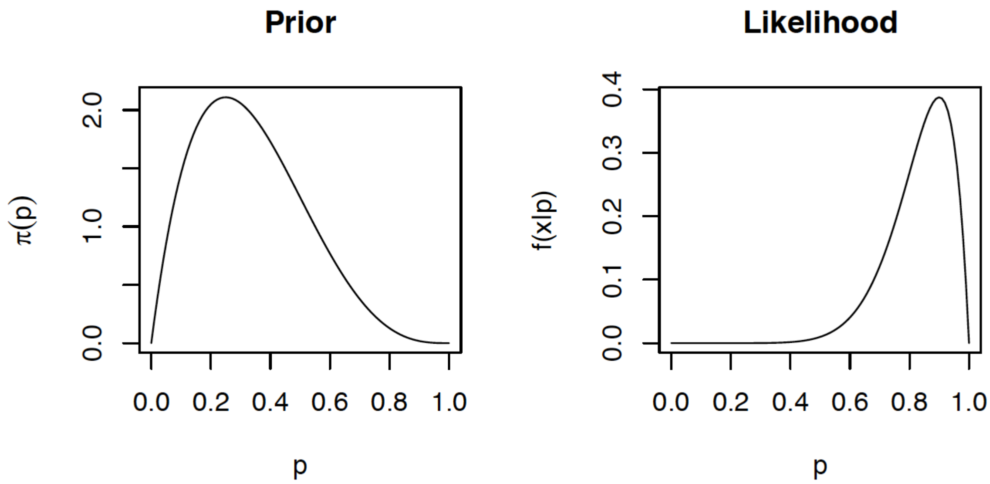
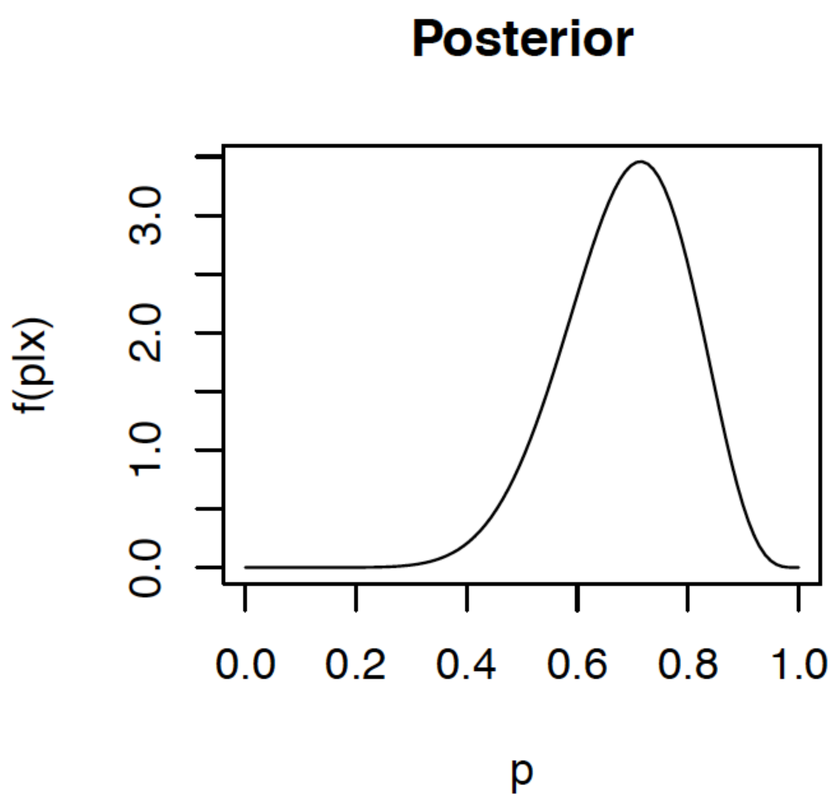


which of the following is most likely to be the posterior distribution of θ?



