Problem 1:

Problem 2: Solution is in the corresponding Jupyter notebook on the GitHub.

Problem 3: Solution is in the corresponding Jupyter notebook on the GitHub.

Problem 4: Derive the analytic posterior for the conjugate Dirichlet-Multinomial model.

Assume we have categories. Thus, we have that and such that .

From , we know the prior:

is the multivariate Beta function.

From , we know the likelihood:

From Bayes’ rule proportionality, we can get the posterior:

Drop the constants:

We see that this is just another Dirichlet distribution. Thus, we have the following posterior:

We see that and such that .

Problem 5: Solution is in the corresponding Jupyter notebook on the GitHub.

Problem 6: Solution is in the corresponding Jupyter notebook on the GitHub.