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| **National University of Computer and Emerging Sciences, Lahore Campus** | | | | |
| C:\Users\saif\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.Word\final design.jpg | **Course:** | **Artificial Intelligence** | **Course Code:** | **AI-2002** |
| **Program:** | **BS(Computer Science)** | **Semester:** | **Spring 2024** |
| **Duration:** | **30 Minutes** | **Total Marks:** | **10** |
| **Paper Date:** | **22-April-23** | **Weight** | **3.33%** |
| **Section:** | **D/F/F** | **Page(s):** | **2** |
| **Exam:** | **Quiz 3B** | **Roll No.** |  |
| **Instruction/Notes:**   * Provide your solution on this sheet. You may use an extra page for rough work. | | | | |

# Problem#1 (CLO-2) 5 Points

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | S-I | S-II | G.Tot | (S-I)2 | (S-II)2 | (G.Tot)2 | S-I\*G.Tot | S-II\*G.Tot |
| ∑ | 688 | 923 | 6932 | 5433 | 9765 | 517503 | 51481 | 69890 |

We possess a dataset containing the sessional marks, grand total marks, and grades of 95 students of AI course in SP23. Leveraging this data, we aim to train a linear regression model. This model will enable us to predict the total marks achieved by students of SP24 based on their sessional performance.

|  |  |  |  |
| --- | --- | --- | --- |
| Features Selected | S-I | S-II | S-I and S-II |
| R2 Score | 0.326 | 0.657 | 0.712 |

i) Above table shows the value of R2 against selection of the independent variables. Interpret the R2 for every selection and suggest the independent variable(s) to be chosen for the above problem.

If we select S-I as independent variable it can only explain 32% of the variance of data. If we choose S-II it is better than s-I and explains 65% of the variance in the data. But choosing both S-I and S-II as independent variable will give us maximum variance and will surely result in a good model.

ii) Suppose we selected S-II as independent variable. For 0 marks in S-II, how much marks should a student obtain in G.Totl according to the model?

SSxx = ∑x2 – (∑x)2/95 = 9765 – 851929/95 = 794.32

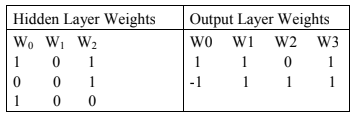
SSxy = ∑xy– (∑x\*∑y)/95 = 69890 – 6398236/95 = 2540

b = SSxx/SSxy = **3.197**

a = yMean – b\*xMean = 72.97 – 3.197 \* 9.715 = **41.9**

**Problem#2**(CLO-2) **5 Points**

Consider a multi-layer perceptron with 2 inputs, a single hidden layer of 3 neurons and an output layer consisting of 2 neurons. The network uses linear activation function in the hidden layer and sigmoid activation at the output layer. Weights of the hidden layer and output layer neurons are given in the following table with the first weight being that of the bias term. After forward pass the output of the neural network given the input (1 1) is 0.982 and 0.952 respectively while the expected outputs were 0.05 and 0.95. Calculate absolute error at each output neuron and then sum it to have total error. Based on the total error compute the delta and update the weights connecting first hidden neuron to second output neuron assuming learning rate is 0.5.



h1 = 2, h2 = 1, h3 = 1

o1 = 4, g(o1) = 0.982

o1 – 3, g(o2) = 0.952

E1 = |0.05-0.982| = 0.932

E2 = |0.95-0.952| = 0.002

Etotal = 0.934

Delta o2 = Etotal \* g’(o2) = 0.04268

Wh1-o1 = Wold + α \* h1 \* delta o1 = 1 + 0.5 \* 2 \* 0.04268 = 1.04268