

**DISCIPLINE OF COMPUTER SCIENCE & ENGINEERING**  
**INDIAN INSTITUTE OF TECHNOLOGY INDORE**

Autumn Semester, 2021  
Mid Semester Examination-SET 3

Course Code and Title: CS403/603 Machine Learning

Date (Day): 23/9/2021 (Thursday)

Max. Time Duration: 2 Hrs+5 minutes

Extra

Max. Marks: 30

Number of Questions: 03

Number of pages in the Question Paper: 02

Instructions:

1. *All questions are compulsory. Clearly state the assumptions wherever required with proper justification*
2. *Answers must be brief and to the point.*
3. *Students are required to submit the complete answer-sheet only once in the single PDF file strictly naming the PDF file with your Roll Number. Resubmissions are not allowed.*
4. *Mention your roll number and name on first page of your answer sheet.*
5. *Examination time is 2 hours and 5 minutes will be provided for scanning and uploading the answer sheet. Additional 2 marks will be deducted for every 5 minute delay in uploading answer sheets.*
6. *Group of Students will be asked to keep the camera on for 5-5 minutes at random for multiple times through google meet & it will be recorded.*

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Q.1

A. What is the relationship between model, features and task? Discuss in context of classification problem. Also draw a neat diagram for showing the interrelationship.

B. What is meant by Ridge Regression? How it improves learning for regression problems? Discuss.

C. What is the role of slack variable in case of Soft-Margin based SVM? Is it workable with complexity parameter(C)? Explain.

[2.5+2.5+5]

Q. 2

A. For the following training data with X is a feature and Y as output, calculate the regression coefficient and obtain the lines of regression:

X	21	23	25	27	29	31	33
Y	1	2	3	4	5	6	7

B. For the following training data with X is a feature and Y as output, obtain regression equation of Y on X and estimate Y when X=18:

X	10	21	11	22	12	26
Y	21	20	19	17	16	15

[5+5]

Q. 3 For the following training data as positively or negatively labelled in the two-dimensional space.

X1	X2	class
1	1	+
2	2	+
2	0	+
0	0	-
-1	0	-
0	-1	-

A. Construct a support vector machine that correctly classify these points with maximal margin. For this write dual optimization form and solve for W. Also evaluate margin and specify support vectors.

B. Show all the steps for evaluating the parameters. Trace out the step wise construction by hand. If the negatively labelled point [0,0] is removed then what is the effect on margin? How decision boundary rotates? Again, show all the steps and evaluation for the parameters. Draw the changed decision boundary.

[5+5]