Exercise Sheet 1

Neural Computation
University of Birmingham

Week 1 2025

Exercise 1. Consider the following perceptron $\mathbf{w} = (1, 1, 3)$, $b = 2$. Compute the output $\hat{y}$ of the perceptron for the following points:

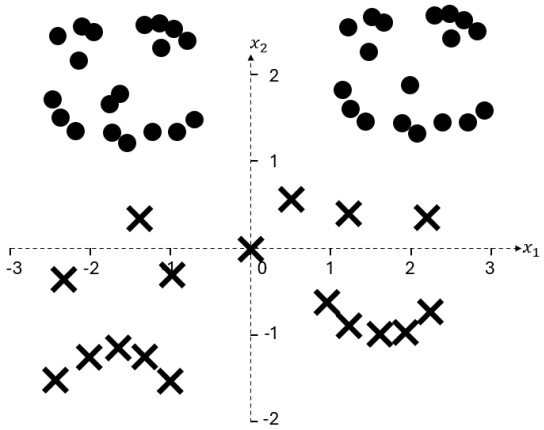
(a) $\mathbf{x} = (0, 0, 1)$

(b) $\mathbf{x} = (0, 0, 0)$

(c) $\mathbf{x} = (-1, -1, -3)$

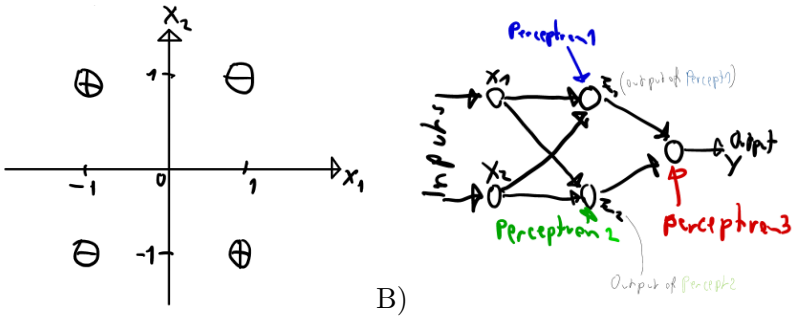
(d) $\mathbf{x} = (-2, -2, , 0)$

Exercise 2. Consider the following datapoints:



Is it possible to find a weight vector $\mathbf{w}$ and bias b, so that the resulting perceptron fully separates circles from crosses.

Exercise 3. Consider the following data points in part A) of the Figure below. It is not possible to separate the datapoints indicated by '+' from the ones indicated by '-' minus using a simple perceptron. However, it is possible to separate them using 3 perceptrons as shown in part B), where the two inputs x_1, x_2 both go into perceptrons 1 and 2, and the outputs z_1, z_2 form both of them are combined in perceptron 3 to produce a final classification.



Find a weight vectors $\mathbf{w}_1, \mathbf{w}_2, \mathbf{w}_3$ and biases b_1, b_2, b_3, so that the resulting arrangement of perceptrons fully separates '+' datapoints from '-' datapoints.

Exercise 4. (Bonus) Take a screen shot of Excercise 2 (including the text above and below the plot) and try to solve it using a GenAI chatbot tool like ChatGPT or Gemini. Can you get the correct solution?