

# Homework 1 (100pts)

Release Date: 09/17/2025

Due Date: 10/08/2025 9:10

The homework questions are selected from the textbook *Learning From Data*. Please provide complete answers according to the corresponding question numbers.

## Answering Requirements

Handwritten problems: Present the full formula derivations and all calculation steps.

Programming problems: Include execution outputs and the generated figures.

Figures: Clearly label all axes and legends, and add a brief caption/explanation.

Analysis: Do not submit figures alone—explain the phenomena observed in the charts.

## Submission Format

File type: PDF

File name format: ML\_HW1\_StudentID.pdf

### 1. Problem 1.6 (15 pts)

Nature: Handwritten derivation problems

Instruction: Complete mathematical derivations and explanations must be provided; listing only the final answer is not acceptable.

Answer requirements: The solution should include detailed calculation steps and the final conclusion.

### 2. Exercise 3.2 (20 pts)

Nature: Programming implementation + result analysis

Instruction: Write a program to perform linear model training and observe the results.

Answer requirements: Include numerical outputs as well as generated charts.

Chart explanation: The figures should display the distribution of the training data and the linear separation result, accompanied by an explanation of the model's

performance.

### **3. Problem 3.1 ( 20 pts )**

Nature: Programming implementation + result analysis

Instructions: Write a program and observe the results.

Answer requirements: The answer must include the generated chart.

Chart explanation: The chart should display the distribution of the training data and the linear separation result, along with an explanation of the model's performance.

### **4. Exercise 4.8 ( 20 pts )**

Nature: Programming implementation + visualization

Instruction: Conduct numerical simulations and compare overfitting under different conditions.

Answer requirements: Include figures of the simulation results.

Chart explanation: Plot the training and test error curves, and explain how the errors change as model complexity increases.

### **5. Problem 4.24 ( 25 pts )**

Nature: Programming implementation + in-depth analysis

Instruction: Fully implement the experiment described in the problem and conduct a thorough analysis of the results.

Answer requirements: Include numerical results, and visualized figures.

Chart explanation: Present the experimental result curves (e.g., generalization performance under different model settings) and include a written explanation highlighting the learning phenomena revealed by the figures.