**Birla Institute of Technology & Science, Pilani**

**Work-Integrated Learning Programmes Division**

**Comprehensive Examination**

Course No. :

Course Title : Regression

Nature of Exam : Open Book

No. of Pages =**2**

No. of Questions = **4**

Weightage : 40%

Duration : 2 Hours

Date of Exam :

Q1. **[ 4 + 4 = 8 Marks]**

1. Discuss the applicability and interpretation of Regression concept in Machine Learning.
2. Interpret overfitting in regression and discuss how this can be handled.

**Q2. [ 12 Marks]**

Consider the following data and models proposed

(x ,y) = (1,2),(2,5),(4,15),(6,25),(7,12)

Model 1:h1(x) = w0 + w1x

Model 2:h2(x) = w0 + w1x2

Fit both models on the data and suggest the model which is the best? Show the working and validate your answer.

**Q3. [ 4 + 8 = 12 Marks]**

1. Why we need to consider Gradient Descent approach in Regression instead of OLS (Ordinary Least Squares) approach, which always gives minimal error. Discuss in detail.
2. Consider the data: (x, y); (5,1),(2,6),(4,9), (5,50) ,(8, 120). Apply Gradient descent (by choosing initial weights and alpha randomly) and OLS algorithms. Based on this, which model you suggest.

**Q4. [ 4 + 4 Marks]**

1. Consider the data set with 1000 records(x ,y): (where x is feature and y is target variable): (1,3), (3,5), (5,8), (7,12), (1,3), (3,5), (5,8), (7,12),……

Samples of sizes 50 selected from these records and linear regression (w0 + w1x)

is tried on these samples for which the values are as given below.

(w0 = 0.2, w1 = 0.8) , (w0 = 105, w1 = 280), (w0 = 1000, w1 = 8006), (w0 = 20, w1 = 120)

What will be the criteria to be used to select the best among these? What will be the reason behind this and how to handle this?

1. Consider a labelled data with features X1, X2, X3 for regression model. Following is the summary of various models built on the data. Write any four valid observations from the this summary which is helpful in having optimal linear regression model.

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| --- | --- | --- | --- | --- | --- |
| **Model** | **Definition** | **R – Square / Adjusted R - Square** | **F - Statistics** | **P - value** | **MSE** |
| Model 1 | y = f(X1) | 0.612/0.610 | 312.1 | 1.47exp(-42) | 3.25(23%) |
| Model 2 | Y = f(X1, X2) | 0.646/0.642 | 179.6 | 3.95exp(-42) | 3.12(22%) |
| Model 3 | Y = f X1, X3) | 0.897/0.896 | 859.6 | 4.83exp(-42) | 1.71(12%) |
| Model 4 | Y = f(X1, X2, X3) | 0.897/0.896 | 570.3 | 1.58exp(-42) | 1.80(13% |

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