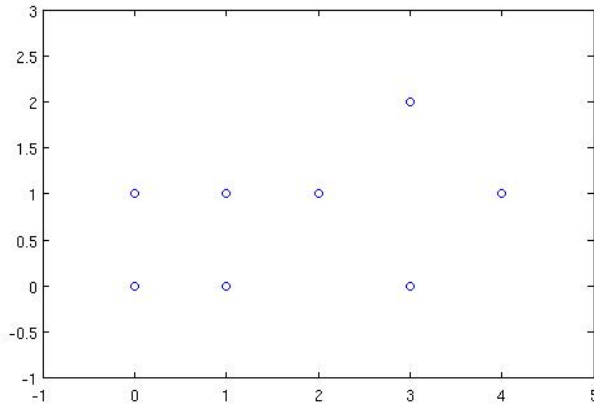


Question 1. **K-means clustering** (10 marks). Consider the following 2D data set:

[0, 1; 1, 0; 0, 0; 1, 1; 2, 1; 3, 0; 4, 1; 3, 2]. See plot below:



(a) Start from [0, 1] and [4,1] as the initial centers. Run Kmeans with k= 2.

(b) Start from [1, 1] and [3,2] as the initial centers. Run Kmeans with k=2.

Question2. **Image filters** (10 marks) Suppose we have an image  $I$  and two filters  $f_1$  and  $f_2$  as follows:

0	1	2	1
1	2	3	0
2	1	1	2
3	2	1	4

0	1
-1	0

1	0
0	-1

(a) Convolve  $I$  with  $f_1$ ,  $f_2$ , respectively. Return the full two-dimensional ( $5 \times 5$ ) convolution, i.e., assume the boundary are padded by zeros.

(b) Explain the purpose or effect of these two filters.