SPRING **MID SEMESTER EXAMINATION-2025**

School of Computer Engineering
Kalinga Institute of Industrial Technology, Deemed to be University
Machine Learning
[CS31002]

Time: 1 1/2 Hours   **Full Mark: 20**

Answer Any four questions including question No.1 which is compulsory.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable and all parts of a
question should be answered at one place only.

1. Answer all the questions.   [1 Mark X 5]

    a) A dataset has an independent variable X = [2, 3, 5, 7] and a dependent variable
        Y = [3, 6, 9, 14]. Using simple linear regression, compute the slope (β_1) and
        intercept (β_0) of the best-fit line.

    b) Which normalization technique scales values to the range [0, 1] by default?
        Provide its formula.

    c) What is the objective of using the kernel trick in an SVM classifier?

    d) Show that the derivative of the logistic function $g(x)$ is $g(x)(1 - g(x))$.

    e) Calculate Accuracy, Precision, Recall and F1 score from the following
        confusion matrix.

Actual Class\Predicted class	cancer = yes	cancer = no	Total
cancer = yes	90	210	300
cancer = no	140	9560	9700
Total	230	9770	10000

2. (a) Parameter k in k-NN algorithm could be a very large value or a very small value.
        Give the drawbacks, if any, of each choice.

    (b) Consider the two-class classification task that consists of the following data points:
        Class 1: $[10, 5]^T$, $[12, 5]^T$, $[15, 8]^T$
        Class 2: $[6.5\ 11]^T$, $[7, 15]^T$, $[8, 10]^T$
        Using *k*-NN classifier with k=3 and Euclidean distance, predict the test data point
        $[16, 8]^T$ belongs to which class.   [1+4 Marks]

3. What are Ridge regression and LASSO regression techniques?
    (a) How are they different from (ordinary) linear regression?
    (b) How is LASSO different from Ridge regression?   [5 Marks]

4.   You are given the following dataset

Color	Legs	Height	Smelly	Species
White	3	Short	Yes	M
Green	2	Tall	No	M
Green	3	Short	Yes	M
White	3	Short	Yes	M
Green	2	Short	No	H
White	2	Tall	No	H
White	2	Tall	No	H
White	2	Short	Yes	H

Use naive bayes to check species for test data X = {Color=Green, Legs=2, Height=Tall, Smelly=No}.   [5 Marks]

5.   (a) Describe One-Against-All (OAA) and One-Against-One (OAO) classification algorithm.

(b) For the optimization of the separating hyperplane for linearly separable patterns, formulate the primal and the dual problems.   [1+4 Marks]

*** Best of Luck ***