

**Department of Data Science**  
**IIT Palakkad**

**DS5006 : Machine Learning**

0800-0850

Test 1 (02 Sep 2024)

Marks : 20

**Instructions**

1. Write your answers neatly in Blue/ Black ink. Do not use pencil / Red ink. Make sure your answers are legible.
2. Doubts and questions will not be answered during the exam. If you have to make any assumption about unspecified things, write the assumption clearly with justification.
3. Write the question number clearly for each answer. Draw a line after the answer.
4. There will be partial markings for the questions, so even if you are not able to solve the entire problem be sincere with the steps.
5. **Be precise.**

1. The solutions of a linear regression problem obtained through normal equations and the least squares iterative gradient descent approach can be different. True or False? Briefly explain.
2. What are the benefits of the *exchangeability* assumption? Give an example where the assumption is not valid.
3. What is the impact on the bias and variance of a LASSO model, when the regularizing coefficient value is increased? Briefly explain.
4. List down the assumptions we made while using linear regression to make predictions. Describe a real-life scenario where some of the assumptions are violated.
5. Derive an analytical solution for Ridge Regression
6. Solve the following constrained optimization problem:

$$\begin{aligned} \text{maximize } f &= - \sum_{i=1}^N P(x) \log P(x) \\ \text{subject to } \sum_{i=1}^N P(x) &= 1 \end{aligned}$$

7. Construct or plot a set of data  $(x; y)_i; i = 1 \text{ to } n$ , for which the least squares and least absolute deviation estimates of  $(c; m)$  in the fit,  $y = c + mx$ , are much different. What did you have to do to make this happen?<sup>1</sup>

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<sup>1</sup>Source: *Regression and Other Stories* by Andrew Gelman, Jennifer Hill, and Aki Vehtari, Published by Cambridge University Press in 2020.