**Q1. Probabilities Computation**

(i)

(ii)

(iii)

(iv)

**Q2. Naïve Bayes Classifier**

(i) Let =

likelihood =

log-likelihood =

max(log-likelihood) =

s.t.

Solve it by langrage multiplier,

=

Since, , so , so

Max likelihood estimate probability of

(ii) Let =

Max likelihood estimate probability of

(iii) Use Laplace Smoothing in to avoid zero probability.

Change the calculation of to , which

(iv) Simply ignore the words only occur in test set.

Utilize stop words corpus or some corpus containing very frequent words to filter out those words before the construction of the bags of words.

**Q3. Running the Classifier on an Example**