
DSC 140B - Quiz 06

February 19, 2026

Name:

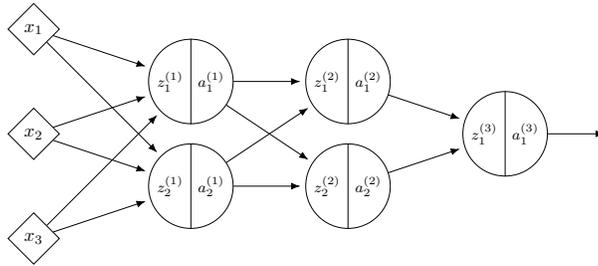
PID:

About the quizzes:

- Quizzes in DSC 140B are *optional* and graded pass/fail.
- A score of 70% or higher earns a “pass” and 1.5 credits toward your final grade.
- If you don’t pass, no credits are earned, but it doesn’t hurt your grade.
- You have 30 minutes to complete the quiz.
- At least one of the questions below will be on an exam (probably with slight changes, such as different numbers).
- Unfortunately, we can’t answer clarifying questions during the quiz. If you think a question has a bug or is unclear, please let us know in a private post on Campuswire after the quiz, and we’ll take it into account when grading.

Problem 1.

Consider the neural network $H(\vec{x})$ shown below:



Let the weights of the network be:

$$W^{(1)} = \begin{pmatrix} 2 & 1 \\ -1 & 3 \\ 1 & -2 \end{pmatrix} \quad W^{(2)} = \begin{pmatrix} 4 & -1 \\ 2 & 1 \end{pmatrix} \quad W^{(3)} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$$

Assume that all nodes use **linear** activation functions, and that all biases are zero.

Suppose $\vec{x} = (1, -1, 2)^T$.

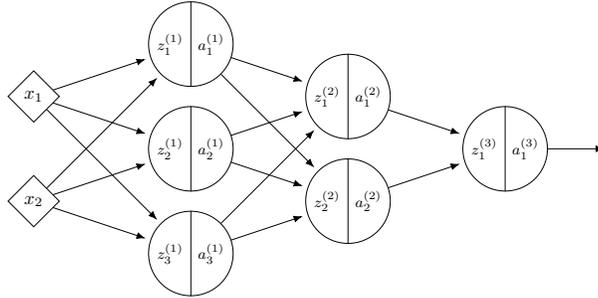
a) ($\frac{1}{2}$ point) What is $a_1^{(1)}$?

b) ($\frac{1}{2}$ point) What is $a_2^{(2)}$?

c) What is $H(\vec{x})$?

Problem 2.

Consider the neural network $H(\vec{x})$ shown below:



Let the weights of the network be:

$$W^{(1)} = \begin{pmatrix} 1 & -2 & 3 \\ 2 & 1 & -1 \end{pmatrix} \quad W^{(2)} = \begin{pmatrix} 2 & -1 \\ 1 & 3 \\ -2 & 1 \end{pmatrix} \quad W^{(3)} = \begin{pmatrix} 4 \\ -3 \end{pmatrix}$$

Assume that all hidden nodes use **ReLU activation** functions, that the output node uses a linear activation, and that all biases are zero.

Suppose $\vec{x} = (1, 3)^T$.

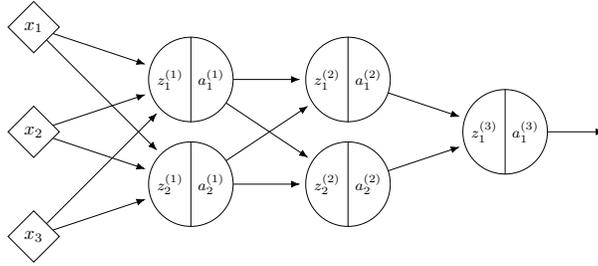
a) ($\frac{1}{2}$ point) What is $a_3^{(1)}$?

b) ($\frac{1}{2}$ point) What is $a_1^{(2)}$?

c) What is $H(\vec{x})$?

Problem 3.

Consider the neural network $H(\vec{x})$ shown below:



The first layer of this neural network can be thought of as a function $f : \mathbb{R}^3 \rightarrow \mathbb{R}^k$ mapping the input feature vector in \mathbb{R}^3 to a new representation. Assume all activations are **linear** and all biases are zero.

What is this new representation if

$$W^{(1)} = \begin{pmatrix} 3 & -1 \\ 1 & 2 \\ -2 & 1 \end{pmatrix}$$

and $\vec{x} = (2, 1, -1)^T$?

- $(-1, 9)^T$
- $(9, -1, 0)^T$
- $(9, -1)^T$
- $(5, 3, -1)^T$

Problem 4.

Suppose H is a neural network with the following architecture: 2 input features, a first hidden layer with 3 nodes, a second hidden layer with 3 nodes, and 1 output node. Every hidden and output node has a bias. You may assume that the network is fully connected, and feed-forward.

The gradient of H with respect to the parameters is a vector. What is this vector's dimensionality?

- 18
- 22
- 25
- 28

Problem 5.

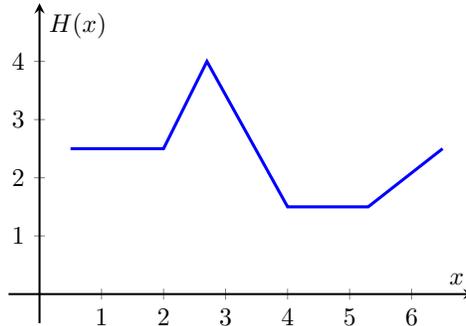
You are predicting salaries (in dollars) with a neural network.

True or False: sigmoid activation is a good choice for the output node.

- True
- False

Problem 6.

Suppose that when a deep neural network $H(x) : \mathbb{R} \rightarrow \mathbb{R}$ is plotted, the resulting graph looks like the following:

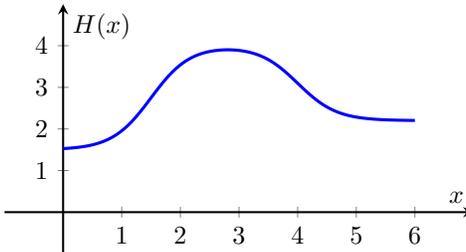


True or False: it is possible that the network uses **ReLU** activation in its hidden layers, and **ReLU** activation in its output layer.

- True
- False

Problem 7.

Suppose that when a deep neural network $H(x) : \mathbb{R} \rightarrow \mathbb{R}$ is plotted, the resulting graph looks like the following:



a) True or False: it is possible that the network uses **sigmoid** activations in its hidden layers and a **linear** activation in its output layer.

- True
- False

b) True or False: it is possible that the network uses **linear** activations in its hidden layers and a **sigmoid** activation in its output layer.

- True
- False