CSE 473/573 Fall 2002 December 13 2010

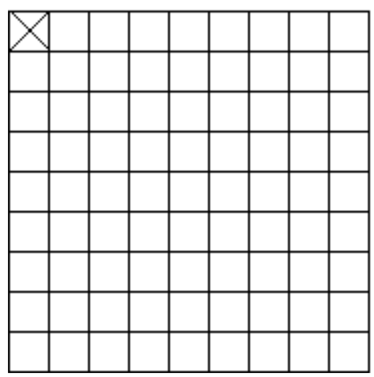
Final Exam

Name____

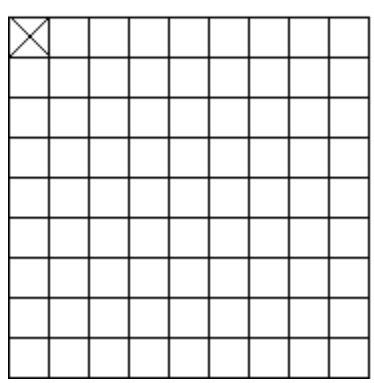
Instructions: ***Write your name above and on the top of the second page.*** *Do not remove the staple. Write answers here or in the bluebook provided as directed. This exam will be collected along with the blue book. 75 minutes closed book/notes* no electronic devices permitted.

1. Consider the blob X consisting of 80 object pixels arranged in a 9x9 square: X={(0,0),… ,(8,8)}, where the middle pixel of this square, the pixel at (4,4), is a background pixel.

(a) Find $S_8(X)$, the maximum ball skeleton of X using 8-connected distance measure. Show your answer by darkening each skeleton pixel in $S_8(X)$ on the graph below. Explain your reasoning in the bluebook.



(b) Find $S_4(X)$, the maximum ball skeleton using the 4-connected distance measure. Show your answer by darkening each pixel in $S_4(X)$ on the graph below. Explain your reasoning in the bluebook.



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2. The discrimination boundaries for a three-class decision problem over a two-dimensional feature space of vectors **x** are shown below. They intersect at **x** = (1,1).

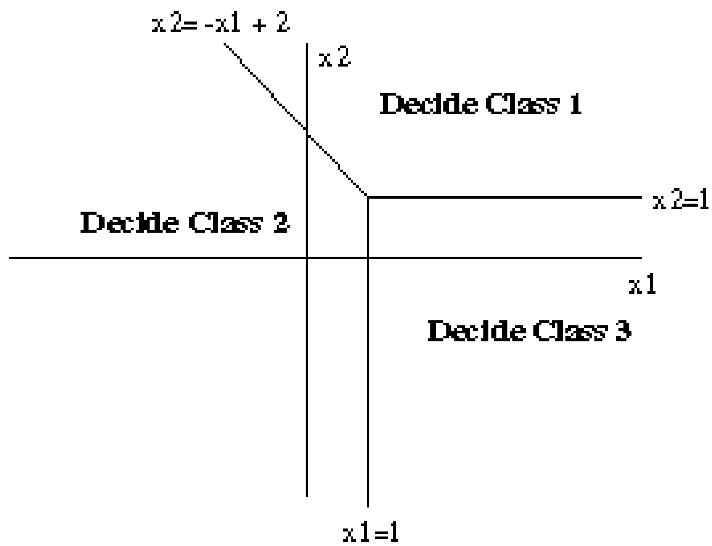

Figure 2

(a) Specify the (x1,x2) coordinates of 3 training atoms so that the minimum distance classifier trained using just this training data set agrees with the figure above.

(b) Is the set of 3 training data answering (a) above unique? If not, specify all sets of 3 training data which solve (a) above.

(c) Could Fig 2 be consistent with a Gaussian minimum-error classifier? If yes, specify mean vectors and covariance matrices $\{\boldsymbol{\mu}_i, \boldsymbol{\Sigma}_i, i=1..3\}$, also prior probabilities $\{\pi_i, i=1..3\}$, which make them consistent. If no, explain why not.

3. In a certain image we have found $n \geq 3$ objects $R_1...R_n$. We see that R_1 is blue, R_2 is green, R_3 is yellow and that R_i is adjacent to R_{i+1} for $i=1..n-1$. We wish to classify these objects using label set $\{O_1,..,O_m\}$. The rules are that only O_1 can be blue, and O_i and O_{i+1} must be adjacent for $i=1..m-1$. Now in the relaxation algorithm for constraint propagation we may check objects in any fixed order. Show that if we check objects in the order R_1 to R_n the algorithm converges much faster than if we check in the reverse order, R_n to R_1. Specify all consistent label sets, and the number of iterations to convergence in each case.