INDIAN INSTITUTE OF INFORMATION TECHNOLOGY SRI CITY
MACHINE LEARNING – M2023 Term-2 EXAMINATION

Date: 17 Oct 2023 Duration: 90 Minutes Total Marks: 20

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1) Derive closed-form solution for linear regression. Use standard notation.

[2 Marks]

2) Given the data for a 1D regression problem, (x, y) value pairs are {(0, 1), (2, 4), (3,4)}, find the linear regression solution where y is written as a linear equation of the dependent variable x. You need to derive step by step solution. **[4 Marks]**

3) Derive the Bias, variance decomposition for regression when the Loss is taken to be squared deviations. Assume D is the set of training sets each of size n, t is the target at x, and y is the prediction at x. You need to derive step by step solution.

[4 Marks]

4) Suppose we observe N samples from a Gaussian distribution $D = \{x^{(i)}\}$ $where\ i = \{1\ to\ N\}$ and $x^{(i)} \sim N(\mu, \sigma^2)$ with pdf,

$$p(x|\mu, \sigma^2) = \frac{1}{\sqrt{2\pi\sigma^2}} exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right)$$

obtain the maximum likelihood estimator for parameters μ and σ^2. **[8 Marks]**

Note: show the step-by-step derivation. Each parameter will get 4 marks.

5) Write Gradient Descent Algorithm.

[2 Marks]