Indian Institute of Information Technology
Allahabad

IML & AIML
C3 Paper

2 hours **35 marks**

INSTRUCTIONS

- *Don't Copy*
- *You can use calculators*
- *Check the time in between*

Answer all the following questions

- *Each right answer will secure the corresponding marks mentioned.*
- *There is no negative marking.*

Question 1: *(15 marks)*

Calculate the Principal Components of the following data and then transform the dataset in to $\mathbb{R}$ and $\mathbb{R} \times \mathbb{R}$ spaces

3.4	3.4
1.4	1.6
3.1	3.8
2.8	3.1
4	4
3.2	3.6
2.9	2.5
1.9	2
2.4	2.5
2	1.8

Write each intermediate step in detail. And finally, calculate the explained variance of each PC.

Question 2: *(15 marks)*

Compute the SVM hyperplane for the following dataset (x_i's are datapoints and y_i's are corresponding class labels)

	x_i	y_i
-1	-1	-1
-2	-1	-1
1	1	1
2	1	1

- **Frame it as an optimization problem and solve it using Lagrange multipliers method. Write all the intermediate steps in solving**;
- **Identify the support vectors based on the values of Lagrange multipliers obtained**.

Question 3: *(5 marks)*

The following dataset consists of eight rows. x, y are input features. Status is the output target variable.

x	y	*status*
2	4	great
5	5	normal
6	4	less
3	6	less
2	2	normal
4	6	great
5	2	less
6	5	great

Classify the following tuple using k-nn algorithm.

- **(3.5, 4)**

Hyperparameters to be used for k-nn algorithm are $k = 1, 2, 3$ and distance metric has to Minkowski distance for $p = 1, 2, 3$.