Week 2 Quiz

Quiz, 10 questions

8/10 points

Congratulations! You passed!

Next Item

1 / 1 point

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 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

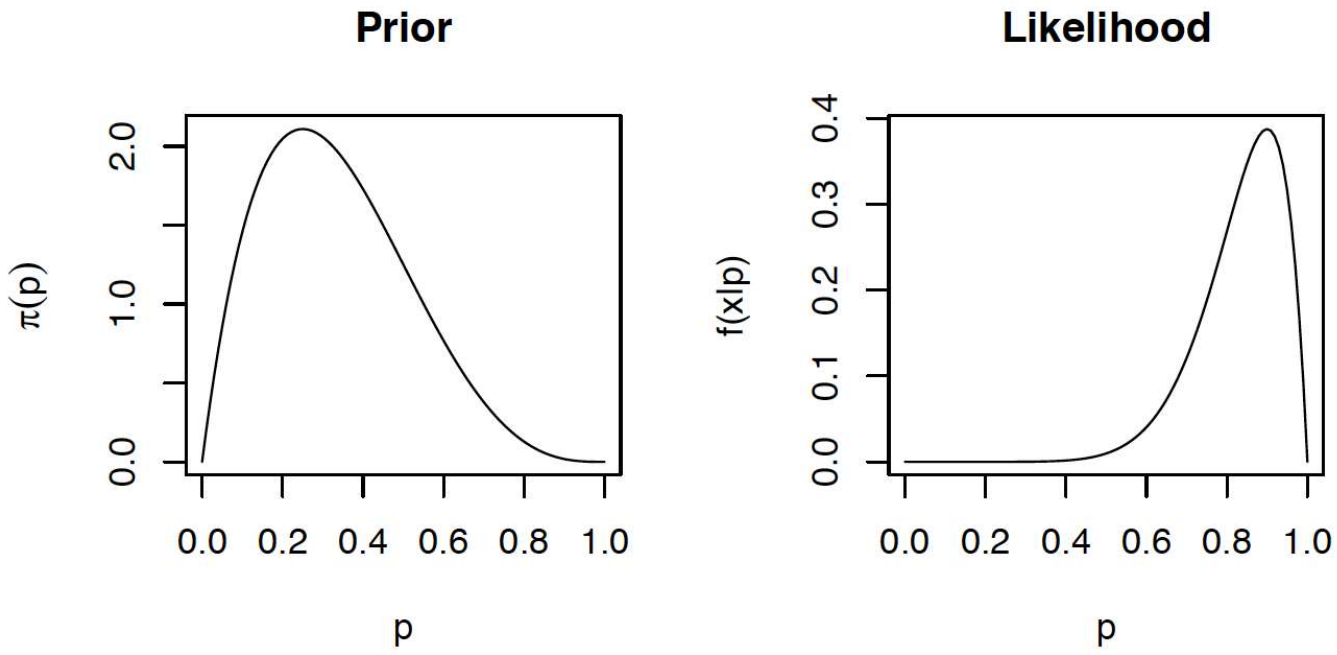
- A discrete random variable, since the number of men who weigh more than 270 pounds can take on only integer values.

0 / 1 point

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.

8/10 points



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

- A.