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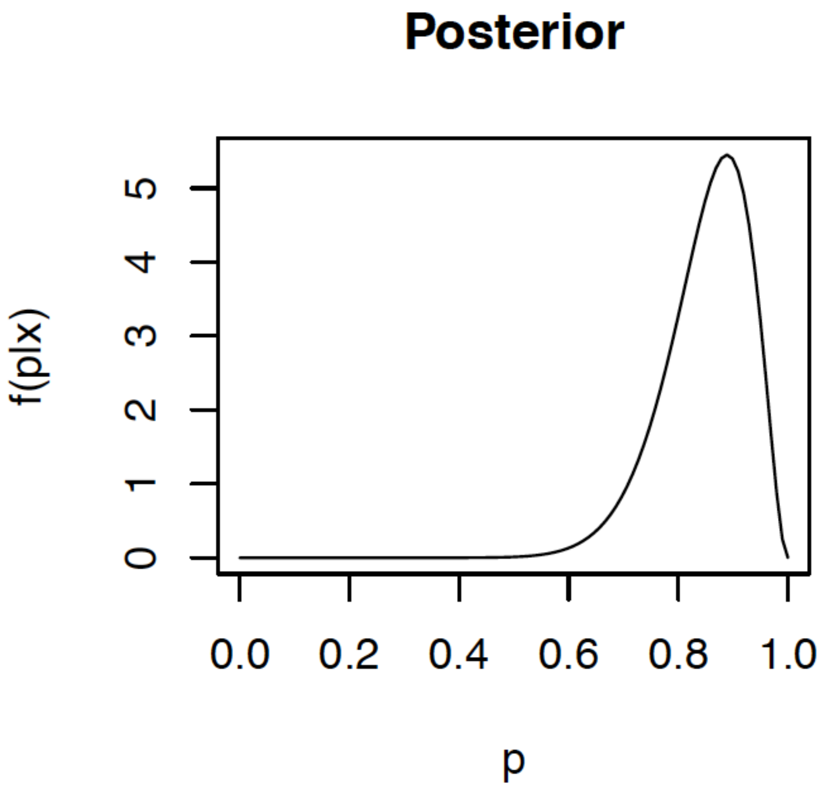
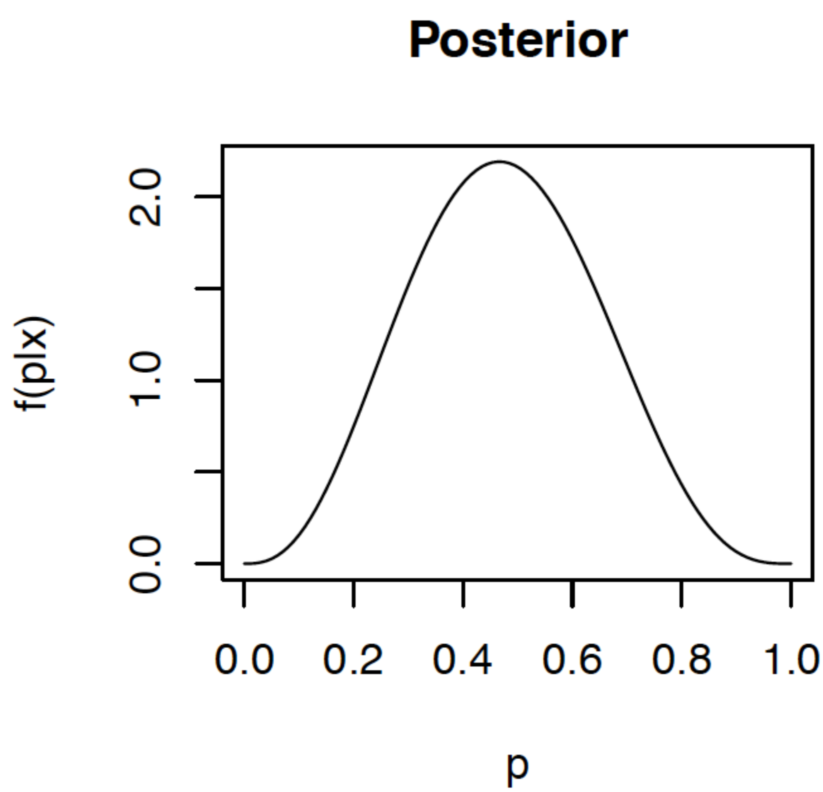


