Nirma University

Institute of Technology
Sessional Exam, February 2026
Semester-II M Tech (CSE, CSE-DS),
6CS272ME25– Deep Learning Applications

Roll / Exam No. 25MCD005

Supervisor's initial with date

Time: 2:00 hours

Max Marks: 50

Instructions:
1. Attempt all questions.
2. Figures to the right indicate full marks.
3. Assume the data if incomplete and mention the assumption.

Q.1 Answer the following questions **[18]**

A CLO3 BL:2 [09]

In a time, series data, a sequence model is designed to predict the **Minimum temperature for the next day** based on previous weather information. The hidden state in an **RNN** is represented by **three units.** The normalized input at each timestamp consists of **maximum and minimum temperature of the date.**

Date	Max Temp (°C)	Min Temp (°C)
2025-06-01	0.36	0.28
2025-06-02	0.34	0.26
2025-06-03	0.33	0.25
2025-06-04	0.32	0.25
2025-06-05	0.30	0.23

The initial hidden state is h_0 = [0.1 0.1 0.1] and bias = [0 0 0]. The input matrix

$$Wa = \begin{bmatrix} 0.20 & 0.10 & 0.25 \\ 0.15 & 0.30 & 0.10 \\ 0.25 & 0.20 & 0.15 \\ 0.25 & 0.35 & 0.10 \\ 0.15 & 0.20 & 0.30 \end{bmatrix}$$

Use tanh as the activation function. Solve to find the hidden state on 2025-06-02 .

B CLO3 BL:4 [09]

Consider the following CNN architecture:

Input Layer (I) → Convolutional layer (C1) → Convolutional layer (C2) → Convolutional layer (C3) → Maxpool Layer → Fully Connected (F1) → output

- The input receives color images of size 150x150x3.
- **C1**: 6 filters, kernel size **F = 9**, stride **S = 1**, padding **P = 4**.
- **C2**: 12 filters, kernel size **F = 5**, stride **S = 2**, padding **P = 2**.

- **C3**: 24 filters, kernel size **F = 3**, stride **S = 1**, padding **P = 1**.
- **Maxpool**: F = 2, S = 2. (count zero parameters for Maxpool layer)
- F1 has **200 neurons**.
- **Output has 50 neurons.**
- **All the layers include biases.**

Solve for the

1. Size of feature map (wherever applicable) after every layer
2. Calculate the number of parameters in each layer and in total
3. Number of Operations in each layer and in total.

Note: Use the floor function to calculate the feature map dimension wherever applicable.

Q.2 **Answer the following questions** **[16]**

A CLO3 BL:2 — Assume a cascaded RNN with two layers. 10000 neurons in the input layer, 100 neurons in the first hidden layer, 50 neurons in the second layer. Determine the total number of parameters involved. Don't ignore bias. [6]

B CLO4 BL:5 — A RNN based language model is to be defined to predict the next word in a sentence. If the size of the vocabulary is 5000, draw the block diagram with the size of the input and hidden specified. Assume the size of the hidden state to be 400 and use a word embedding layer with size 700. Draw the diagram, define the interpretation and training (X, Y definition) [6]

C CLO1 BL:2 — What is word embedding layer? What is its relevance? How this layer can be trained? [4]

Q.3 **Answer the following questions** **[16]**

A CLO2 BL:5 — In LSTM equations, we use Sigmoid activation and Tanh activation. Specify the relevance of each in LSTM functioning. Write the equation and use diagram to discuss the same [08]

B CLO3 BL:4 — In the Matrix given below, calculate the feature map after the convolution operation. The padding parameter is set to keep the output size the same as the input size. The convolution layer uses the Relu activation function. [08]

0	2	1	1	1
0	1	2	1	0
1	0	2	0	0
1	1	0	1	0
1	0	1	0	2

Input Image

0	1	-4
0	2	0
-1	4	3

Channel 1 Filter

1	1	-2
0	1	1
2	2	1

Channel 2 Filter