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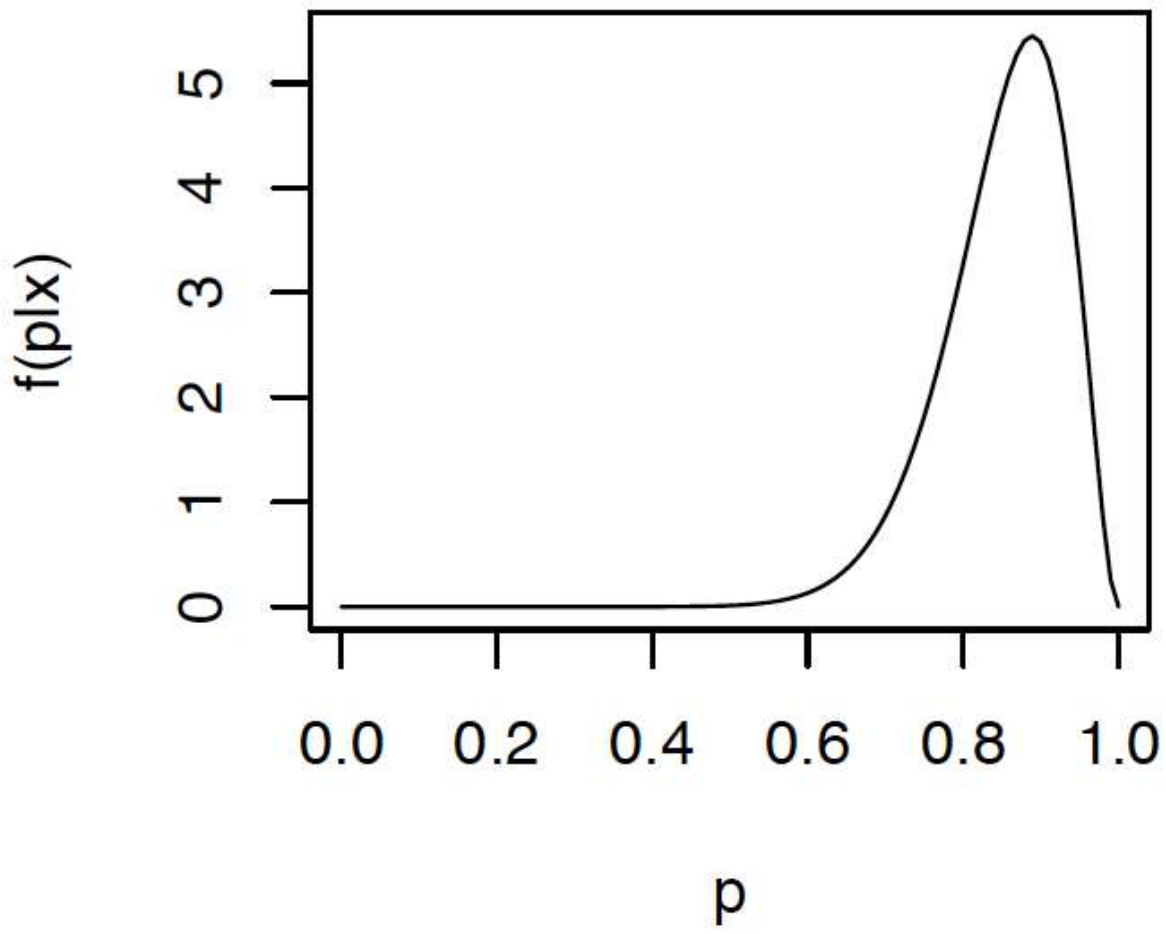
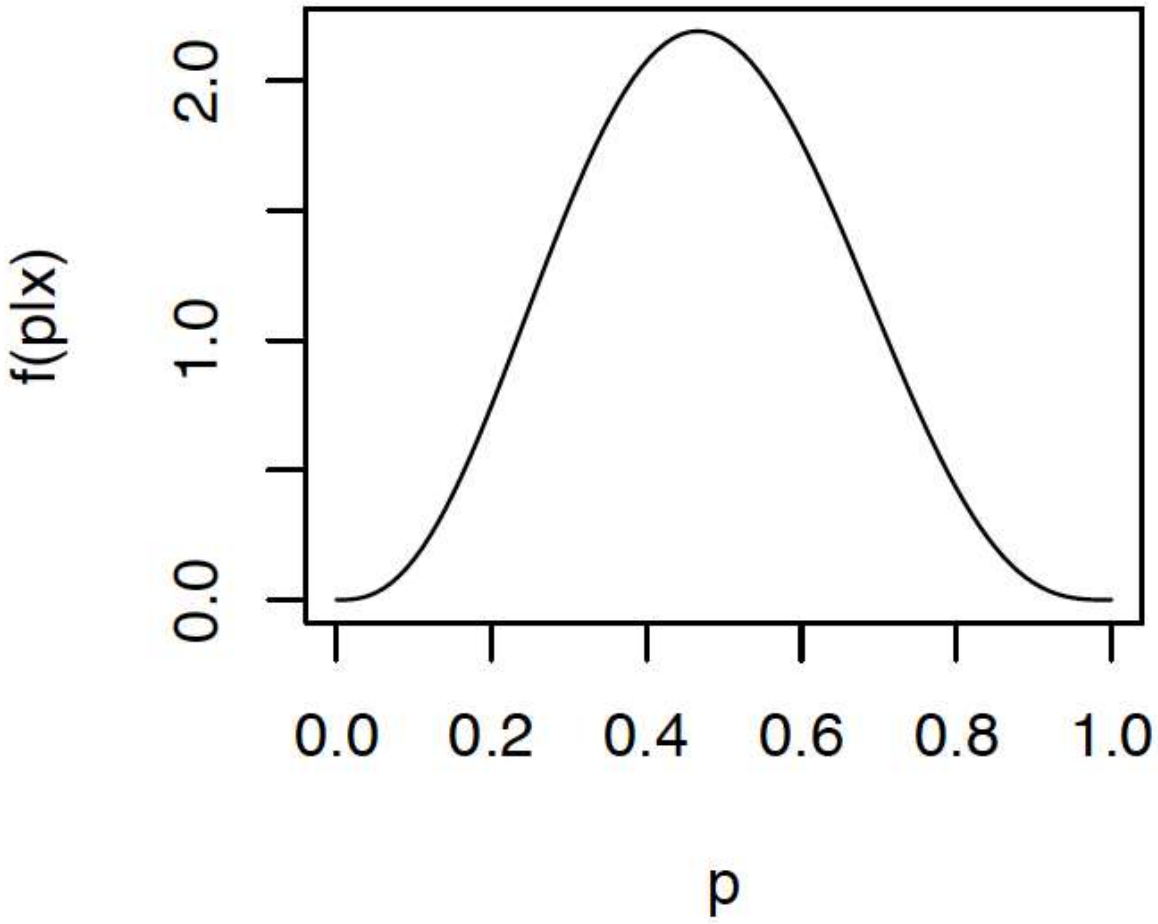


