# LAB 1

↳ 8 cells hidden

# LAB 2

```
import numpy as np
# for AND gate (Input/Output)
x_list = np.array([[0,0],[0,1],[1,0],[1,1]])
y_list = np.array([0,0,0,1])
epochs = 4
w,b = np.zeros(2),0

for _ in range(epochs):
  for x,y in zip(x_list,y_list):
    z = np.dot(x,w) + b
    ### condition area for y_pred
    y_pred = 1 if z >= 0 else 0
    E = y - y_pred
    print("error : ",E,"<- at epoch",_)
    w += E*x
    b += E
    print(w,b)


print("Ansh Tripathi,426")
print("Date:29/01/2026")
```

```
error :  -1 <- at epoch 0
[0. 0.] -1
error :  0 <- at epoch 0
[0. 0.] -1
error :  0 <- at epoch 0
[0. 0.] -1
error :  1 <- at epoch 0
[1. 1.] 0
error :  -1 <- at epoch 1
[1. 1.] -1
error :  -1 <- at epoch 1
[1. 0.] -2
error :  0 <- at epoch 1
[1. 0.] -2
error :  1 <- at epoch 1
[2. 1.] -1
error :  0 <- at epoch 2
[2. 1.] -1
error :  -1 <- at epoch 2
[2. 0.] -2
error :  -1 <- at epoch 2
[1. 0.] -3
error :  1 <- at epoch 2
[2. 1.] -2
error :  0 <- at epoch 3
[2. 1.] -2
error :  0 <- at epoch 3
[2. 1.] -2
error :  -1 <- at epoch 3
[1. 1.] -3
error :  1 <- at epoch 3
[2. 2.] -2
Ansh Tripathi,426
Date:29/01/2026
```

```
import numpy as np
# for AND gate (Input/Output)
x_list = np.array([[0,0],[0,1],[1,0],[1,1]])
y_list = np.array([0,0,0,1])
epochs = 10
w,b = np.array([2,5]),0

for _ in range(epochs):
  for x,y in zip(x_list,y_list):
    z = np.dot(x,w) + b
```

```
    ### condition area for y_pred
    y_pred = 1 if z >= 0 else 0
    E = y - y_pred
    print("error : ",E,"<- at epoch",_)
    w += E*x
    b += E
    print(w,b)
```

```
error :  0 <- at epoch 2
[1 3] -4
error :  0 <- at epoch 3
[1 3] -4
error :  0 <- at epoch 3
[1 3] -4
error :  0 <- at epoch 3
[1 3] -4
error :  0 <- at epoch 3
[1 3] -4
error :  0 <- at epoch 4
[1 3] -4
error :  0 <- at epoch 4
[1 3] -4
error :  0 <- at epoch 4
[1 3] -4
error :  0 <- at epoch 4
[1 3] -4
error :  0 <- at epoch 5
[1 3] -4
error :  0 <- at epoch 5
[1 3] -4
error :  0 <- at epoch 5
[1 3] -4
error :  0 <- at epoch 5
[1 3] -4
error :  0 <- at epoch 6
[1 3] -4
error :  0 <- at epoch 6
[1 3] -4
error :  0 <- at epoch 6
[1 3] -4
error :  0 <- at epoch 6
[1 3] -4
error :  0 <- at epoch 7
[1 3] -4
error :  0 <- at epoch 7
[1 3] -4
error :  0 <- at epoch 7
[1 3] -4
error :  0 <- at epoch 7
[1 3] -4
error :  0 <- at epoch 8
[1 3] -4
error :  0 <- at epoch 8
[1 3] -4
error :  0 <- at epoch 8
[1 3] -4
error :  0 <- at epoch 8
[1 3] -4
error :  0 <- at epoch 9
[1 3] -4
error :  0 <- at epoch 9
[1 3] -4
error :  0 <- at epoch 9
[1 3] -4
error :  0 <- at epoch 9
[1 3] -4
```

```
import numpy as np
# for AND gate (Input/Output)
x_list = np.array([[0,0],[0,1],[1,0],[1,1]])
y_list = np.array([0,0,0,1])
epochs = 10
w,b = np.random.rand(2), np.random.rand() # Initialize weights and bias with random values

for _ in range(epochs):
  for x,y in zip(x_list,y_list):
    z = np.dot(x,w) + b
    ### condition area for y_pred
    y_pred = 1 if z >= 0 else 0
    E = y - y_pred
    print("error : ",E,"<- at epoch",_)
    w += E*x
```

```
        b += E
        print(w,b)
```

```
error :  -1 <- at epoch 0
[0.74289672 0.04408914] -0.4512195928110635
error :  0 <- at epoch 0
[0.74289672 0.04408914] -0.4512195928110635
error :  -1 <- at epoch 0
[-0.25710328  0.04408914] -1.4512195928110634
error :  1 <- at epoch 0
[0.74289672 1.04408914] -0.4512195928110634
error :  0 <- at epoch 1
[0.74289672 1.04408914] -0.4512195928110634
