Home Work 3: CAP 6610 Spring ’07
Due Date: Apr 3rd 2007
Show all steps. Be as concise as possible.

1. Code and test a two layer feed-forward net of sigmoidal nodes with two input units, ten hidden units and one output unit that learns the concept of a circle in 2D space. The concept is: $(x, y)$ is labeled “+” if $(x - a)^2 + (y - b)^2 < r^2$ and is labeled “-” otherwise.

Draw all data from the unit square $[0, 1]^2$. Set $a = 0.5$, $b = 0.6$, $r = 0.4$.

Generate 100 random samples uniformly distributed on $[0, 1]^2$ to train the network using error back-propagation and 100 random samples to test it. Repeat the procedure multiple epochs and with multiple initial weights. Report the changing accuracy and the hyperplanes corresponding to the hidden nodes (when the sigmoid is turned into a step function).

2. Problem 33. from chapter 5 (page 276) of the book. You are asked to use the KKT conditions to formulate the dual of the constrained optimization problem for SVMs.

3. Retrieve the Iris Plant database from the UCI Machine learning Repository. Program a decision tree that uses the entropy impurity to split nodes and relies on a Chi-squared test as a stopping criteria to stop splitting nodes. Report the resultant tree for the Iris database.