FIT 3181/5215 Deep Learning

# Quiz for:
# Feed-forward Neural Nets with TensorFlow

**Teaching Team**

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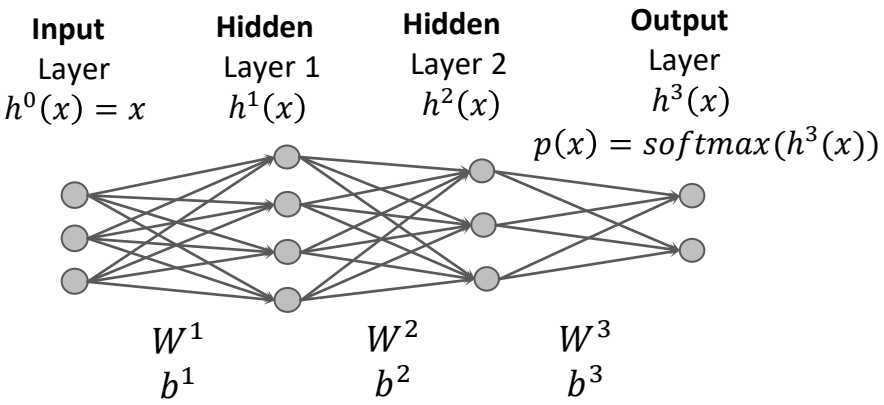
# Question 1

- *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. $W^1 \in \mathbb{R}^{4\times4}, W^2 \in \mathbb{R}^{3\times3}, W^3 \in \mathbb{R}^{2\times2}$

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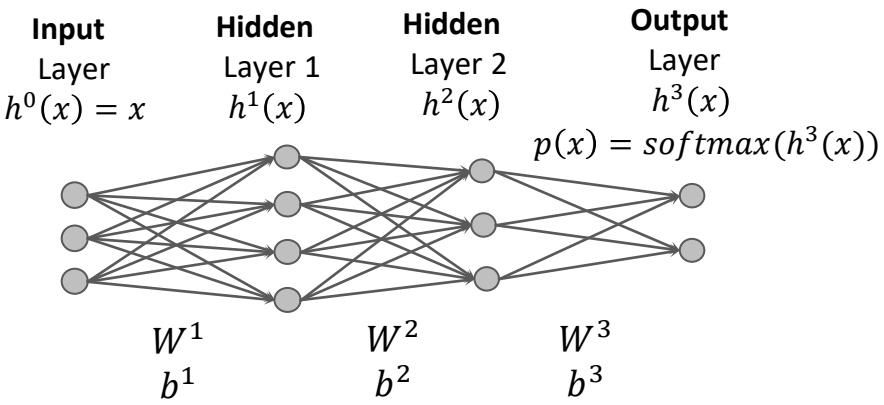


