Problem 1

1. **Figure 1** shows six training points, they are linearly separable.

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**Figure 1**

1. By inspection, ; support vectors are: .
2. If is deleted, the optimal margin stays the same;

If is deleted, the optimal margin increases.

Problem 2

1. Suppose we want to find the optimal hyperplane, we need to find :

We can easily find that (w,b) are scale invariant. So, we define the hyperplane as following (Page 12):

This equation is equivalent as:.

If is the parameter for the optimal hyper plane, then

1. From the question we can derive that:

So, we can derive that:

Let .

Therefore, the problem is feasible.

1. According to the result derived from (a), (b) we have:

Problem 3

1. If there is a solution that satisfy the constraints for the hard-margin SVM problem, then the following inequalities should hold:

From the first inequality we can derive that:

From the second one we can derive that:

So, it is impossible to satisfy the constraint.

1. One of the solutions is:

So, we have a solution (0,1, -2,2,0,2,0).