B.



This should not be selected

The posterior is a mixture of prior and the likelihood, this distribution is centered farther to the right than either the prior or the likelihood.

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

C.

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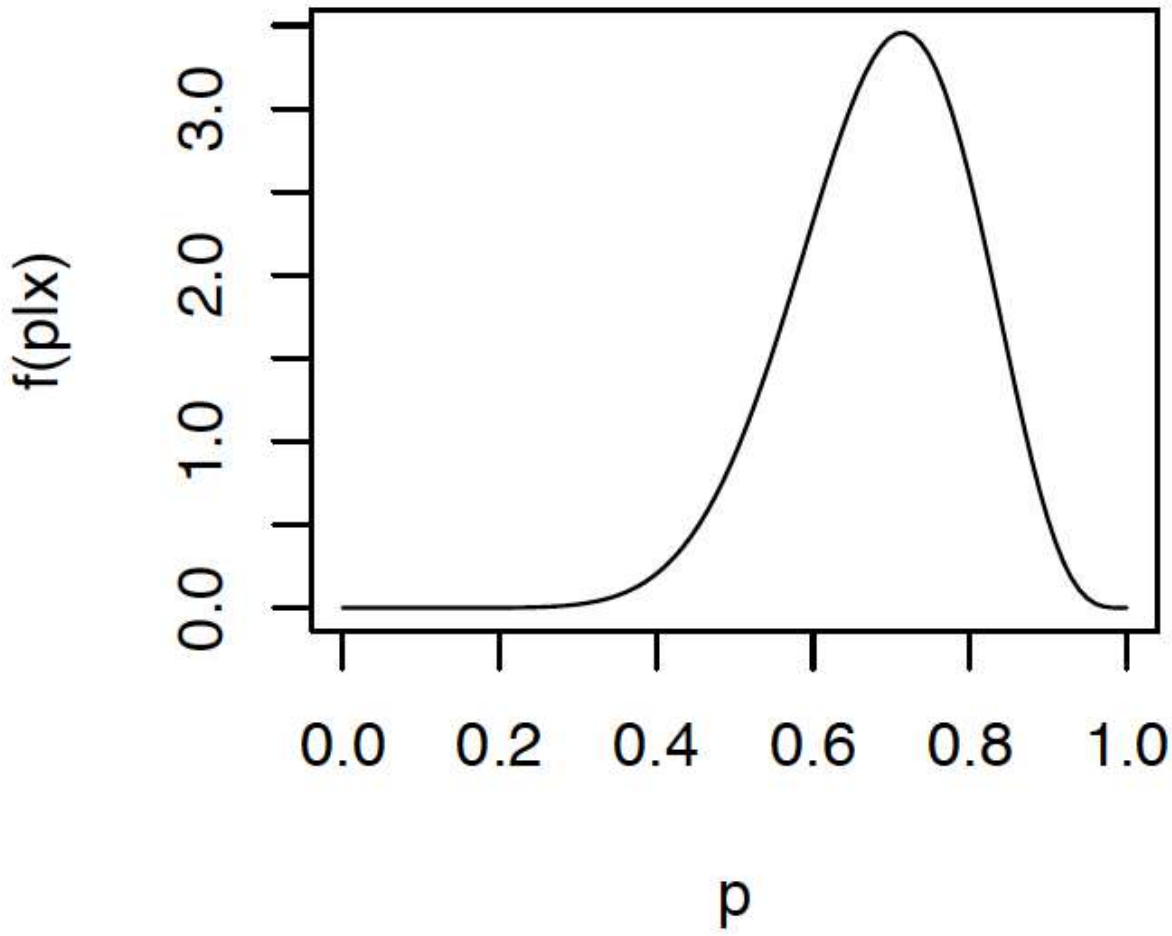
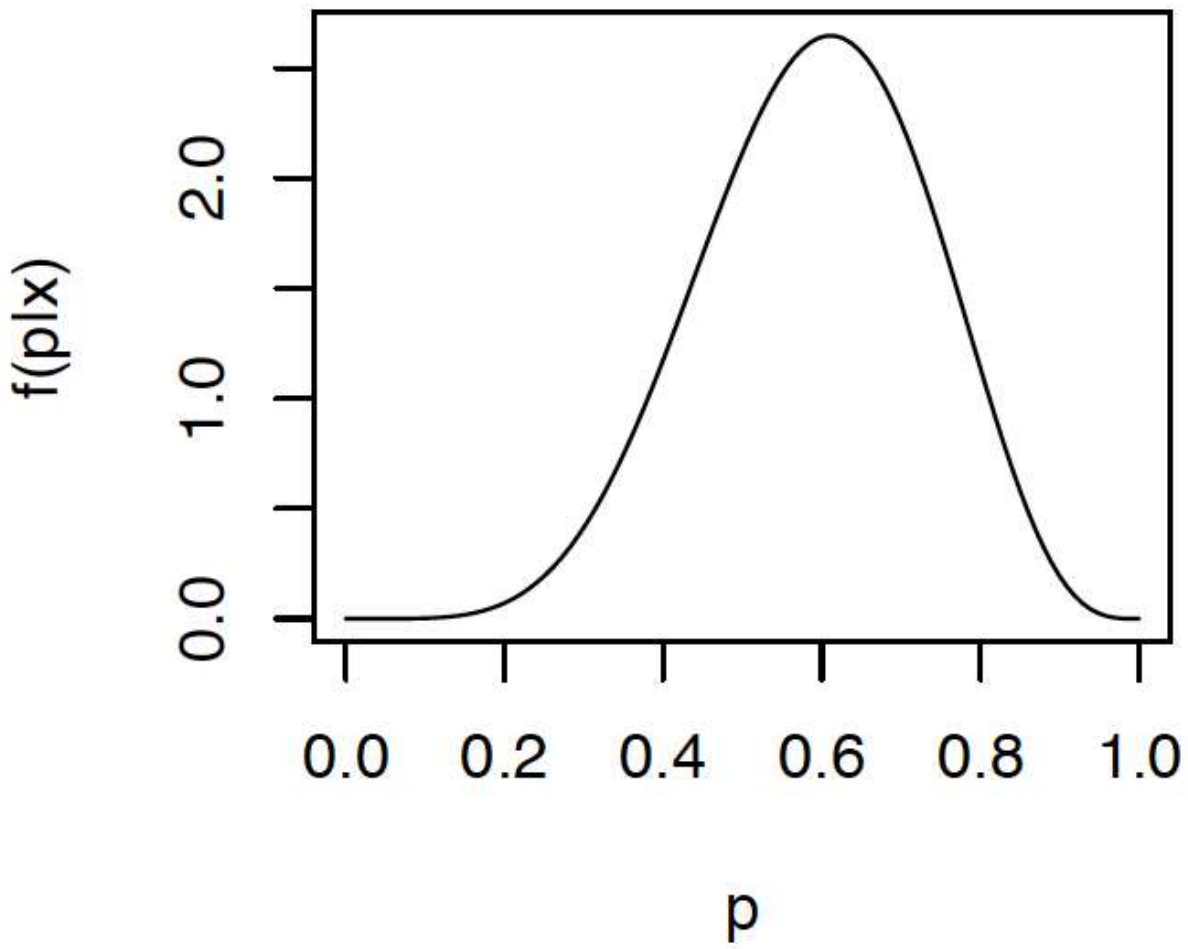


