

Stat 136 (Bayesian Statistics)

Second Semester AY 2024-2025

Laboratory Exercise No. 1

INSTRUCTIONS: Answer the following as indicated.

1. Suppose suicides occur in a population at a rate p persons per year, p is unknown. If we model the number of suicides in a population of total N persons as $Poisson(Np)$, and we observed 22 suicides in a population of 30345 persons. Calculate the Bayes factor and test the hypothesis $H_0 : p = 0.001$ versus $H_1 : p = 0.0001$. [5 points]
2.
 - a. Let Y_1 be the number of successes in $n = 10$ independent trials where each trial results in a success or failure, and p , the probability of success, remains constant over all trials. Suppose the 4 possible values of p are 0.20, 0.40, 0.60, and 0.80. We do not wish to favor any value over the others so we make them equally likely. We observe $Y_1 = 7$. Find the posterior distribution for p . [5 points]
 - b. Suppose another $n = 5$ independent trials of the experiment are performed and $Y_2 = 2$ successes are observed. Use the posterior distribution for p from (a) as the prior distribution for p . [5 points]
 - c. Suppose we combine all the $n = 15$ trials all together and think of them as a single experiment where we observed a total of 9 successes. Start with the initial equally weighted prior from (a) and find the posterior after the single combined experiment. [5 points]
 - d. What can you conclude based on the results from (a) to (c). [3 points]
 - e. It is believed that p is at least 0.60. Is there a strong evidence supporting this claim? Use the results in (c) to justify your answer. [5 points]