Week 2 Quiz

Back to Week 2

9/10 points earned (90%)

Quiz passed!

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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 varible, since weights are often measured to the nearest pound.
- A continuous random variable, since weight can theoretically take on any non-negative value in an interval.

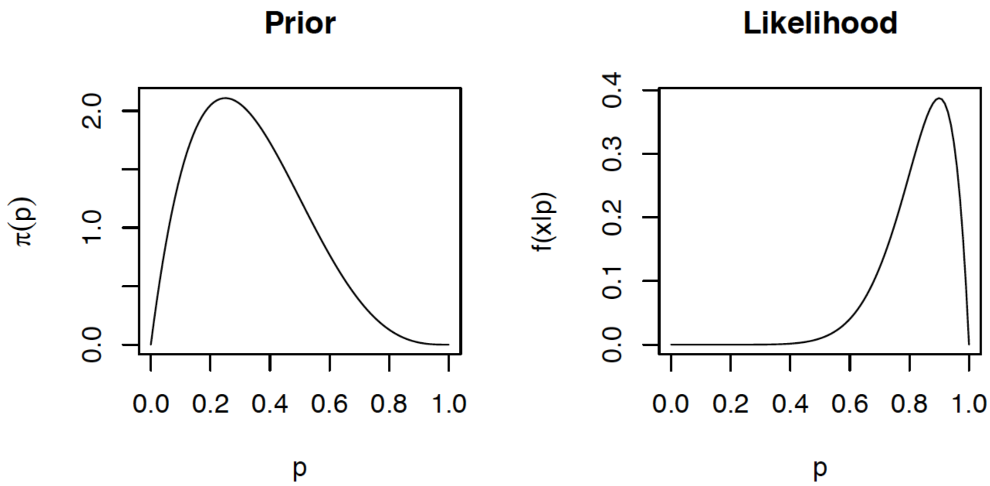
Correct
This question refers to the following learning objective(s):

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

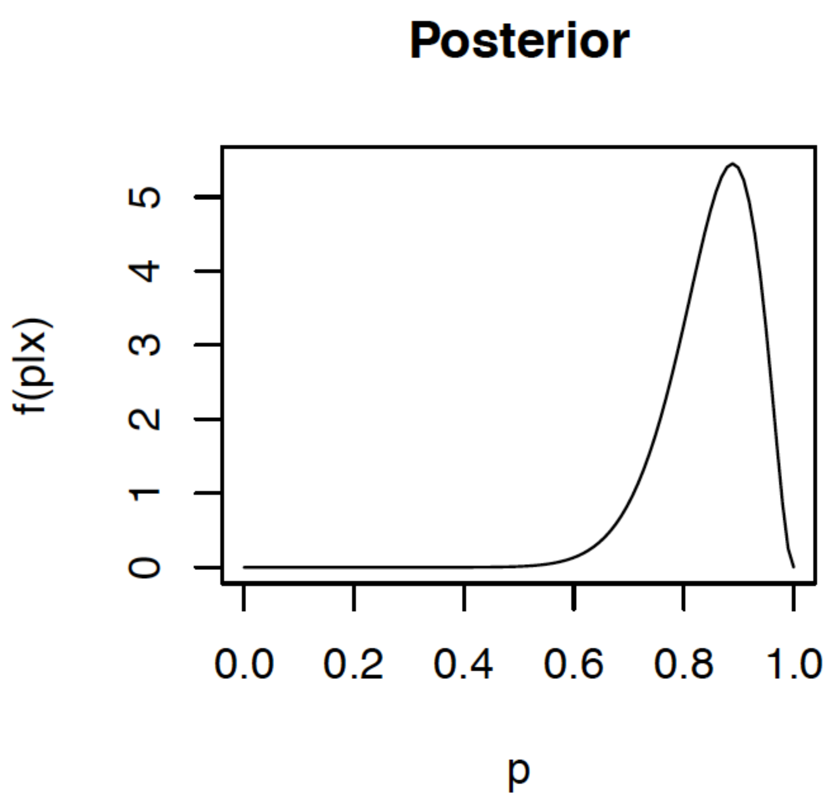
- A discrete random variable, since the number of men who weigh more than 270 pounds can take on only integer values.
- A continuous random variable, since the prior probability that a random male between the ages of 35 and 44 weighs more than 270 pounds gives non-zero probability to all values between 0 and 1.

