FIT 3181/5215 Deep Learning

Quiz for:
Feed-forward Neural Nets with TensorFlow

Teaching Team

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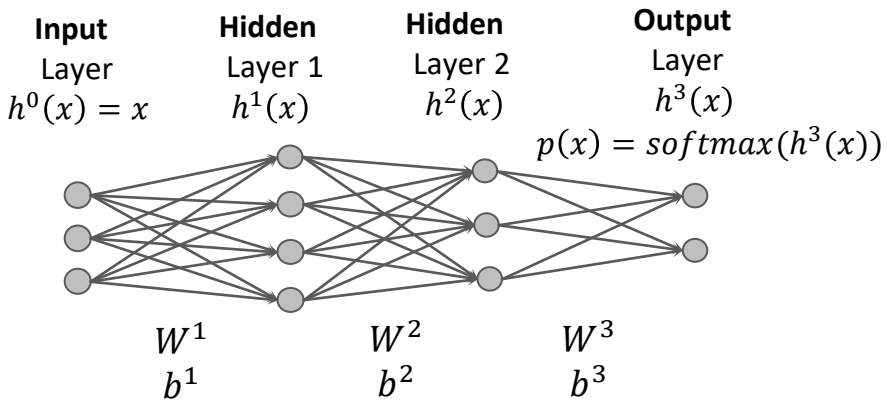
Question 1

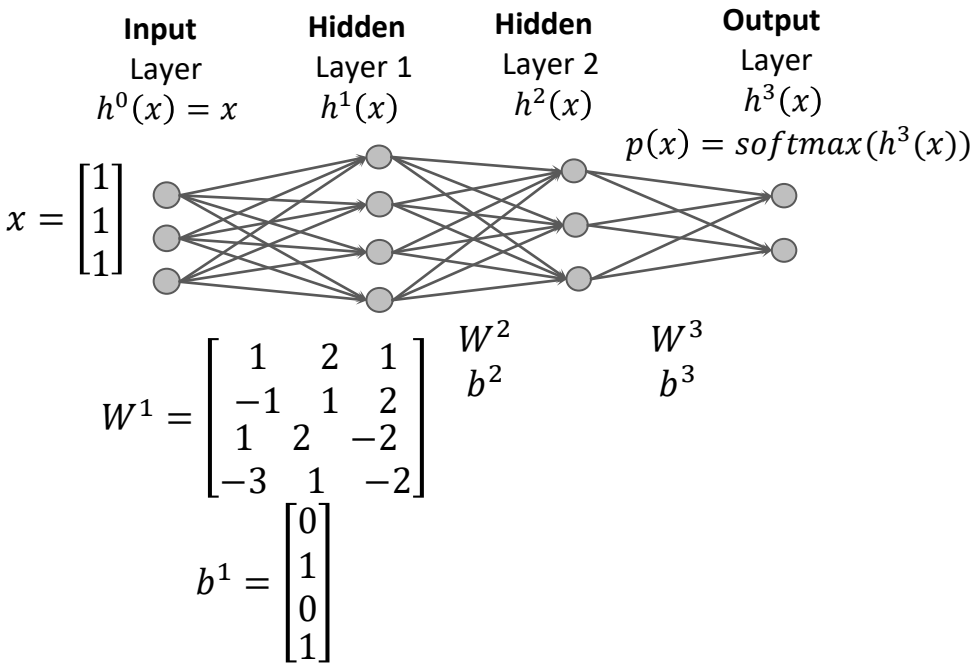
- *Given the following feed-forward neural network. What are the shapes of weight matrices if we follow the convention in the lecture not TF implementation?*