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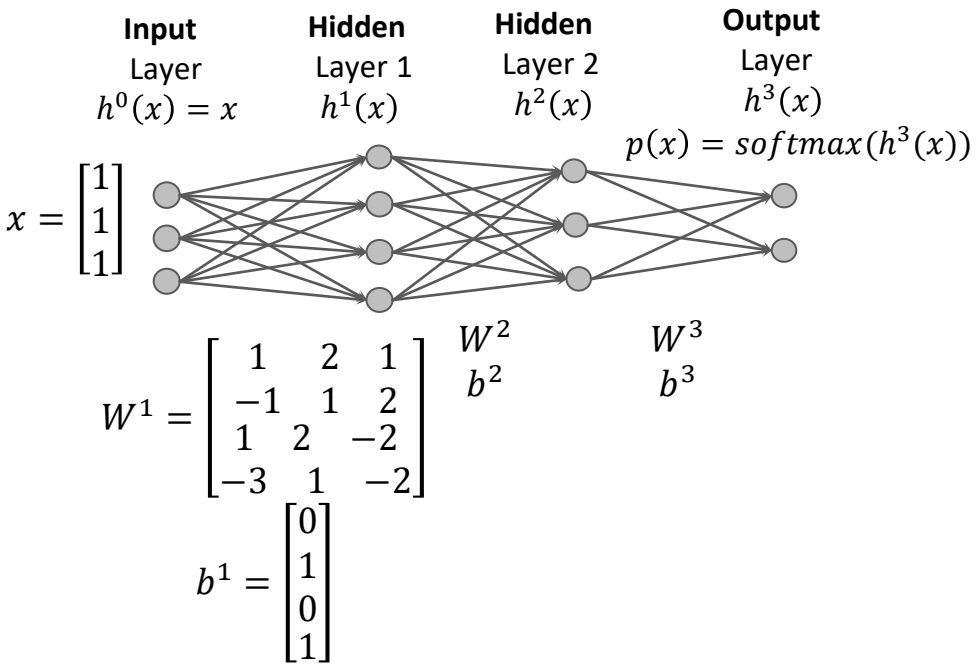
- B. $W^1 \in \mathbb{R}^{4\times3}, W^2 \in \mathbb{R}^{3\times4}, W^3 \in \mathbb{R}^{2\times3}$ **[x]**
- C. $W^1 \in \mathbb{R}^{3\times4}, W^2 \in \mathbb{R}^{4\times3}, W^3 \in \mathbb{R}^{3\times2}$
- D. $W^1 \in \mathbb{R}^{4\times4}, W^2 \in \mathbb{R}^{3\times3}, W^3 \in \mathbb{R}^{2\times2}$

# 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. $\bar{h}^1 = [4\ 2\ 1\ -4]^T$

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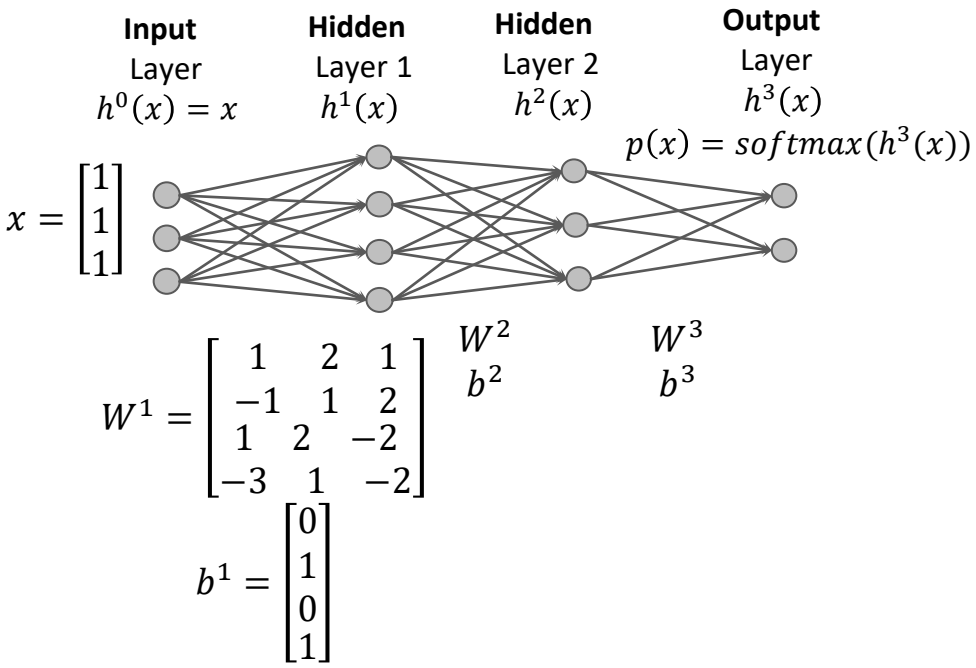


