1
point

1.
You draw two balls from one of three possible large urns, labelled A, B, and C. Urn A has 1/2 blue balls, 1/3 green balls, and 1/6 red balls. Urn B has 1/6 blue balls, 1/2 green balls, and 1/3 red balls. Urn C has 1/3 blue balls, 1/6 green balls, and 1/2 red balls. With no prior information about which urn your are drawing from, you draw one red ball and one blue ball. What is the probability that you drew from urn C?

- 1/3
- 5/9
- 19/36
- 6/11

1
point

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 the data, given the prior beliefs about the distribution of μ and σ^2 .
- The probability of observing the data, given μ , σ^2, and the prior.
- 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.

1

point

3.
You go to Las Vegas and sit down at a slot machine. You are told by a highly reliable source that, for each spin, the probability of hitting the jackpot is either 1 in 1,000 or 1 in 1,000,000, but you have no prior information to tell you which of the two it is. You play ten times, but do not win the jackpot. What is the posterior probability that the true odds of hitting the jackpot are 1 in 1,000?

- 0.269
- 0.475
- 0.498
- 0.500

1
point

4.
The posterior distribution after repeating the same experiment twice and then analyzing the data from both experiments at the same time is the same as that after running the second experiment with the posterior of the first experiment as the prior.

- True
- False

1
point

5.
Which of the following is the **best** Bayesian interpretation of the following statement: ”the probability of Liverpool defeating Swansea City tomorrow is 0.9“?

- We would be indifferent to betting on Liverpool to win at 1:9 odds.
- Liverpool is a heavy favorite to beat Swansea City.
- Liverpool would beat Swansea City nine times out of ten.
- Teams as good as Liverpool have historically beaten teams as good as Swansea City 90 percent of the time.

1
point

6.
Which of the following statements can be used to describe a 95 percent Bayesian credible interval for a parameter μ, but not a 95 percent Frequentist confidence interval?

- If we ran an infinite number of experiments, 95 percent of our intervals generated this way would contain the true value of μ .
- μ is either in the interval, or it is not. More data can increase or decrease our uncertainty that μ is in the interval.
- The probability that μ falls within the interval is 0.95
- μ is in this interval 95 percent of the time.

1
point

7.
A new breast cancer screening method is tested to see if it performs better than existing methods in detecting breast cancer. To measure the sensitivity of the test, a total of 10,000 patients known to have various stages of breast cancer are testing using the new method. Of those 10,000 patients, 9,942 are identified by the new method to have breast cancer. Given that the sensitivity of the best current test is 99.3%, is there significant evidence at the $\alpha = 0.05$ level to conclude that the new method has higher sensitivity than existing methods? Hint - $H_0 : p = 0.993$ and $H_1 : p > 0.993$

- No, since the p-value under H_0 of no difference is approximately equal to 0.063, which is greater than $\alpha = 0.05$
- Yes, since the p-value under H_0 of no difference is approximately equal to 0.033, which is less than $\alpha = 0.05$
- Yes, since the p-value under H_0 of no difference is approximately equal to 0.048, which is less than $\alpha = 0.05$
- No, since the p-value under H_0 of no difference is approximately equal to 0.081, which is greater than $\alpha = 0.05$

1
point

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
- 0.589
- 0.612
- 0.625

1 point

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 :


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1-pbinom(x-1,N,p)
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- 0.500
- 0.684
- 0.800
- 0.881

1 point

10.

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

- No matter the likelihood, a prior probability of zero ensures that the posterior probability is also zero.
- In general, the prior becomes less influential as the sample size increases.
- Bayesian inferences are made using both the prior and the posterior distributions.
- If we were modeling a coin flip, the likelihood would be based on a Binomial Distribution.