- A. $W^1 \in \mathbb{R}^{3\times3}, W^2 \in \mathbb{R}^{4\times4}, W^3 \in \mathbb{R}^{3\times3}$
- B. $W^1 \in \mathbb{R}^{4\times3}, W^2 \in \mathbb{R}^{3\times4}, W^3 \in \mathbb{R}^{2\times3}$
- C. $W^1 \in \mathbb{R}^{3\times4}, W^2 \in \mathbb{R}^{4\times3}, W^3 \in \mathbb{R}^{3\times2}$
- D. $W^1 \in \mathbb{R}^{4\times4}, W^2 \in \mathbb{R}^{3\times3}, W^3 \in \mathbb{R}^{2\times2}$

Question 2

- *Given the following feed-forward neural network. Assume that we input to the network feature vector $x = [1\ 1\ 1]^T$. What is the values of pre-activations $\bar{h}^1$?*

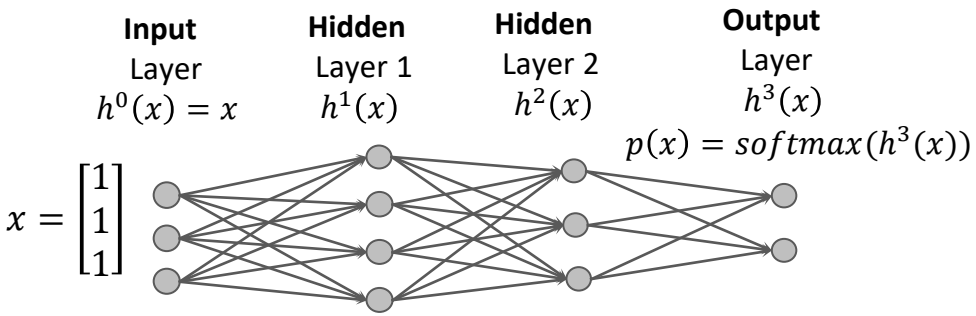


- A. $\bar{h}^1 = [4\ 2\ 1\ -4]$
- B. $\bar{h}^1 = [4\ 3\ 1\ -3]$
- C. $\bar{h}^1 = [4\ 3\ 1\ -3]^T$
- D. $\bar{h}^1 = [4\ 2\ 1\ -4]^T$

Question 3

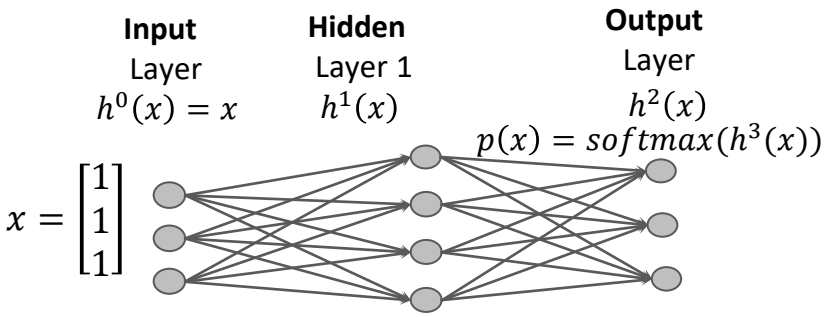
- *Given the following feed-forward neural network. Assume that we input to the network feature vector* $x = [1\ 1\ 1]^T$. *What is the hidden values* h^1 *if we use ReLU activation function?*

- A. $\mathrm{h}^1 = [0\ 0\ 0\ -4]^T$
- B. $\mathrm{h}^1 = [4\ 3\ 1\ 0]^T$
- C. $\mathrm{h}^1 = [0\ 0\ 0\ -3]^T$
- D. $\mathrm{h}^1 = [4\ 2\ 1\ -4]^T$



Question 4

- *Given the following feed-forward neural network. Assume that we input to the network feature vector $x = [1\ 1\ 1]^T$. What are the correct statements if we use ReLU activation function? (MC)*



$$W^1 = \begin{bmatrix}1 & -1 & 1\\ -1 & 0 & 1\\ -1 & 0 & 2\\ -1 & -1 & 1\end{bmatrix} \quad W^2 = \begin{bmatrix}-1 & 1 & 1 & 2\\ 1 & -1 & 1 & -2\\ 1 & 1 & -1 & 2\end{bmatrix}$$

$$b^1 = \begin{bmatrix}0\\1\\0\\-1\end{bmatrix} \quad b^2 = \begin{bmatrix}-1\\1\\-2\end{bmatrix}$$