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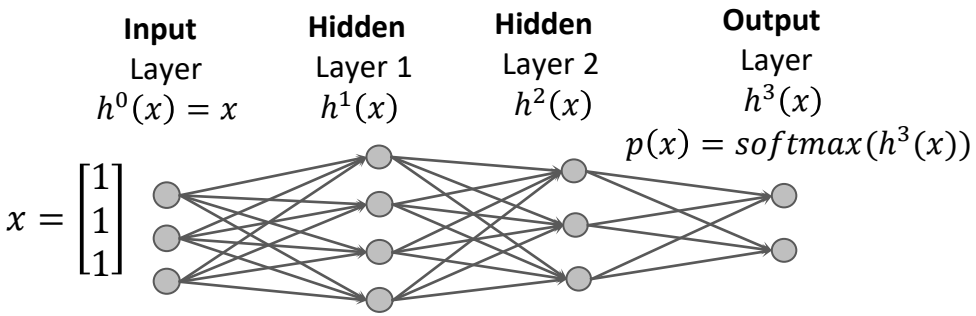
- B. $\bar{h}^1 = [4\ 3\ 1\ -3]$
- C. $\bar{h}^1 = [4\ 3\ 1\ -3]^T$ **[x]**
- D. $\bar{h}^1 = [4\ 2\ 1\ -4]^T$

# 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. $\mathrm{h}^1 = [4\ 2\ 1\ -4]^T$



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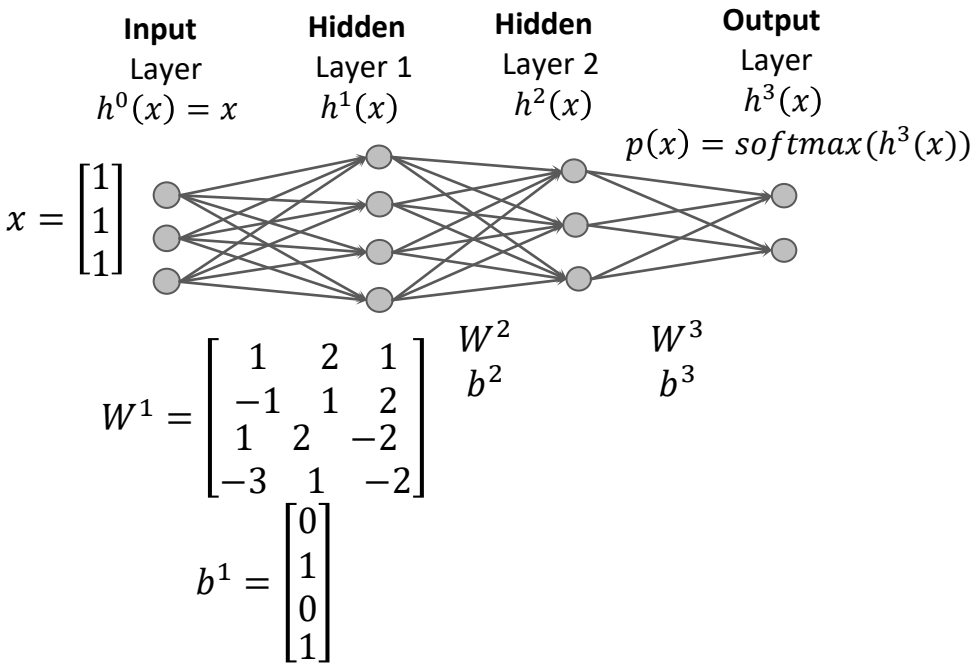