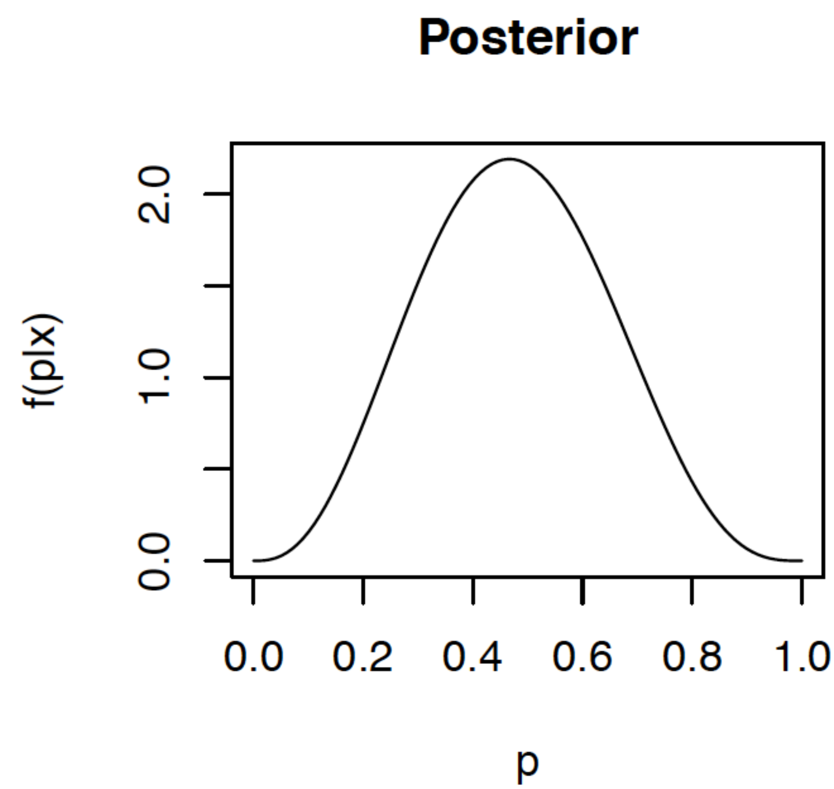
1 / 1
points

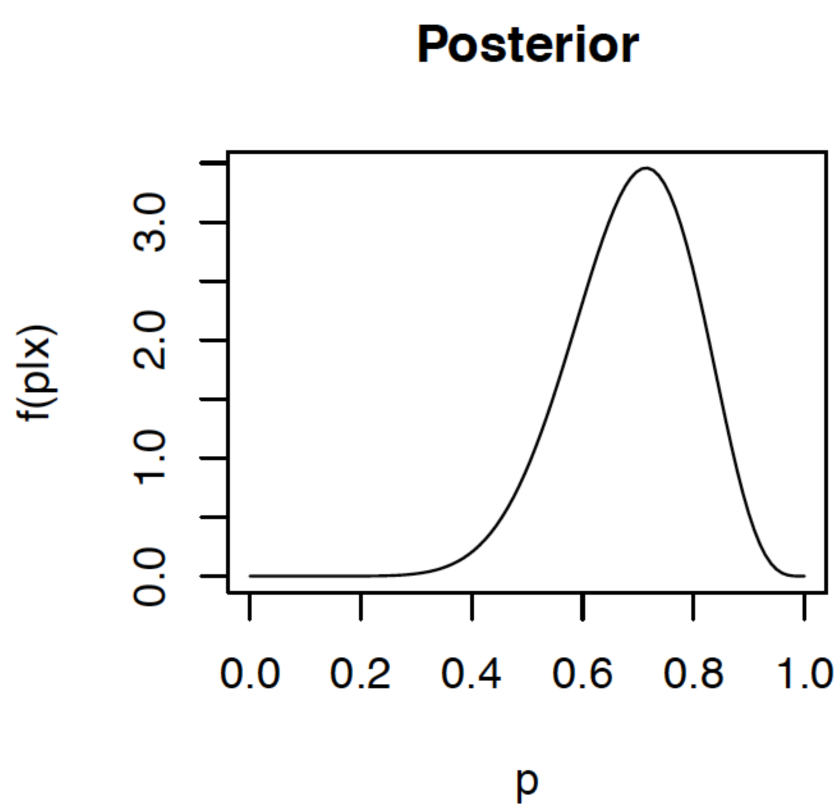
2.
Below are plots of the prior distribution for a proportion p and the likelihood as a function of p based on 10 observed data points.



