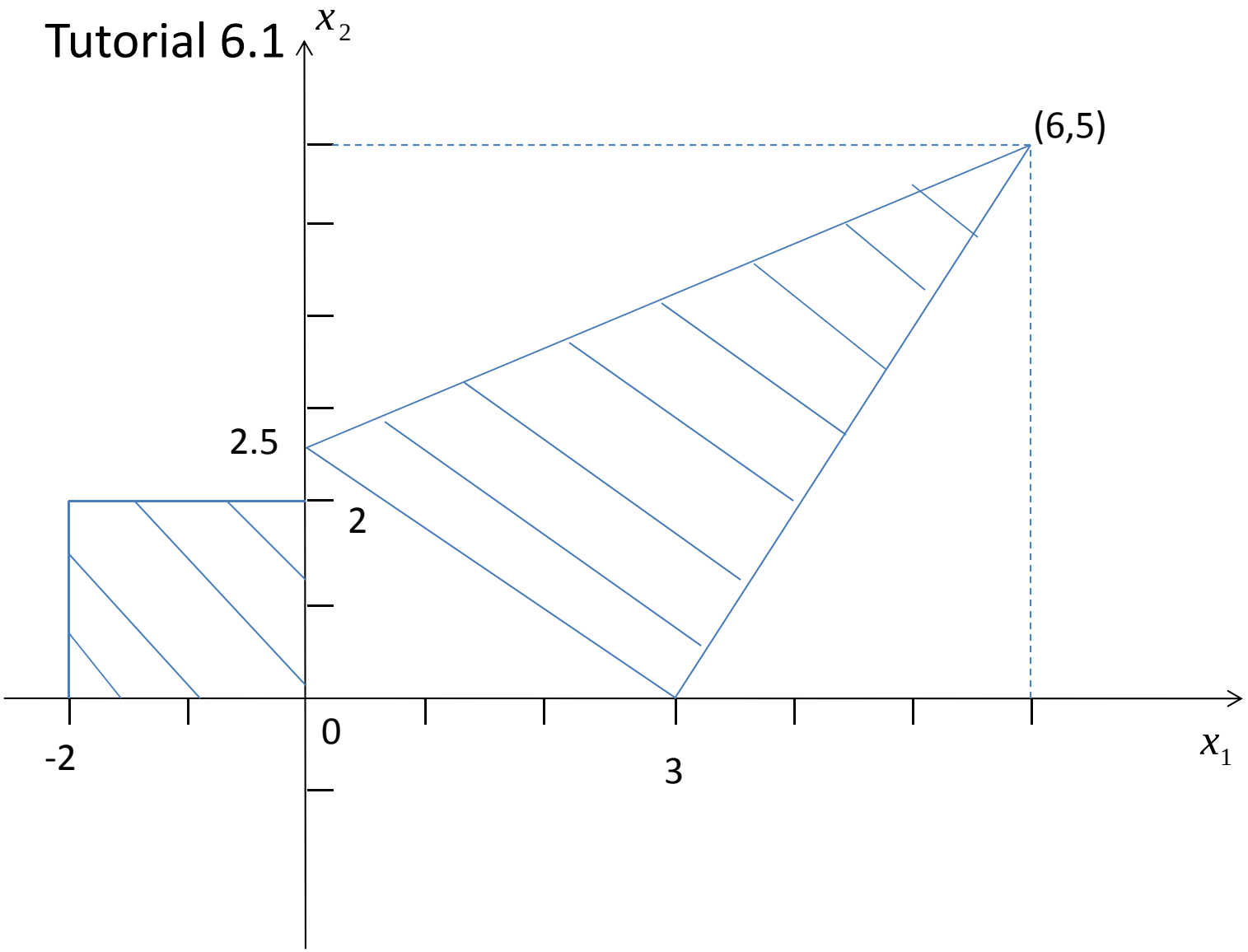
