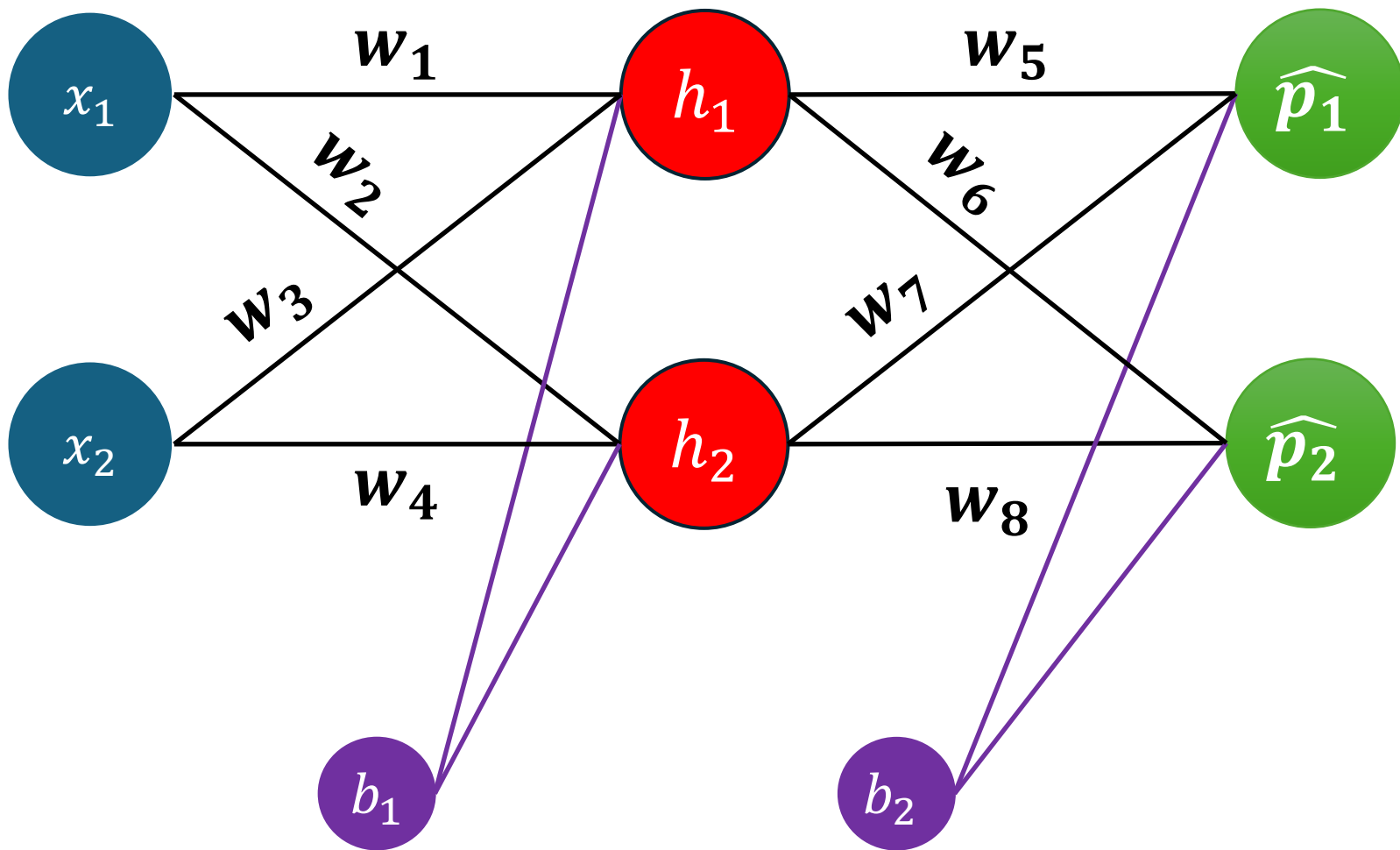


# Midterm Exam

CCDEPLRL – Deep Learning



Parameter	Value
$w_1$	0.15
$w_2$	0.20
$w_3$	0.25
$w_4$	0.30
$w_5$	0.40
$w_6$	0.45
$w_7$	0.50
$w_8$	0.55
$b_1$	.35
$b_2$	.60

$x_1$	$x_2$	$y_1$	$y_2$
0.05	0.10	.01	.99

$$\textcolor{red}{loss}_1 = \sum_{i=1}^{n=1} (y_1 - \widehat{p}_1)^2$$

$$\textcolor{red}{loss}_2 = \sum_{i=1}^{n=1} (y_2 - \widehat{p}_2)^2$$

$$h_1 = \frac{1}{1 + e^{z_1}}$$

$$\widehat{p}_1 = \frac{1}{1 + e^{z_3}}$$

$$h_2 = \frac{1}{1 + e^{z_2}}$$

$$\widehat{p}_2 = \frac{1}{1 + e^{z_4}}$$

Parameter	Value
$w_1$	0.15
$w_2$	0.20
$w_3$	0.25
$w_4$	0.30
$w_5$	0.40
$w_6$	0.45
$w_7$	0.50
$w_8$	0.55
$b_1$	.35
$b_2$	.60

# Part 1: Forward Pass

1. What is the value of  $\mathbf{h}_1$ ?
2. What is the value of  $\mathbf{h}_2$ ?
3. What is the value of  $\widehat{\mathbf{p}}_1$ ?
4. What is the value of  $\widehat{\mathbf{p}}_2$ ?
5. What is the combined loss/total loss of the neural network?

# Part 2: Back Propagation

1. Find the derivative of  $\frac{d \text{ loss}}{d \widehat{p}_1}$

2. Find the derivative of  $\frac{d \text{ loss}}{d \widehat{p}_2} = ?$



3. Find the derivative of  $\frac{d \text{ loss}}{d b_2} = ?$

4. Find the derivative of  $\frac{d \text{ loss}}{d w_5} = ?$

5. Find the derivative of  $\frac{d \text{ loss}}{d w_7} = ?$

6. Find the derivative of  $\frac{d \text{ loss}}{d w_6} = ?$

7. Find the derivative of  $\frac{d \text{ loss}}{d w_8} = ?$

8. Find the derivative of  $\frac{d \text{ loss}}{d h_1} = ?$

9. Find the derivative of  $\frac{d \text{ loss}}{d h_2} = ?$

10. Find the derivative of  $\frac{d \text{ loss}}{d b_1} = ?$



11. Find the derivative of  $\frac{d \text{ loss}}{d w_1} = ?$

# Part 3: Gradient Descent

Given a **learning rate of 0.5**,

1. What will be the new value of  $w_5$ ?
2. What will be the new value of  $w_6$ ?
3. What will be the new value of  $w_7$ ?
4. What will be the new value of  $w_8$ ?
5. What is the combined loss/total loss of the neural network?