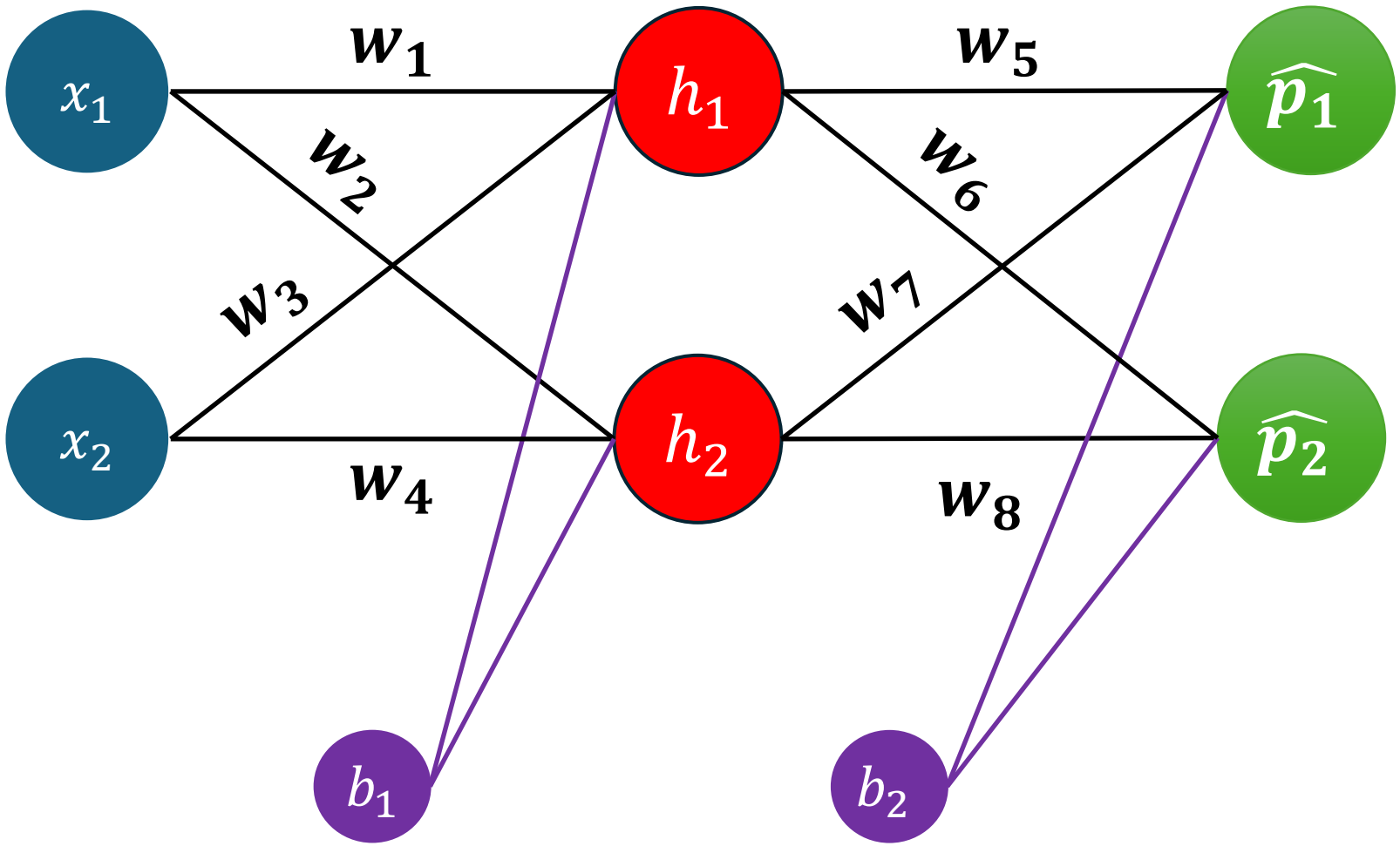
Midterm Exam

CCDEPLRL – Deep Learning


x_1
x_2
h_1
h_2
$\widehat{p_1}$
$\widehat{p_2}$
b_1
b_2
w_1
w_2
w_3
w_4
w_5
w_6
w_7
w_8

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

$$\boldsymbol{loss_1} = \sum_{i=1}^{n=1} (y_1 - \widehat{p_1})^2$$

$$\boldsymbol{loss_2} = \sum_{i=1}^{n=1} (y_2 - \widehat{p_2})^2$$

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

$$\widehat{p_1} = \frac{1}{1 + e^{z_3}}$$

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

$$\widehat{p_2} = \frac{1}{1 + e^{z_4}}$$

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 of $\boldsymbol{h_1}$?
2. What is the value of of $\boldsymbol{h_2}$?
3. What is the value of of $\widehat{\boldsymbol{p_1}}$?
4. What is the value of of $\widehat{\boldsymbol{p_2}}$?
5. What is the combined loss/total loss of the neural network?

Part 2: Back Propagation

1. $Find\ the\ derivative\ of\ \frac{d\ loss}{d\ \widehat{p_1}}$

$$2.\ Find\ the\ derivative\ of\ \frac{d\ loss}{d\ \widehat{p_2}} = \ ?$$

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

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

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

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

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

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

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

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

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

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

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

Part 3: Gradient Descent

Given a **learning rate of 0.5**,

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