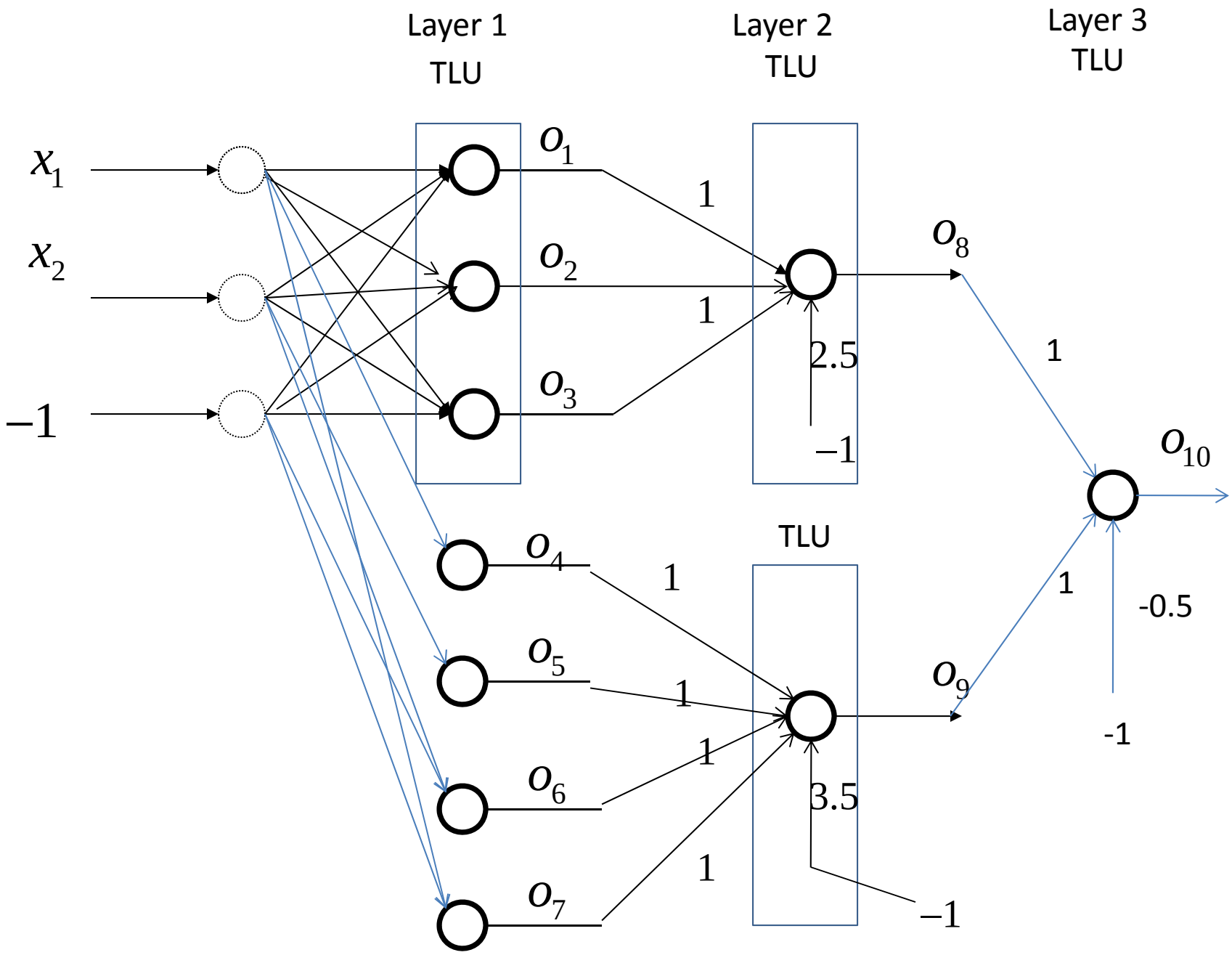
Tutorial 6.1

