

# Assignment3

October 28, 2021

CSE 242 Assignment 3, Fall 2021

2 Questions, 60 pts, due: 23:59 pm, Nov 5th, 2021

## 0.1 Instruction

- Submit your assignments onto **Gradescope** by the due date. Upload a **PDF** file containing:  
(1) Your solutions for both math questions.

**For assignment related questions, please reach TA or grader through Slack/Piazza/Email.**

- This is an **individual** assignment. All help from others (from the web, books other than text, or people other than the TA or instructor) must be clearly acknowledged.

## 0.2 Objective

- **Task 1:** Perceptron (math)
- **Task 2:** Support Vector Machine (math)

## 1 Question 1. (Perceptron, 30 pts)

### 1.1 (a – 10 pts)

On what kinds of training data does the perceptron algorithm converge?

### 1.2 (b – 5\*4 pts)

Simulate one pass through the following data with the perceptron algorithm described in lecture and homework. Use the learning rate  $\eta = 1$ .

Start with  $w = (0, 0, 0)$  and show the resulting weight vector after each example.

(Assume that the perceptron algorithm predicts incorrectly when  $w \cdot x = 0$ , and ignore the bias term.)

$x_1$	$x_2$	$x_3$	$y$
1	0	1	+1
0	-1	1	-1
1	1	1	+1
-1	2	0	-1

Initially,  $w = (0, 0, 0)$ .

After the first example,  $w = ( \quad )$ ;

After the second example,  $w = ( \quad )$ ;

After the third example,  $w = ( \quad )$ ;

After the fourth example,  $w = ( \quad )$ .

**Reminder:** if you are unsure about your answers, give as many details as possible so that you won't get 0 points in the wrong answers.

## 2 Question 2. (Support Vector Machines, 30 pts)

Suppose that we have the following training set (where the instances have two features):

$x_1$	$x_2$	$y$
1	1	+1
1	2	+1
2	1	+1
0	0	-1
1	0	-1
0	1	-1

### 2.1 (a – 10 pts)

Plot them (in hand or with python) and find the support vectors (by eye).

### 2.2 (b – 10 + 10 pts)

Using the support vectors, find the equation for the maximum margin separating plane, and determine the geometric margin. (Assume a simple linear SVM and no soft-margin).