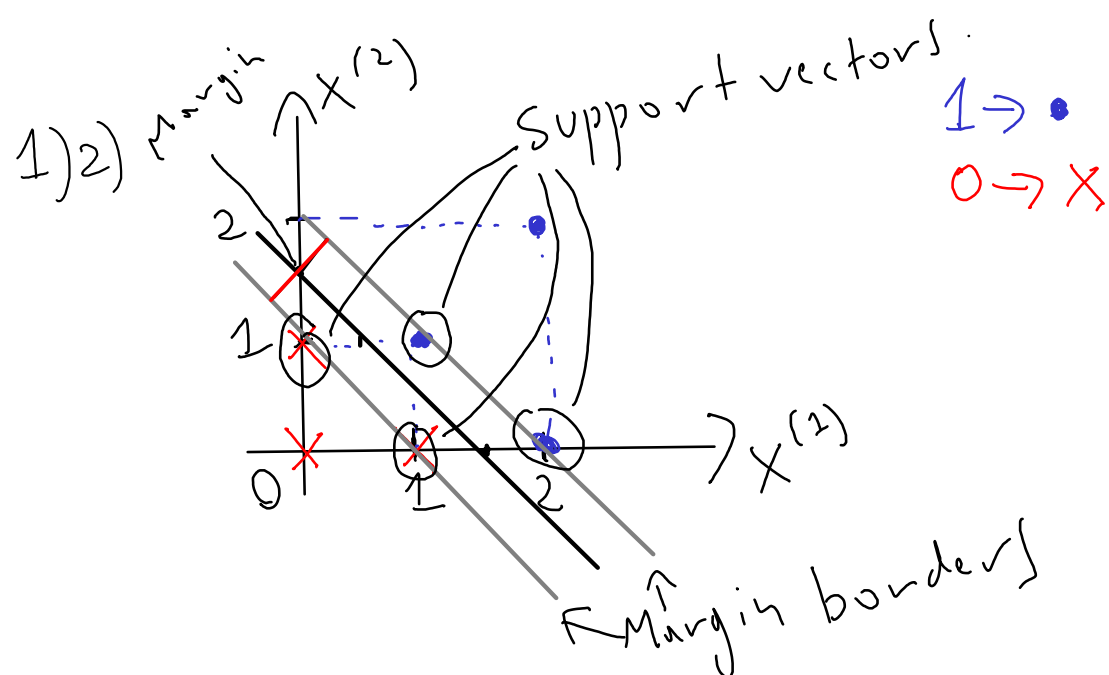# Introduction to AI
Assignment 4: SVM
Solutions to Part I-A

1)2)

The classes are linearly separable.

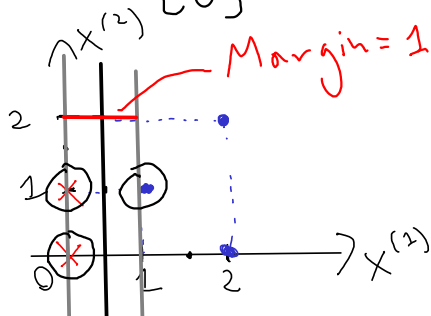Support vectors.