Input pattern regions of class 1 and 2 are shown in the figure below. Use a three layered feedforward neural network with discrete time threshold logical unit (TLU) for the design of a tow-class neural classifier (using the minimum number of neurons).

Tutorial 6.1




Layer 1
TLU
Layer 2
TLU
Layer 3
TLU
x_1
x_2
-1
o_1
o_2
o_3
o_4
o_5
o_6
o_7
1
1
1
1
1
1
2.5
-1
o_8
o_9
TLU
3.5
-1
1
1
-0.5
-1
o_{10}

$$o_1 = \text{sgn}(-5x_1 + 3x_2 + 15)$$

$$o_2 = \text{sgn}(2.5x_1 + 3x_2 - 7.5)$$

$$o_3 = \text{sgn}(2.5x_1 - 6x_2 + 1.5)$$

$$o_4 = \text{sgn}(-x_1)$$

$$O_5 = sgn(x_2)$$

$$O_6 = sgn(-x_2 + 2)$$

$$O_7 = sgn(x_1 + 2)$$

Note that the last layer presents an OR condition, i.e. either O8 or O9 to be one then O10 Is one, such that the bias weight is 0.5.

6.2 The following data specifying the input patterns

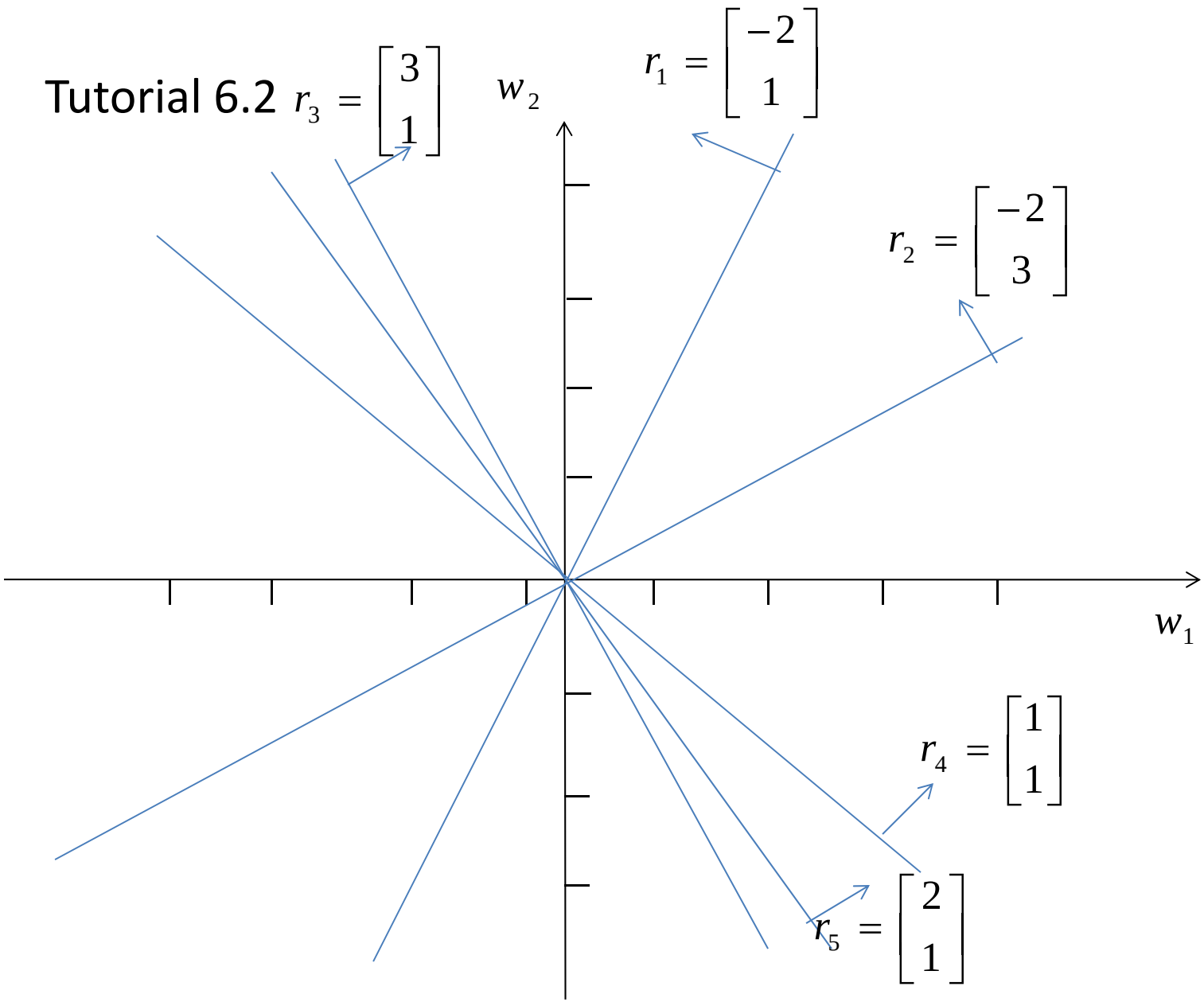
$$\mathbf{x}_1 = [-2]; \mathbf{x}_2 = [-\frac{2}{3}]; \mathbf{x}_3 = [3]; \qquad \text{class } 1$$

$$\mathbf{x}_4 = [1]; \mathbf{x}_5 = [2]; \qquad \text{class } 2$$

a) Draw the patterns in the augmented pattern space;
b) Draw separating lines in the augmented weight space for each pattern;
c) Find the set of weights if a single neuron classifier is proposed.

- A) Draw by yourself;
- B) See the figure later. There is no area existing in the weight space for $g(X)>0$ of class 1 and $g(X)<0$ of class 2.
- C) No weight solution for a single layered neural classifier.

Tutorial 6.2


$r_3 = \begin{bmatrix} 3 \\ 1 \end{bmatrix}$
w_2
$r_1 = \begin{bmatrix} -2 \\ 1 \end{bmatrix}$
$r_2 = \begin{bmatrix} -2 \\ 3 \end{bmatrix}$
w_1
$r_4 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$
$r_5 = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$