|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Roll No. |  |  |  |  |  |  |  |  |  |  |  |  |



 **PRESIDENCY UNIVERSITY**

  **Bengaluru**

|  |
| --- |
| **End - Term Examinations – JANUARY 2025** |
| Date: 07 – 01- 2025 Time: 09:30 am – 12:30 pm |

|  |  |
| --- | --- |
| **School:** SOCSE | **Program:** B. Tech-CSE |
| **Course Code:** CSE3010 | **Course Name:** Deep Learning Techniques |
| **Semester**: VII | **Max Marks**: 100 | **Weightage**: 50% |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |
| **Marks** | **30** | **30** | **20** | **20** | **N/A** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Do not write anything on the question paper other than roll number.*
3. *Your answers for the* ***FIRST 12 questions*** *must end by* ***PAGE #12****. You must start answering* ***QUESTION 13*** *from* ***PAGE #13****.*

**Part A**

|  |
| --- |
| **Answer ALL the Questions. Each question carries 2marks. 10Q x 2M=20M** |
| **1** | State the derivative of the Leaky ReLU activation function when x < 0. | **2 Marks** | **L1** | **CO1** |
| **2** | State true or false. A larger batch size will enable the neural network to train an epoch faster because there are lower number of back-propagations. | **2 Marks** | **L1** | **CO1** |
| **3** | Name a technique for automatic parameter tuning if the number of hyperparameters are small (Eg. less than 3). | **2 Marks** | **L1** | **CO1** |
| **4** | Expand RNN | **2 Marks** | **L1** | **CO1** |
| **5** | State true or false. Deep learning is able to automatically learn features from the training data. | **2 Marks** | **L1** | **CO1** |
| **6** | State the derivative of the ReLU function if x > 0. | **2 Marks** | **L1** | **CO1** |
| **7** | A particular pooling function takes the vectors V1 = [1,2,3] and V2 = [1,4,5]. It produces the output V = [1,3,4]. State the type of pooling function it is. | **2 Marks** | **L1** | **CO1** |
| **8** | Mention any 2 types of autoencoders. | **2 Marks** | **L1** | **CO1** |
| **9** | Name any Boolean function which **cannot** be solved using a single perceptron. | **2 Marks** | **L1** | **CO1** |
| **10** | Write down the activation function of tanh. | **2 Marks** | **L1** | **CO1** |

 **Part B**

|  |
| --- |
| **Answer the Questions Total 80 Marks.** |
| **11.** | **a.****b.** | Prove that the Leaky ReLU activation function is not differentiable at x=0, unless a certain condition is met. Also write down that condition, and explain what happens to the derivative of the Leaky ReLU activation function if it is met, when x > 0 and x < 0.Given the loss function L(a,b,c) = 2a\*(b-3c). Calculate the gradients of the loss function L with each of the inputs a, b, and c, when a = -1, b = 0, and c = 1. | **10 Marks****10 Marks** | **L2****L3** | **CO1****CO2** |
| **Or** |
| **12.** | **a.****b.** | Let f(x) be the ELU of x. Let f'(x) be the derivative of f(x) with respect to x. Prove that f'(x) = 1 if x > 0 and f'(x) = f(x) + a, if x is less than 0, where a is the parametric constant used in calculating the ELU.Given the loss function L(a,b,c) = 2a\*(b-3c). Calculate the gradients of the loss function L with each of the inputs a, b, and c, when a = 7, b = 1, and c = 4. | **10 Marks****10 Marks** | **L2****L3** | **CO1****CO2** |
|  |  |  |  |  |  |
| **13.** | The following are the weight matrices learnt in an LSTM:$Wf= \left[\begin{matrix}0&-1&0\\-2&0&-2\end{matrix}\right]$, $bf= \left[\begin{matrix}0&-2\\-2&0\end{matrix}\right]$$Wc= \left[\begin{matrix}0&1&0\\-1&0&-1\end{matrix}\right]$, $bc= \left[\begin{matrix}0&-1\\-4&0\end{matrix}\right]$$Wi= \left[\begin{matrix}2&0&3\\0&1&0\end{matrix}\right]$, $bi= \left[\begin{matrix}1&0\\0&2\end{matrix}\right]$$Wo= \left[\begin{matrix}1&1&0\\0&0&-1\end{matrix}\right]$,$bi= \left[\begin{matrix}1&0\\-2&-2\end{matrix}\right]$For the input sequence: X1 = [1,2,1], X2 = [2,1,0], X3 = [0, -1, 3]. Calculate the output. | **20 Marks** | **L3** | **CO4** |
| **Or** |
| **14.** | The following are the weight matrices learnt in an LSTM:$Wf= \left[\begin{matrix}0&-1&0\\-2&0&-2\end{matrix}\right]$, $bf= \left[\begin{matrix}0&-2\\-2&0\end{matrix}\right]$$Wc= \left[\begin{matrix}0&1&0\\-1&0&-1\end{matrix}\right]$, $bc= \left[\begin{matrix}0&-1\\-4&0\end{matrix}\right]$$Wi= \left[\begin{matrix}2&0&3\\0&1&0\end{matrix}\right]$, $bi= \left[\begin{matrix}1&0\\0&2\end{matrix}\right]$$Wo= \left[\begin{matrix}1&1&0\\0&0&-1\end{matrix}\right]$, $bi= \left[\begin{matrix}1&0\\-2&-2\end{matrix}\right]$For the input sequence: X1 = [1,0,1], X2 = [0,1,0], X3 = [1, -1, 0]. Calculate the output. | **20 Marks** | **L3** | **CO4** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **15.** | The input to a softmax classifier is the following vector: X = [2024, 2025]. Calculate the output. **NOTE:** Your output should be correct up to **3 decimal places**. | **20 Marks** | **L3** | **CO2** |
| **Or** |
| **16.** | The input to a softmax classifier is the following vector: X = [1987, 1988, 1989, 1990].Calculate the output. **NOTE:** Your output should be correct up to **5 decimal places**. | **20 Marks** | **L3** | **CO2** |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **17.** | Consider the following 6\*6 matrix:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 1 | 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 | 0 | 1 |
| 1 | 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 | 0 | 1 |
| 1 | 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 | 0 | 1 |

Calculate the output of applying the following convolution filter (stride = 1) to that matrix:

|  |  |  |
| --- | --- | --- |
| 1 | 2 | 1 |
| 2 | 4 | 2 |
| 1 | 2 | 1 |

 | **20 Marks** | **L3** | **CO3** |
| **Or** |
| **18.** | Consider the following 6\*6 matrix:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 0 | 1 | 0 | 1 | 0 | 1 |
| 1 | 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 | 0 | 1 |
| 1 | 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 | 0 | 1 |
| 1 | 0 | 1 | 0 | 1 | 0 |

Calculate the output of applying the following convolution filter (stride = 1) to that matrix:

|  |  |  |
| --- | --- | --- |
| 4 | 2 | 4 |
| 2 | 1 | 2 |
| 4 | 2 | 4 |

 | **20 Marks** | **L3** | **CO3** |

**\*\*\*\*\* BEST WISHES \*\*\*\*\***