University of TEHRAN

# Machine Learning

## Problem Set 13

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**Problem 1: Review Questions**
Write a summary of the lectures of this week. Write down all formulas we discussed in the lectures and explain in detail each step of derivations. As a guideline, you may consider the following topics:

(a) Bayesian inference; conjugate models; Bayesian linear regression; Laplace approximation

(b) **(Important)** Explain in detail the derivations of the Bayesian linear regression.

(c) Clustering methods

**Problem 2: Conjugate prior**
Show that the gamma distribution is a prior conjugate for the exponential distribution.

**Problem 3: Laplace approximation for Bayesian logistic regression**
Formulate the logistic regression in the Bayesian framework. Derive a Laplace approximation for the posterior distribution of Bayesian logistic regression.

**Problem 4: The Stirling number of the second kind (extra credit)**
Solve the recursive equation for the Stirling number of the second kind and find a closed-form expression for it,

Submit your solutions (using Easyclass) by Dey 7.