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



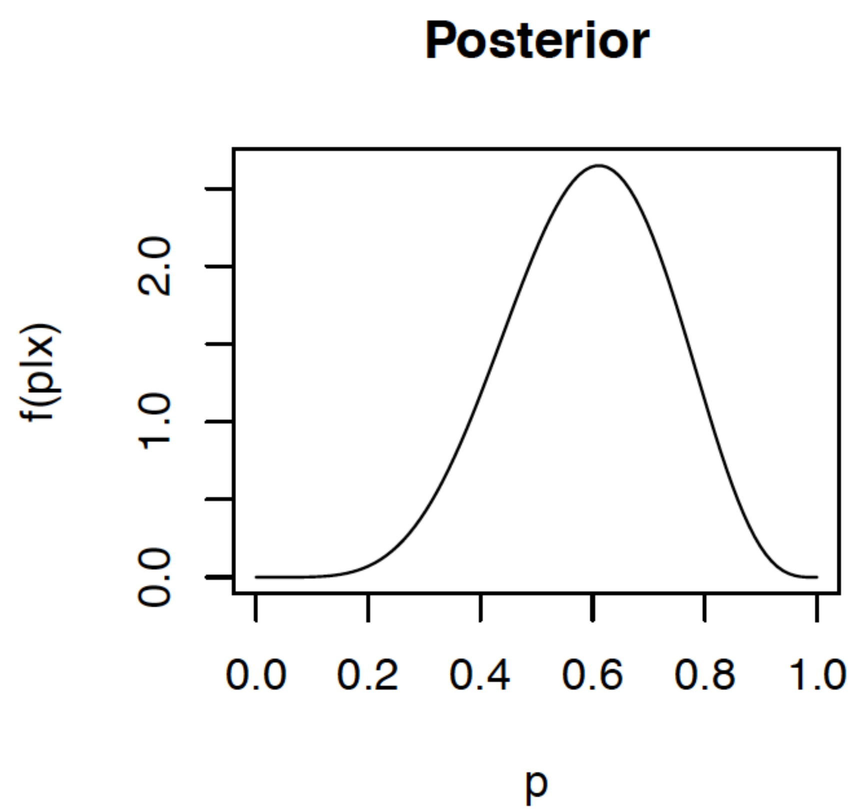

Posterior
f(p|x)
0.0
1.0
2.0
0.0
0.2
0.4
0.6
0.8
1.0
p


Posterior
f(p|x)
0.0
1.0
2.0
3.0
0.0
0.2
0.4
0.6
0.8
1.0
p

Correct

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



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1 / 1
points

3.

Which of the following distributions would be a good 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(10, 90)
- Beta(90, 10)

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

- ◯ Beta(9, 1)
- ◯ Beta(50, 50)
- ◯ Beta(1, 9)

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1 / 1 points

4.

If you are told that the prior for parameter θ has a distribution from family A and that it is conjugate to the likelihood from family B, then to which distribution family will the posterior belong?

- ◯ The posterior will belong to the B family.
- ◉ The posterior will belong to the A family.

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

- ◯ We need to know more about the two distributions.

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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(103, 97)
- Beta(163, 137)
- Beta(142, 156)
- 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
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, $Beta(4,13)$. 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*(4,13). After the second run, *Beta*(6,11).
- After the first run, *Beta*(3,12). After the second run, *Beta*(5,10).
- After the first run, *Beta*(3,12). After the second run, *Beta*(8,22).

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1 / 1
points

7.

Suppose we are interested in modeling the number of airline passenger deaths per year, assuming that the number of deaths follows a Poisson distribution. If we observe data for one year, record a total of 761 deaths, and find that our posterior distribution of the annual rate of passenger deaths λ is $Gamma(862, 12/13)$, what was our conjugate prior distribution?

- Gamma(862, 1)
- Gamma(100, 13)
- Gamma(101,12)

Correct

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

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

- Gamma(761, 1)

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0 / 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?

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

This should not be selected

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:

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

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

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

- $Normal(149.38, 1.998^2)$

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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

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?

- 3/8
- 3/10

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

- 2/5
- 1/3
