

## Assignment 3 (Due: Dec. 31, 2023)

1. **(Math)** Please prove the Proposition 20 mentioned in our lecture.

**Proposition 20:**



Suppose that  $\mathbf{x}^*$  and  $(\alpha^*, \beta^*)$  are primal feasible and dual feasible respectively. If the duality gap associated with them is 0, i.e.,

$$f_0(\mathbf{x}^*) - g(\alpha^*, \beta^*) = 0$$

Then,  $\mathbf{x}^*$  and  $(\alpha^*, \beta^*)$  should be primal optimal and dual optimal, respectively, and the primal problem has strong duality

2. **(Programming)** On the website, I provide you a Matlab program which demonstrates how to train a soft-margin SVM model from simulated data. Please add comments, as detailed as possible, to the code.