D.



0 / 1 point

3.
Which of the following distributions would be the best choice of prior to use if you wanted to determine if a coin is fair when you have a **strong** belief that the coin is biased towards heads? (Assume a model where we call heads a success and tails a failure).

- Beta (9, 1)
- Beta (10, 90)

This should not be selected

8/10 points

We can view the α and β of the Beta prior as pseudo-observations of successes and failures respectively. Therefore, this prior represents a strong belief about the coin being biased towards tails (failures).

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

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

- Beta (90, 10)
- Beta (50, 50)
- Beta (1, 9)

1 / 1 point

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

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

- Gamma
- Poisson
- Normal

1 / 1 point

5.

8/10 points

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(103, 97)
- Beta(143, 157)

Correct

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

- Make inferences about a proportion using a conjugate Beta prior

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1 / 1 point

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?

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

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

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

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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?

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

Correct

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

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

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

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1 / 1 point

8.

The posterior distribution for a mean of a normal likelihood, with a known variance σ^2 and data $x_1, x_2, \ldots, x_n$, and a normal prior with mean μ_0 and variance σ_0^2 has the following distribution:

$$\mu \sim N\left(\left(\frac{\mu_0}{\sigma_0^2} + \frac{\sum_{i=1}^n x_i}{\sigma^2})\right) \Big/ \left(\frac{1}{\sigma_0^2} + \frac{n}{\sigma^2}\right), \left(\frac{1}{\sigma_0^2} + \frac{n}{\sigma^2}\right)^{-1}\right).$$

If you were to collect a large amount of data, how can you simplify the formulas given above? Hint - both n and $\sum_{i=1}^n x_i$ are very large relative to μ_0 and σ_0^2.

- $\mu \sim N\left(\frac{\sum_{i=1}^n x_i}{n}, \frac{\sigma^2}{n}\right)$

Correct

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

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

- $\mu \sim N\left(\frac{\sum_{i=1}^n x_i}{n}, \sigma^2\right)$

8/10 points

$\mu \sim N(\mu_0, \sigma_0^2)$

$\mu \sim N\left(\mu_0, \frac{\sigma_0^2}{n}\right)$

1 / 1 point

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

1 / 1 point

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?

3/5

11/15

2/3

Correct
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

4/5

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