- A. $\mathrm{h}^1 = [0\ 0\ 0\ -4]^T$
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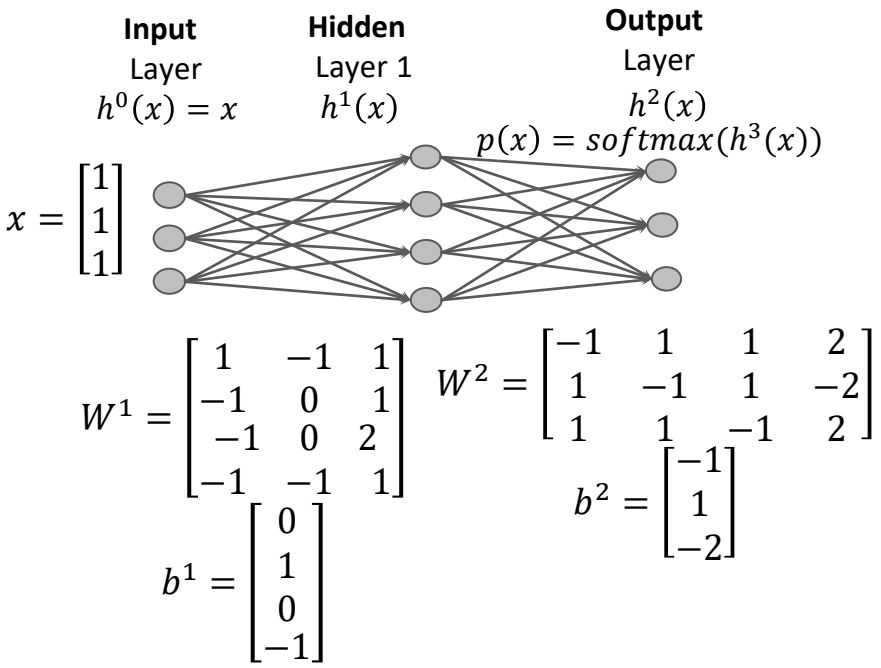
# Question 4

- *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)*




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

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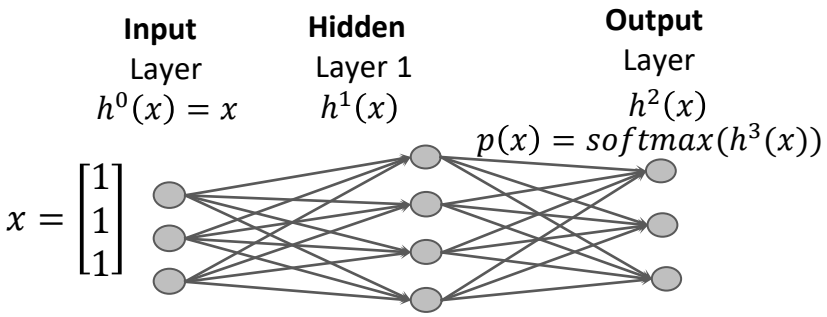


- A. $\mathrm{h}^1 = [1\ 1\ 1\ 0]^T$ **[x]**
- B. $\mathrm{h}^1 = [1\ 1\ 1\ 1]^T$
- C. Logit $\mathrm{h}^2 = [0\ \ 2\ \ -1]^T$ **[x]**
- D. Logit $\mathrm{h}^2 = [0\ \ 2\ \ 0]^T$

$$W^1 = \begin{bmatrix}1 & -1 & 1\\ -1 & 0 & 1\\ -1 & 0 & 2\\ -1 & -1 & 1\end{bmatrix} \times \begin{bmatrix}1\\1\\1\end{bmatrix} + b^1 = \begin{bmatrix}0\\1\\0\\-1\end{bmatrix}$$

$$W^2 = \begin{bmatrix}-1 & 1 & 1 & 2\\ 1 & -1 & 1 & -2\\ 1 & 1 & -1 & 2\end{bmatrix} \times \begin{bmatrix}1\\1\\1\\0\end{bmatrix} + b^2 = \begin{bmatrix}-1\\1\\-2\end{bmatrix}$$

# 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)

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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) **[x]**
- 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).*

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```

- A. The model has 5 Fully Connected layers
- B. The batch size is 784
- 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 6

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```

- A. The model has 5 Fully Connected layers **[x]**
- B. The batch size is 784
- C. The model can work with an arbitrary batch size **[x]**
- 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,)

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     print('shape W=',weights.shape)
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```

- A. (32, 32), (32,)
- B. (32, 784), (784,)
- C. (784, 32), (32,) **[x]**
- D. (784, 32), (784,)

# 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

# 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 **[x]**

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

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