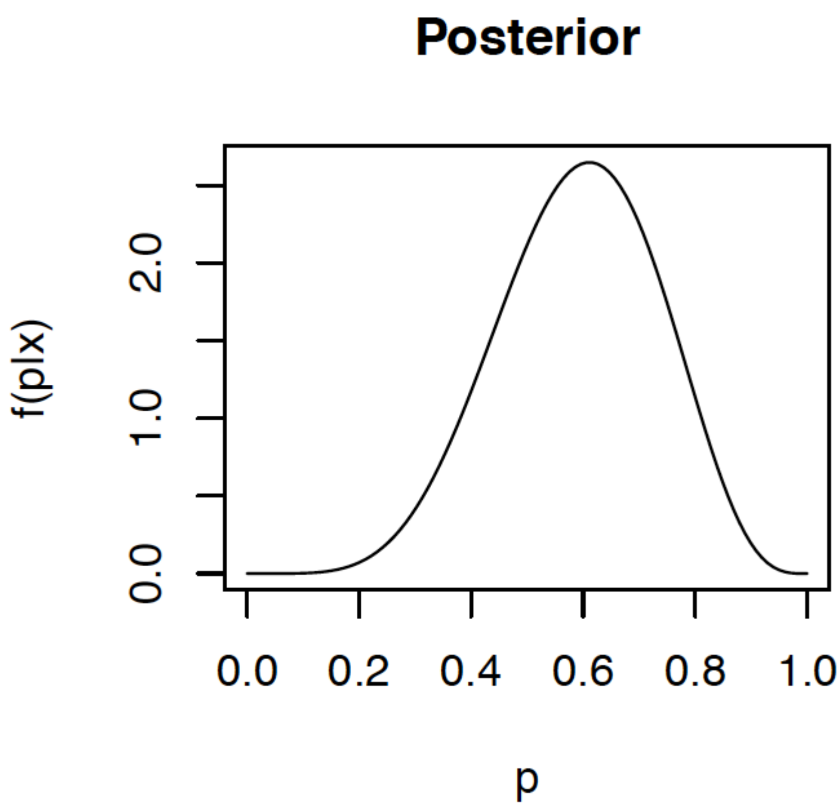


This should not be selected

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?

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

Correct

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

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

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1 / 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 ?

- Gamma
- Beta

Correct

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

- Normal
- Poisson

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 probability that the majority of people prefer politician A to politican B (i.e. P(p>0.5|data))?

- 0.198
- 0.209

Correct

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

- Make inferences about a proportion using a conjugate Beta prior

- 0.664
- 0.934

1 / 1 points

6.

An engineer has just finished building a new production line for manufacturing widgets. They have no idea how likely this process is to produce defective widgets so they plan to run two separate runs of 15 widgets each. The first run produces 3 defective widgets and the second 5 defective widgets.

We represent our lack of apriori knowledge of the probability of producing a defective widgets, p, using a flat, uninformative prior - $Beta(1,1)$. What should the posterior distribution of p be after the first run is finished? And after the second?

- After the first run, $Beta(3,12)$. After the second run, $Beta(8,22)$.
- After the first run, $Beta(4,13)$. After the second run, $Beta(6,11)$.

- After the first run, *Beta*(4,13). After the second run, *Beta*(9,23).

Correct

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

- After the first run, *Beta*(3,12). After the second run, *Beta*(5,10).

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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?

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

Correct

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 nugget 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 nugget 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?

- $Normal(149.38, 1.998^2)$

Correct

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

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

- $Normal(149.3, 2^2)$
- $Normal(149.56, 1.998^2)$
- $Normal(151.25, 1.387^2)$

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1 / 1 points

9.

True or False: When constructing a 95% credible interval, a good rule of thumb is to use the shortest of all such intervals.

- True

Correct

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

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

- False

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0 / 1

points

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10.

Suppose you are given a die and told that the die is either fair or is loaded (it always comes up as a 6). Since most dice are not loaded, you place a prior probability of 0.8 on the outcome that the die is fair. You roll a die and it comes up as a 6. What is the posterior probability that your next roll will also be a 6?

- 11/15
- 4/5
- 3/5

This should not be selected

Use the discrete form of Bayes' rule to find the posterior probability that the die is fair. Then find the probability that the next roll is a 6 for each of the two possibilities (fair die or loaded die) to find the posterior predictive probability.

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

- 2/3