$1 \rightarrow$ •
$0 \rightarrow X$

Margin borders

Margin

Margin = Half of the diagonal of a unit square
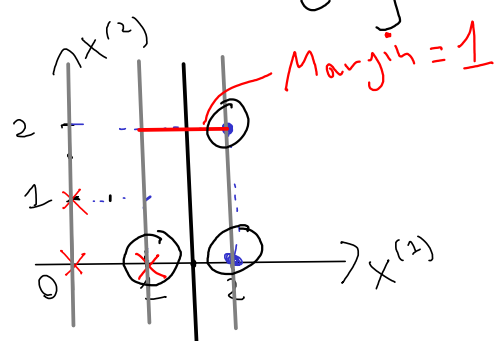
$$= \frac{\sqrt{2}}{2}$$
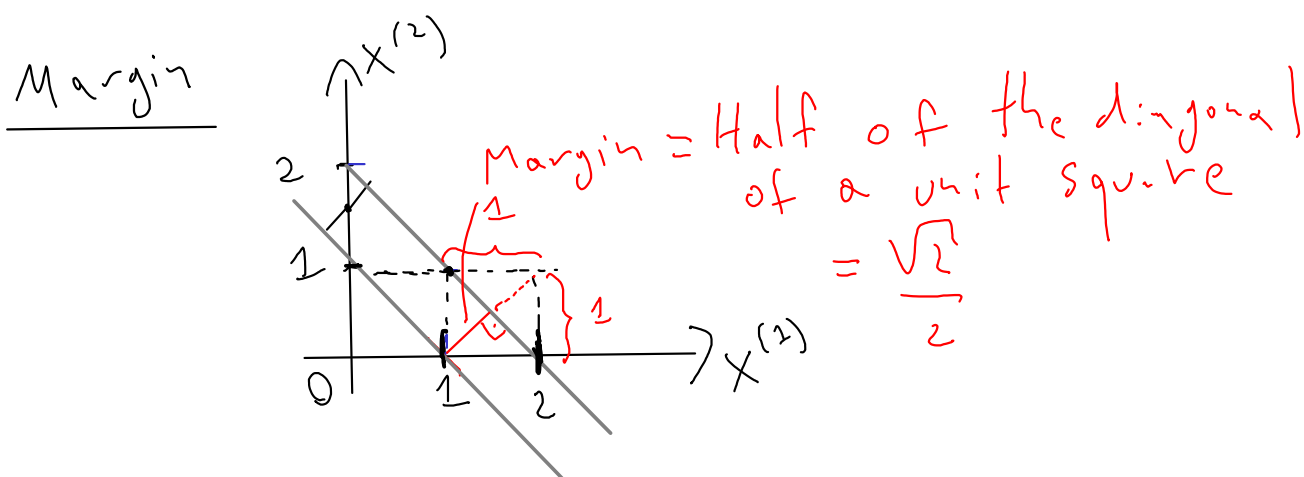
3) Yes, if you remove points $\begin{bmatrix} 1 \\ 0 \end{bmatrix}$ or $\begin{bmatrix} 1 \\ 1 \end{bmatrix}$ the border line changes and the margin increases. See below.
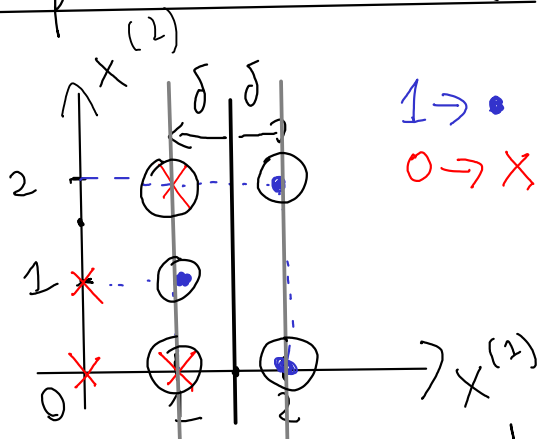
- without $\begin{bmatrix} 1 \\ 0 \end{bmatrix}$

Margin = 1

- without $\begin{bmatrix} 1 \\ 2 \end{bmatrix}$

Margin = 1

4)

Updated dataset

$1 \Rightarrow \bullet$
$0 \Rightarrow \times$

border line between the classes

Line equation:

$$\beta_0 + \beta_1 X^{(1)} + \beta_2 X^{(2)} = 0$$

$$-3 + 2 X^{(1)} + 0 X^{(2)} = 0 \Rightarrow X^{(1)} = \frac{3}{2}$$

Margin:

$$\text{Margin} = \frac{2}{\|\beta'\|_2} = \frac{2}{\sqrt{\beta_1^2 + \beta_2^2}} = \frac{2}{\sqrt{4}} = 1 \Rightarrow \delta = \frac{1}{2}$$