

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATIONS- 2026

B.Tech-VI Semester (CSE/IT/BT)

COURSE CODE (CREDITS):18B11BI611 (3)

MAX MARKS: 35

COURSE NAME: Machine Learning for Bioinformatics

COURSE INSTRUCTOR: KLK and SKP

MAX. TIME: 2 Hours

Note: (a) All questions are compulsory.

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

(c) Use of a calculator is allowed

Q. No	Question	CO	Marks																				
Q1	(A) Define the following in brief: (1) 2-point crossover, (2) Local generalization, (3) Kernel function, (4) Pair-wise Independent events, (5) Neighbours in k-NN. [1X5=5] (B) How is Machine Learning different from Deep Learning? [2]	1, 2	7																				
Q2	Derive the Schema Theorem . Consider a population of size $N = 10$. A schema H has the following parameters: order of schema $o(H) = 2$, defining length $\delta(H) = 4$, average fitness of schema $f(H) = 8$, population average fitness $\bar{f} = 6$, crossover probability $p_c = 0.6$, mutation probability $p_m = 0.01$, and number of instances of schema in the current generation $m(H, t) = 3$. Using the Schema Theorem bound, compute the expected number of instances of schema H in the next generation, i.e., $m(H, t + 1)$. Assume chromosome length = 6. [4+3]	3	7																				
Q2	<table border="1"> <thead> <tr> <th>Point</th><th>x1</th><th>x2</th><th>Class y</th></tr> </thead> <tbody> <tr> <td>X1</td><td>2</td><td>2</td><td>+1</td></tr> <tr> <td>X2</td><td>4</td><td>4</td><td>+1</td></tr> <tr> <td>X3</td><td>2</td><td>0</td><td>-1</td></tr> <tr> <td>X4</td><td>0</td><td>2</td><td>-1</td></tr> </tbody> </table> Explain the concept of a maximum margin hyperplane in the context of a linear SVM. Why are only subsets of points called <i>support vectors</i> important for defining the decision boundary? Compute the margin given the above data and predict the class of point (3, 2). [2+2+3]	Point	x1	x2	Class y	X1	2	2	+1	X2	4	4	+1	X3	2	0	-1	X4	0	2	-1	5	7
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Q3	Fill the following Table with Yes/No, High/Low, or appropriate words. [3] <table><tr><th>Aspect</th><th>Model-Based Learning</th><th>Instance-Based Learning</th></tr><tr><td>Training Cost</td><td></td><td></td></tr><tr><td>Inference Cost</td><td></td><td></td></tr><tr><td>Local Generalization</td><td></td><td></td></tr><tr><td>Sensitivity to Noise</td><td></td><td></td></tr><tr><td>Memory Requirement</td><td></td><td></td></tr><tr><td>Type of Learner</td><td></td><td></td></tr></table> Write the expressions corresponding to a query (x) that gives a response to (A) classification (B) Regression in an instance-based learning scenario (assume k-NN). [2+2]	Aspect	Model-Based Learning	Instance-Based Learning	Training Cost			Inference Cost			Local Generalization			Sensitivity to Noise			Memory Requirement			Type of Learner			4	7
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Q5	Give the statement of Bayes' Theorem with the appropriate assumption. Explain how Maximum-Likelihood estimation is related to Bayes' Theorem. Derive the expression that establishes that Maximum-Likelihood estimation applied to regression problems is actually the minimization of Mean Squared Error. [1+1+5]	5	7																					