- A. $h^1 = [1\ 1\ 1\ 0]^T$
- B. $h^1 = [1\ 1\ 1\ 1]^T$
- C. Logit $h^2 = [0\ \ 2\ \ -1]^T$
- D. Logit $h^2 = [0\ \ 2\ \ 0]^T$

no relu at the softmax layer lol

Question 5

Given an implementation as below. Which of following architecture is correct (SC).

```
dnn_model = Sequential()
dnn_model.add(Dense(units=32,  input_shape=(784,), activation='relu'))
dnn_model.add(Dense(units=64, activation='relu'))
dnn_model.add(Dense(units=64, activation='relu'))
dnn_model.add(Dense(units=32, activation='relu'))
dnn_model.add(Dense(units=10, activation='softmax'))
```

- A. 784→32(ReLU)→64(ReLU)→64(ReLU)→32(ReLU)→10(ReLU)
- B. 784→32(ReLU)→64(ReLU)→64(ReLU)→32(ReLU)→10(Softmax)
- C. 32(ReLU)→64(ReLU)→64(ReLU)→32(ReLU)→10(ReLU)
- D. 784(ReLU)→32(ReLU)→64(ReLU)→64(ReLU)→32(ReLU)→10(Softmax)

Question 6

Given an implementation as below. Which of following statements are correct (MC).

```
dnn_model = Sequential()
dnn_model.add(Dense(units=32,  input_shape=(784,), activation='relu'))
dnn_model.add(Dense(units=64, activation='relu'))
dnn_model.add(Dense(units=64, activation='relu'))
dnn_model.add(Dense(units=32, activation='relu'))
dnn_model.add(Dense(units=10, activation='softmax'))
```

- A. The model has 5 Fully Connected layers
- B. The batch size is 784 784 is number of features not batch size
- C. The model can work with an arbitrary batch size
- D. The model's output is a logit value and in range [-inf, +inf]

Question 7

Given an implementation as below. What are outputs of the two print functions (SC).

```
[5]: dnn_model = Sequential()
     dnn_model.add(Dense(units=32,  input_shape=(784,), activation='relu'))
     dnn_model.add(Dense(units=64, activation='relu'))
     dnn_model.add(Dense(units=64, activation='relu'))
     dnn_model.add(Dense(units=32, activation='relu'))
     dnn_model.add(Dense(units=10, activation='softmax'))
```

```
[8]: hidden1 = dnn_model.layers[0]
     weights, biases = hidden1.get_weights()
     print('shape W=',weights.shape)
     print('shape b=',biases.shape)
```

- A. (32, 32), (32,)
- B. (32, 784), (784,)
- C. (784, 32), (32,)
- D. (784, 32), (784,)

```
shape b=',biases.shape)
```

Wx + b

why not (32,784) , (32,)? this is tensorflow specific

Question 8

Given an implementation as below. What is the total parameters of the model (SC).

```
dnn_model = Sequential()
dnn_model.add(Dense(units=20,  input_shape=(10,), activation='relu'))
dnn_model.add(Dense(units=20, activation='relu'))
dnn_model.add(Dense(units=10, activation='softmax'))
```

- A. 800
- B. 830
- C. 840
- D. 850

(10 x 20 + 20) +(20 x 20 + 20) + (20 x 10)

(20x 10 + 10) there is bias even at the last layer!

Architecture **10 → 20 (ReLU) → 20 (ReLU) → 10 (softmax)**

$$(20 \times 10 + 20) + (20 \times 20 + 20) + (10 \times 20 + 10) = 850$$