Guided Thought Questions

MATH 322: Mathematical Statistics II
Learning Module 7: Bayesian Analysis

All textbooks are written at two cognitive levels. The surface level is the literal information provided in the book. The deeper level is the connections between the topics. Textbooks are excellent at the surface level, rarely good at the deeper level. To help with the deeper levels, I am providing several questions for each section of the textbook.

You should take time to answer these questions after reading the section. Answer them in your notes. Make sure that you are able to confidently answer them. In fact, you should feel pressure to ask these questions in class if you cannot answer them.

Readings: Sections 11.1 to 11.5

§1: Introduction

1. What are some differences between the Bayesian approach and the frequentist approach?
2. What makes an approach "Bayesian"? What makes one "frequentist"?

§2: Bayesian Point Estimation

1. What is Bayes' Law?
2. What are the prior distribution, the likelihood, and the posterior distribution? Which is generated by the researcher, which is generated by the data-generating process, and which is the result of performing Bayesian analysis?
3. Why should the posterior mean be used instead of the posterior median?
4. What is a loss function? Which loss function is "correct"?

§3: Bayesian Credible Intervals

1. How is a credible interval calculated?
2. How does a credible interval differ from the confidence interval?

§4: Bayesian Hypothesis Testing

1. Why are null hypotheses of the form $\theta=\theta_0$ rarely used in Bayesian analysis?
2. What is the main difference between the prior odds ratio and the posterior odds ratio?
3. How does using the posterior odds ratio different than using α in the frequentist p-values?

§5: Bayesian Decision Theory

1. What is the utility function?
2. Why doesn't frequentist statistics use a utility function?
3. Why is the "expected utility" an important concept in Bayesian decision theory?