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**M.Sc. 3rd Semester Examination, 2024**

**COMPUTER SCIENCE**

**PAPER – COS-302 (M1 & M2)**

*Full Marks : 50*

*Time : 2 hours*

**Answer all questions**

*The figures in the right hand margin indicate marks*

*Candidates are required to give their answers in  
their own words as far as practicable*

**Illustrate the answers wherever necessary**

**PAPER – COS-302 M1**

*( Machine Learning )*

*Full Marks : 25*

**GROUP—A**

**Answer any two questions : 2 × 2**

- 1. What do “bias” and “variance” mean in a machine learning model ?**

*( Turn Over )*

( 2 )

2. What is the role of a loss function in machine learning ?
3. Explain the difference between bagging and boosting.
4. Define one vs. all and one vs. rest multiclass classification.

**GROUP-B**

Answer any two questions :  $4 \times 2$

5. What is cross-validation and why is it used ?  
 $2 + 2$
6. What are the key differences between linear regression and logistic regression ?
7. What is the role of activation functions in neural networks ? Name commonly used activation functions.  
 $2 + 2$
8. Explain the KNN classifier algorithm.

## GROUP – C

Answer any one question : 8 × 1

9. Given the following table S, find the class of a new record (Sunny, Hot, Normal, False) using Naïve Bayes algorithm.

Outlook	Temperature	Humidity	Wind	Play Tennis
Sunny	Hot	High	Weak	No
Sunny	Hot	High	Strong	No
Overcast	Hot	High	Weak	Yes
Rain	Mild	High	Weak	Yes
Rain	Cool	Normal	Weak	Yes
Rain	Cool	Normal	Strong	No
Overcast	Cool	Normal	Strong	Yes
Sunny	Mild	High	Weak	No
Sunny	Cool	Normal	Weak	Yes
Rain	Mild	Normal	Weak	Yes
Sunny	Mild	Normal	Strong	Yes
Overcast	Mild	High	Strong	Yes
Overcast	Hot	Normal	Weak	Yes
Rain	Mild	High	Strong	No

( 4 )

- What do you mean by kernel trick in SVM? 6 + 2
10. What is PCA (Principal Component Analysis) ? Explain how it reduces dimensionality and why it is used. 2 + 6

[ Internal Assessment — 05 Marks ]

PAPER — COS-302 M2

( *Deep Learning* )

*Full Marks : 25*

GROUP—A

Answer any **two** questions : 2 × 2

1. Distinguish between valid padding and same padding in convolution operation.
2. What is batch normalization ?
3. List any two applications of CNN.

4. Mention two limitations of traditional machine learning.

**GROUP – B**

Answer any **two** questions :  $4 \times 2$

5. How can you prevent overfitting in deep learning model ? Briefly explain drop out in deep neural network with a diagram.  $2 + 2$

6. What is pooling ? Perform max pooling and average pooling operations considering stride=2 on feature map F as given below :  
(Considering Pooling Window Size  $2 \times 2$ )  $1 + 3$

$$F = \begin{bmatrix} 12 & 20 & 30 & 0 \\ 8 & 12 & 2 & 0 \\ 34 & 70 & 37 & 4 \\ 112 & 100 & 25 & 12 \end{bmatrix}$$

7. Highlight the applications of deep generative models in image and text generation. **4**

8. Define ReLU activation function ? Obtain the feature map of X after ReLU operation where,

$$X = \begin{bmatrix} -1 & 2 \\ 4 & -5 \end{bmatrix} \quad 4$$

GROUP – C

Answer any one question :  $8 \times 1$

9. (a) Briefly describe the architecture of a Convolutional Neural Network (CNN) with a proper diagram.
- (b) Consider an input matrix (image/feature map) I and filter matrix K as below :

$$I = \begin{bmatrix} 4 & 3 & 4 & 1 \\ 6 & 5 & 8 & 7 \\ 9 & 10 & 15 & 12 \\ 14 & 10 & 16 & 10 \end{bmatrix} \text{ and } K = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$$

Obtain the output feature map after convolution operation with stride = 2 and zero padding.  $4 + 4$

( 7 )

10. You are given the following confusion matrix for a binary classification problem :

	Predicted Positive	Predicted Negative
Actual Positive	50	10
Actual Negative	5	85

Calculate accuracy, precision for the positive class, recall for the positive class and the F1 score for the positive class.      2 + 2 + 2 + 2

[ Internal Assessment — 05 Marks ]

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