**CSE 4095/5095 Deep Learning**

**Assignment 1**

**Due Date: 9/5/2025 (by 11:59 pm)**

Name: Sy Nguyen-Van Student ID: 3068504

Background Knowledge Test

**Problem 1**. (1 point) We are machine learners with a slight gambling problem (very different from gamblers with a machine learning problem!). Our friend, Bob, is proposing the following payout on the roll of a dice:

where is the outcome of the roll, (+) means payout to us and (-) means payout to Bob. Is this a good bet for us? Are we expected to make money? [Hint: you can calculate expected payout

A math equations on a graph paper

Description automatically generated

**Problem 2.** (1 point) Recall that the variance of a random variable is defined as , where . Use the properties of expectation to show that we can rewrite the variance of a random variable as

A math equations on a graph paper

Description automatically generated

**Problem 3**. (1 point) Let

, ,

Compute the vector . [Note: as we will see later, this is a basic operation of a neural network layer]

A math equations on a graph paper

Description automatically generated

**Problem 4**. (4 points) Consider the following function of :

where log(x) is the natural log function, and is the sigmoid function

Evaluate at . Then, compute the gradient and evaluate it at the same point. [Hint: you can use the chain rule of derivative to calculate gradient]

A math equations on a graph paper

Description automatically generated

A math equations on a graph paper

Description automatically generated

A math equation on a graph paper

Description automatically generated

**Problem 5**. (3 points) Set up your Python programming environment by following the instructions below.

Setting up a Python programming environment for deep learning can be challenging. Depending on the system and privilege you have, it can be as easy as running a few scripts or be a headache completely. In this class, we will use Python3+ and Numpy for programming assignments. In general, you can set up your environment in Linux, Mac, or Windows. However, Linux and Mac are much preferred as they have better support to python and DL frameworks; you may just need to run a few scripts and complete this task. You may, however, set up your environment in Windows as you wish, but it’s a little bit more involved. So, the windows’ route is not recommended, and you should avoid it whenever possible.

1. Download assignment1.zip from HuskyCT “Homework/HW1” section

**Linux (Preferred. Setup in Mac is similar to this):**

set up python3 environment (e.g., [install anaconda](https://docs.anaconda.com/anaconda/install/index.html) or [install virtual environment](https://help.dreamhost.com/hc/en-us/articles/115000695551-Installing-and-using-virtualenv-with-Python-3))

conda activate dl

unzip assignment1.zip

cd assignment1

pip install -r requirements.txt

cd assignment1/lib/datasets

source get\_datasets.sh

cd assignment1

jupyter notebook (and save your results)

1. If your notebook runs without problem, then press “ctrl + s” to save your notebook, run “. collectSubmission.sh” to collect your results, and upload your zip file along with your completed problem set to Homework/HW1 folder.

**Windows: Not recommended, but you can try it by yourself (e.g. Windows Linux subsystem) as long as you can complete the assignments.**