## **IMLPR Homework #09**

## 1. Chain Method of Clustering

The following samples are taken in the order shown for the chain method of clustering (original formulation, in which the distance to a cluster is the distance to the first sample of the cluster):

 $x_1 = (1,0), x_2 = (1,1), x_3 = (0,1), x_4 = (0,0), x_5 = (3,1), x_6 = (4,1), x_7 = (4,0), x_8 = (3,0)$ 

- (a) What clusters are obtained with a threshold of  $d_o=3?$
- (b) Repeat for  $d_o=1.5$
- (c) Repeat for  $d_o=0.5$
- (d) If a ninth point,  $x_9=(2, 0.5)$ , is added, in what cluster does it fall with  $d_o=1.5$ , when starting the algorithm with  $x_1$ .
- (e) Perform the chain method on the data (all nine samples) in reversed order ( $x_9$  first) for  $d_o=1.5$ . What clusters result? In this case  $x_9$  is referred to as a bridge.

## 2. Criterion Functions

Given	A=(0,1)	B=(0,2)	C=(1,1)	D=(1,2)
	E=(-1,0)	F=(-1,1)	G=(-2,0)	H=(-2,1)

Group #1 A, B, C, D vs. E, F, G, H

Group #2 A, B, C, D, F vs. E. G. H

- (a) Compute between cluster and within cluster scatter matrices for each grouping
- (b) Compute sum-of-square-error criterion function  $J_e$  for each grouping
- (c) Which grouping gives the minimum variance (lowest  $J_e$ ) clustering?