Problem 1: For the data given, find a decision boundary that separates the two classes using the following models (Use the same initial condition for those two models):

1. Perceptron

2. MLP

$$C_1 : \boldsymbol{x}_1 = \begin{pmatrix} 1 \\ -1 \end{pmatrix}, \boldsymbol{x}_2 = \begin{pmatrix} 1 \\ -2 \end{pmatrix}, \boldsymbol{x}_3 = \begin{pmatrix} 2 \\ -1 \end{pmatrix}, \boldsymbol{x}_4 = \begin{pmatrix} 2 \\ -2 \end{pmatrix}$$
$$C_2 : \boldsymbol{x}_5 = \begin{pmatrix} -1 \\ 0 \end{pmatrix}, \boldsymbol{x}_6 = \begin{pmatrix} -1 \\ 1 \end{pmatrix}, \boldsymbol{x}_7 = \begin{pmatrix} -2 \\ 0 \end{pmatrix}, \boldsymbol{x}_8 = \begin{pmatrix} -2 \\ 1 \end{pmatrix}$$

Problem 2: Answer for the following prototypes in two classes:

$$C_1 : \boldsymbol{x}_1 = \begin{pmatrix} -2 \\ 3 \end{pmatrix}, \boldsymbol{x}_2 = \begin{pmatrix} 1 \\ -1 \end{pmatrix}, \boldsymbol{x}_3 = \begin{pmatrix} 2 \\ 1 \end{pmatrix}, \boldsymbol{x}_4 = \begin{pmatrix} 2 \\ -1 \end{pmatrix}$$
$$C_2 : \boldsymbol{x}_5 = \begin{pmatrix} 0.5 \\ 1 \end{pmatrix}, \boldsymbol{x}_6 = \begin{pmatrix} -0.2 \\ 0.5 \end{pmatrix}, \boldsymbol{x}_7 = \begin{pmatrix} -1 \\ 3 \end{pmatrix}, \boldsymbol{x}_8 = \begin{pmatrix} 0 \\ 2 \end{pmatrix}$$

1. Find an optimal linear decision boundary that maximizes the margin of separation in a nonlinear transform space.
2. Find an optimal nonlinear decision boundary that maximizes the margin of separation in the original feature space.