

Midterm Exam

Instructions: Write all your answers on the test paper provided. Circle what you think is the correct answer on multiple choice questions, and *be specific on short-answer questions*. Point values are indicated in parentheses. Good luck!

1. (8) Let \mathcal{Y} be the set of all possible observations. A class \mathcal{P} of priors is conjugate for a given set of likelihoods \mathcal{F} if
 - (a) $\pi(\cdot | \mathbf{y}) \in \mathcal{P}$ for all $\pi \in \mathcal{P}$ and all $\mathbf{y} \in \mathcal{Y}$.
 - (b) $\pi(\cdot | \mathbf{y}) \in \mathcal{P}$ for some $\pi \in \mathcal{P}$ and all $\mathbf{y} \in \mathcal{Y}$.
 - (c) $\pi \in \mathcal{P}$ implies that $\pi(\cdot | \mathbf{y})$ is a proper distribution for each $\mathbf{y} \in \mathcal{Y}$.
 - (d) the likelihood is proportional to some member of \mathcal{P} for each $\mathbf{y} \in \mathcal{Y}$.

2. (8) The Jeffreys noninformative prior is
 - (a) sometimes improper.
 - (b) proportional to the square root of the determinant of the information matrix.
 - (c) derived from an invariance argument.
 - (d) all of the above.

3. (8) An improper prior
 - (a) is too subjective for scientific investigations.
 - (b) expresses ignorance about the underlying parameter values.
 - (c) is integrable over the parameter space.
 - (d) is not necessarily any of the above.

4. (8) Frequentist inference is based on measures of initial precision, while Bayesian inference is based on measures of _____ .

5. (8) Lindley's paradox occurs when a frequentist P -value for a null hypothesis H_0 is _____ and a Bayesian posterior probability for H_0 is _____ .

6. (8) The mean of the posterior distribution is often a weighted average of what two quantities?

7. (6) Is the following statement true or false? “Computation of the posterior requires the entire data set and not just a sufficient statistic.”

8. (18) Define the terms *Bayesian credible region* and *highest posterior density region*.

9. (12) The posterior odds ratio, α_0/α_1 , is used for what purpose?

10. (16) The posterior distribution may be approximated by a multivariate normal under appropriate regularity conditions. One version of this result depends on the prior distribution. Give an explicit statement of this version of the result. Note: You do **not** have to state the regularity conditions.