**Problem 1:** Given training data ,  is the mean of the training data, is its covariance matrix with eigenvectors  and eigenvalues . Given an eigenvector, the projection of data to eigenvector  subspace is defined by

, where .

1. Derive the solution  to the above optimal problem.
2. Prove that 

**Problem 2:** The Non-negative Matrix Factorization  can be formulated as maximum likelihood of Poisson distribution. Prove that such a formulation is equivalent to minimizing the KL divergence of 。