Assignment 2

You can use printing and handwriting together to finish your assignment. Please ensure that your name and student ID have been written on every page of your assignment file. You should hand in your assignment 2 on May 22th, 2023, during the morning class. Late submission should be unacceptable.

Search and download a data set in your own interesting area. This data set will also be used in your assignment 3 and your final project. The data set is strongly recommended to include numerical random variables, binary random variables, and categorical random variables with more than two categories.

1. Please apply the structure of normal distribution to fit the numerical variable from your data set with the likelihood function. Then use an appropriate non-informative prior distribution to deduct the posterior distribution. Please write down the whole deduction process.
2. Select the numerical variable in your data set, then use the distribution above to calculate the hyperparameters. You may need to use software to help your calculation.
3. Use the posterior distribution to sample observations with an appropriate sample size, then compare the sample distribution with your real data distribution. You can use density plot or histogram to do the comparison. Explain any differences or similarities.
4. Please use a gamma distribution as the prior distribution of the variance and a conditional normal distribution given the variance as the prior distribution of the mean, then deduct the kernel function of the posterior distribution.
5. Use the kernel function above to do MCMC sampling to sample observations, then compare the sample distribution with your real data distribution. You can use density plot or histogram to do the comparison. Explain any differences or similarities.