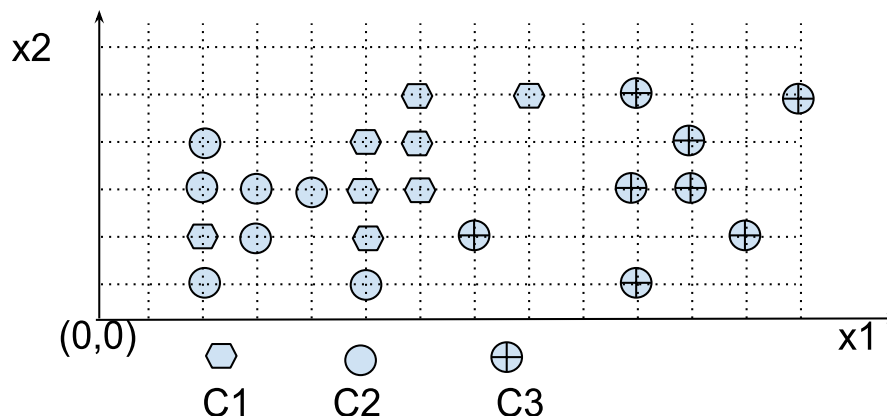# Sheet#5 Ensemble+SVM+NeuralNets+ Linear Regression (MARKED OUT OF 20 POINTS)

A. Given the data below

1. How many SVM binary classifiers are needed to find the label of any new example?**[No python]**
2. Sketch the (non-linear) boundary of the classes based on your understanding of RBF kernel. Assume Hard-Margin.**[No python]**
3. We want to build a binary classifier that classifies all samples of class C3 as positive and all other samples into a negative class.
    a. Assume Hard-Margin. Which samples will be on the margin. find the size of the margin.**[No python]**
    b. What weights would you give to the support vectors to account for class balance.**[No python]**
    c. Use Scikit-learn package for finding the support vectors, with different values of C=[0.1,0.3,1,3,10]. Sketch the lines you learned using the different values of C.
    d. Use the ensemble of the 5 classifiers you learned in 3.c to give labels to the following samples **[No python]**
        ■ p1=(6,6)
        ■ p2=(9,4)
        ■ p3=(8,4)
    e. Draw a diagram of input layer and hidden layer and output layer to illustrate the ensemble in 3.d. How many parameter you would learn in this case.

B. Given the data below

x1	1	2	2	2	3	3	4	4	4	5
x2	5	6	10	12	17	12	6	5	7	10
y	10	40	50	60	70	50	30	20	40	70

1. How many parameter to find to solve a linear regression problem on the data? **[No python]**
2. Use Normal equations to find the equation of the line produced using linear regression algorithm. Specify the dimensionality of each matrix carefully.
   Assume no regularization**[No python]**
   Use Scikit-learn package for
      a. Finding the linear regression solution.
         Then compare to the normal solution in 2 **[No python]**
      b. We want to add L-2 regularization to the obtained solution. We use Ridge regression from Scikit-learn to do so. Set alpha to [0.1,1,10,100].
         [python]
3. Use the 5 regressor coefficients and intercepts you learned in 3.a,3.b to predict **y** for the following samples **[No python]**
      - p1=(3,16)
      - p2=(2,4)
      - p3=(5,4)

C. Design a neural net to produce the majority function of three binary inputs. [No python]