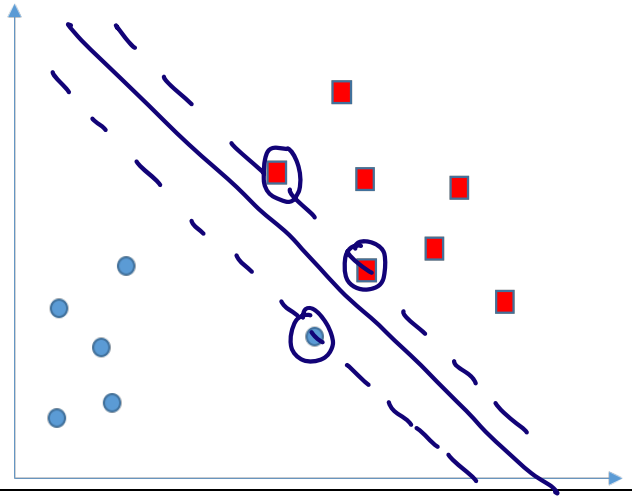
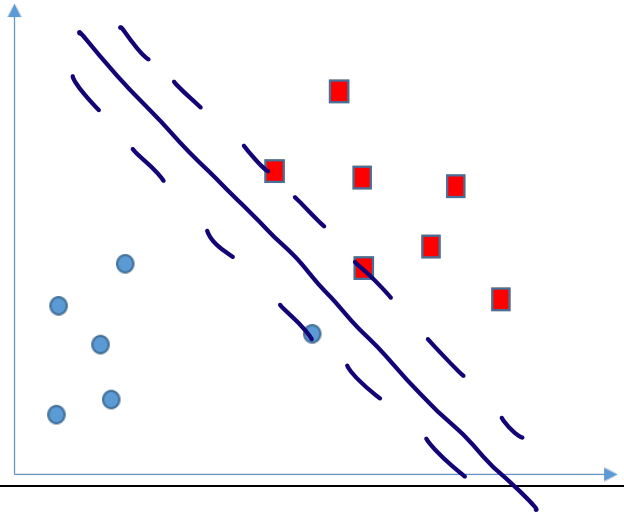
Name_____

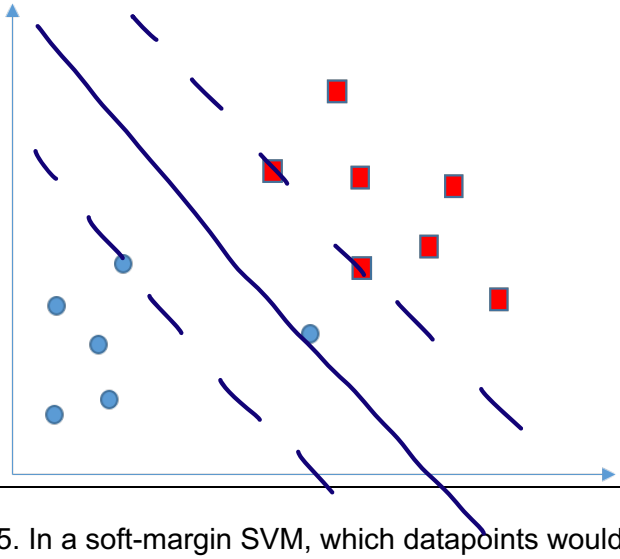
1. Draw a hyperplane (including the margin lines) generated by a linear hard-margin SVM. Circle the support vectors.



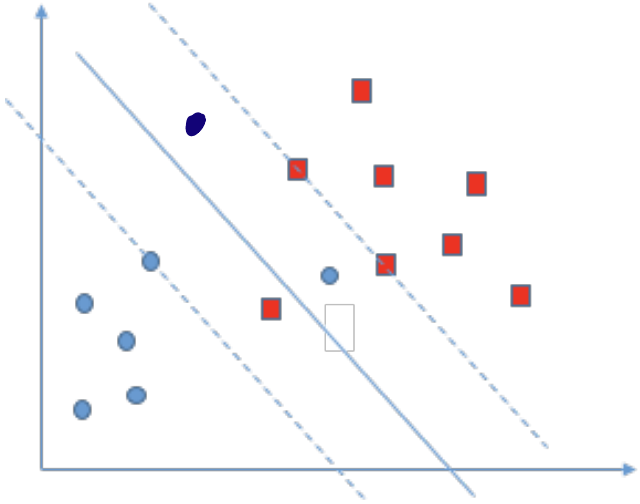
2. Draw a hyperplane (including the margin lines) generated by a linear soft-margin SVM with a large value of C (i.e. C → ∞).



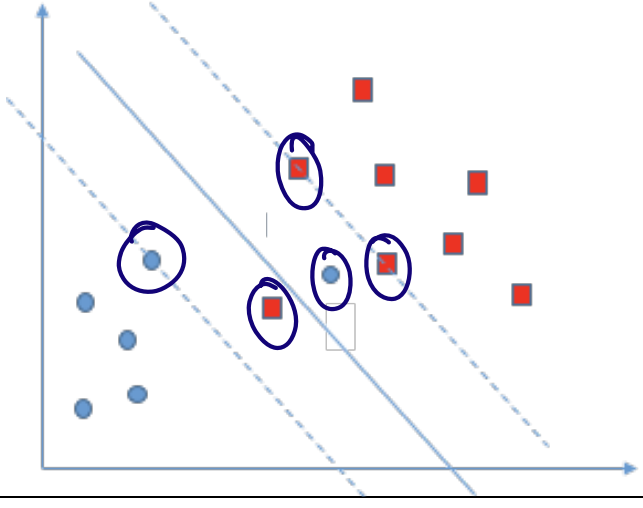
3. Draw a hyperplane (including the margin lines) generated by a linear soft-margin SVM with a small value of C (i.e. C → 0).



4. Draw a circle-class data point with slack $1 < \xi < 2$



5. In a soft-margin SVM, which datapoints would be the support vectors? Circle the support vectors here:



Explanations:
1) A hard margin SVM does not allow for any misclassifications of the training data.

2) A soft margin SVM with a very high C value puts a high cost for each misclassification, so it will try very hard to not misclassify anything in the training data.

3) A soft margin SVM with a very low C value will focus on widening the margin as much as possible, even if there are misclassifications, since misclassifications cost very little.

4) Slack is measured from the margin on the side where the point is supposed to be (the dotted line on the blue-circle side). Remember also that the margin on the left side is set equal to -1, the hyperplane is set equal to 0, and the margin on the right side is set equal to 1. So starting from the left margin, getting to the hyperplane is a distance of 1 and getting to the right margin is a distance of 2, so slack between 1 and 2 would be between the hyperplane and the right margin.

5) Support vectors are points that determine where the hyperplane is placed; points that if you removed them, the hyperplane would change locations. In looking at the soft margin SVM objective function, it is trying to both widen the margin and minimize slack, so it places the hyperplane based on the points that are defining the margin and the points that contribute to the total slack.