

Edps 590BAY
Fall 2019
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Homework 2
Due September 11, 2019

1. For each of the scenarios, in your opinion would an informative or non informative prior be most appropriate? Briefly explain why you selected the prior.
 - (a) A research group at small college has done a study which yielded a surprising result. You decide to replicate the study at UIUC and use Bayesian method to analyze your data.
 - (b) You are conducting an experiment using fMRI, which is very expensive. Since there is only one machine available, you collect data from subjects one at a time. To try to minimize your cost and time to complete the project, you decide to only collect data until you obtain a reasonable result within a pre-determined level of precision.
 - (c) You are trying to predict the probability of getting lung cancer given that a person is a smoker. Data from retrospective studies exist that give the incidence of lung cancer in the population of interest, the incidence of smoking in the population, and the incidence of a person being a smoker among lung cancer patients.
2. Compute the probability among 40 year old women of having breast cancer given that they have a positive mammogram result using the following information:
 - According to major journals, 4/10 get a mammogram
 - The probability of breast cancer patients having a positive results is 32/40.
 - The probability of a positive results is 1/10.

- The probability of cancer is $1/69$
3. Below is data from the 2006, 2016 and 2018 General Social Survey where respondents indicated whether they favor or oppose a law which would require a person to obtain a police permit before he or she could buy a gun. Note that these are cross-sectional data (i.e., different respondent each year).

Year	Response	
	favor	oppose
2006	1568	395
2016	1330	528
2018	1102	439

- (a) For the year 2006,
- i. What is the sample proportion to favor a law?
 - ii. What is the posterior distribution for the proportion of people who favor gun control (use Uniform prior)? Also, plot the prior, likelihood and posterior and comment on the plot.
 - iii. What is the mean of this distribution?
 - iv. What is the 95% credible interval? Interpret.
 - v. What is the 95% high density interval? Interpret.
 - vi. If you were reporting this result in a paper, which interval would you use?
- (b) For the year 2016,
- i. What is the sample proportion to favor a law?
 - ii. Using data from 2016 as the prior, what is the posterior distribution for the proportion of people who favor gun control? Also plot the prior, likelihood and posterior and comment on the plot.
 - iii. What is the mean of this distribution?
 - iv. What is the 95% credible interval? Interpret.
 - v. What is the 95% high density interval? Interpret.
 - vi. If you were reporting this result in a paper, which interval would you use?