1. Determine a single-layer perceptron neural network to classify the two-class patterns:

A: {0,0), (0.5,0)}

B: {1, 0.5), (0.5,1)}

2. **(i)** Writing (1.1) into (1.2) so that solving (1.1) equals to solving (1.2)

$$\min \quad -2x_3 + x_4 + x_5$$
$$s.t.\begin{cases} x_1 + x_3 + 2x_4 = 7 \\ x_1 - x_2 + 2x_4 = 2 \\ x_i \geq 0 \ (i = 1, \cdots, 5) \end{cases} \qquad (1.1)$$

$$\begin{aligned} &\min \quad c^T x \\ &s.t. \quad Bx = b \\ &\qquad\ x \geq 0 \end{aligned} \qquad (1.2)$$

(ii) Showing that the equilibrium point of the following system

$$\begin{pmatrix} \dfrac{dx(t)}{dt} \\ \dfrac{dy(t)}{dt} \end{pmatrix} = \begin{pmatrix} (x(t) + B^T y(t) - w)^+ - x(t) - B^T(Bx(t) - b) \\ b - B(x(t) + B^T y(t) - w)^+ \end{pmatrix} \qquad \textbf{(1.3)}$$

is the solution of the following system

$$\begin{cases} Bx = b \\ (x + B^T y - w)^+ = x \end{cases}$$

where $x \in R^n$, $y \in R^m$