Bayesian Statistics: Homework 0.

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Problem 1

Part a

Who originally coined the word *Bayesian*?

L.J. Savage is the person who coined the word *Bayesian*, as described in the paper *When Did Bayesian Inference Become "Bayesian"?*, Savage was using the word *Bayesian* as we use it today in as early as 1960's. Since Savage is the first person who use the word *Bayesian* with the meaning in the same way as we understand, he should be the right person who originally coined the word.

Part b

Who was the founder of Bayesian statistics? Justify why you think so.

According to the paper *When Did Bayesian Inference Become "Bayesian"?*, the founder of Bayesian statistics is the French scientist Pierre Simon Laplace. In a paper published in 1774, Laplace gave a clear demonstration of how to make inference on a binomial parameter (using Bayesian method), he also discussed about the choice of uniform prior and claimed the posterior should be proportional to likelihood. As claimed in the paper *When Did Bayesian Inference Become "Bayesian"?*, "the original 1774 memoir had far-reaching influence on the adoption of Bayesian ideas in the mathematical world, influence that was unmatched by Bayes paper, to which it did not refer."

Problem 2

Part a

Compute the posterior distribution over the valid range of θ and plot the likelihood, prior and posterior in a single graph.

The formula for calculating the posterior is shown as follows:

$$P(\theta_i|X) = \frac{L(\theta_i|X)P(\theta_i)}{\sum_{i=1}^{8} L(\theta_i|X)P(\theta_i)} \tag{1}$$

Using R (see code in appendix), we can obtain the posterior for each θ value. The result is shown in the last row of the following table.

Theta	-3	-2	-1	0	1	2	3	4
Likelihood	0.5000	2.0000	1.0000	3.0000	1.0000	3.0000	2.0000	0.5000
Prior	0.1000	0.3000	0.0500	0.1500	0.0500	0.1000	0.2000	0.0500
Posterior	0.0260	0.3117	0.0260	0.2338	0.0260	0.1558	0.2078	0.0130

The plot including the data of likelihood, prior and posterior can be found in the following figure.

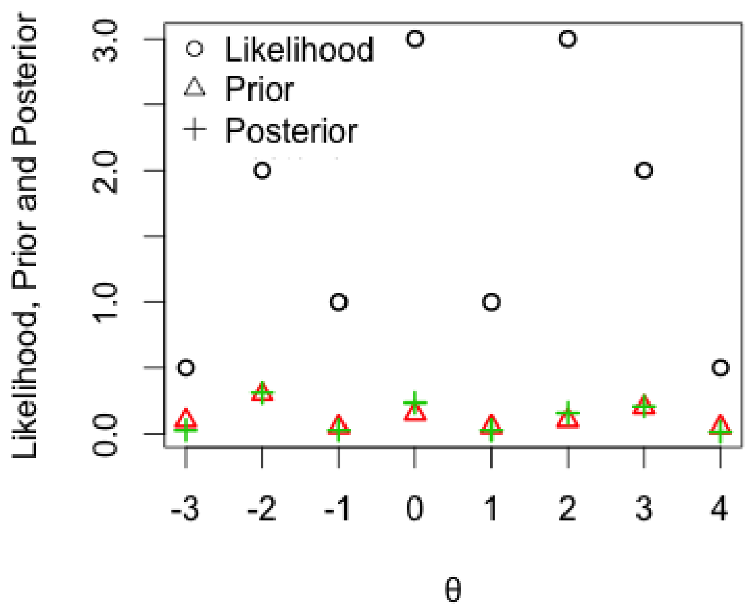

Figure 1: Plot of Likelihood, Prior and Posterior versus θ.

Part b

Compute $E[\theta|X]$.

The $E[\theta|X]$ can be calculated by the following formula:

$$E[\theta|X] = \sum_{i=1}^{8} \theta_i \times P(\theta_i|X) \tag{2}$$

The result obtained by R is $E[\theta|X] = 0.2857143$. (See code in appendix.)