error :  -1 <- at epoch 1
[0.74289672 0.04408914] -1.4512195928110634
error :  0 <- at epoch 1
[0.74289672 0.04408914] -1.4512195928110634
error :  1 <- at epoch 1
[1.74289672 1.04408914] -0.4512195928110634
error :  0 <- at epoch 2
[1.74289672 1.04408914] -0.4512195928110634
error :  -1 <- at epoch 2
[1.74289672 0.04408914] -1.4512195928110634
error :  -1 <- at epoch 2
[0.74289672 0.04408914] -2.4512195928110634
error :  1 <- at epoch 2
[1.74289672 1.04408914] -1.4512195928110634
error :  0 <- at epoch 3
[1.74289672 1.04408914] -1.4512195928110634
error :  0 <- at epoch 3
[1.74289672 1.04408914] -1.4512195928110634
error :  -1 <- at epoch 3
[0.74289672 1.04408914] -2.4512195928110634
error :  1 <- at epoch 3
[1.74289672 2.04408914] -1.4512195928110634
error :  0 <- at epoch 4
[1.74289672 2.04408914] -1.4512195928110634
error :  -1 <- at epoch 4
[1.74289672 1.04408914] -2.4512195928110634
error :  0 <- at epoch 4
[1.74289672 1.04408914] -2.4512195928110634
error :  0 <- at epoch 4
[1.74289672 1.04408914] -2.4512195928110634
error :  0 <- at epoch 5
[1.74289672 1.04408914] -2.4512195928110634
error :  0 <- at epoch 5
[1.74289672 1.04408914] -2.4512195928110634
error :  0 <- at epoch 5
[1.74289672 1.04408914] -2.4512195928110634
error :  0 <- at epoch 5
[1.74289672 1.04408914] -2.4512195928110634
error :  0 <- at epoch 6
[1.74289672 1.04408914] -2.4512195928110634
error :  0 <- at epoch 6
[1.74289672 1.04408914] -2.4512195928110634
error :  0 <- at epoch 6
[1.74289672 1.04408914] -2.4512195928110634
error :  0 <- at epoch 6
[1.74289672 1.04408914] -2.4512195928110634
error :  0 <- at epoch 7
[1.74289672 1.04408914] -2.4512195928110634
```

```
import numpy as np
x_list = np.array([[0,0],[0,1],[1,0],[1,1]])
y_list = np.array([0,1,1,1])

epochs = 8
w = np.array([0.5,0.5])
b = -0.5
for _ in range(epochs):
    total_error_in_epoch = 0
    for x, y in zip(x_list, y_list):
        z = np.dot(x, w) + b
        y_pred = 1 if z >= 0 else 0
        E = y - y_pred
        total_error_in_epoch += abs(E)
        print("error : ", E, "<- at epoch", _)
        w += E * x
        b += E
        print(w, b)
```

```
error :  0 <- at epoch 0
[0.5 0.5] -0.5
error :  0 <- at epoch 0
[0.5 0.5] -0.5
error :  0 <- at epoch 0
[0.5 0.5] -0.5
error :  0 <- at epoch 0
[0.5 0.5] -0.5
error :  0 <- at epoch 1
[0.5 0.5] -0.5
error :  0 <- at epoch 1
[0.5 0.5] -0.5
error :  0 <- at epoch 1
[0.5 0.5] -0.5
error :  0 <- at epoch 1
[0.5 0.5] -0.5
error :  0 <- at epoch 2
[0.5 0.5] -0.5
error :  0 <- at epoch 2
[0.5 0.5] -0.5
error :  0 <- at epoch 2
[0.5 0.5] -0.5
error :  0 <- at epoch 2
[0.5 0.5] -0.5
error :  0 <- at epoch 3
[0.5 0.5] -0.5
error :  0 <- at epoch 3
[0.5 0.5] -0.5
error :  0 <- at epoch 3
[0.5 0.5] -0.5
error :  0 <- at epoch 3
[0.5 0.5] -0.5
error :  0 <- at epoch 4
[0.5 0.5] -0.5
error :  0 <- at epoch 4
[0.5 0.5] -0.5
error :  0 <- at epoch 4
[0.5 0.5] -0.5
error :  0 <- at epoch 4
[0.5 0.5] -0.5
error :  0 <- at epoch 5
[0.5 0.5] -0.5
error :  0 <- at epoch 5
[0.5 0.5] -0.5
error :  0 <- at epoch 5
[0.5 0.5] -0.5
error :  0 <- at epoch 5
[0.5 0.5] -0.5
error :  0 <- at epoch 6
[0.5 0.5] -0.5
error :  0 <- at epoch 6
[0.5 0.5] -0.5
error :  0 <- at epoch 6
[0.5 0.5] -0.5
error :  0 <- at epoch 6
[0.5 0.5] -0.5
error :  0 <- at epoch 7
[0.5 0.5] -0.5
```

```
import numpy as np

x_list = np.array([[0,0],[0,1],[1,0],[1,1]])
y_list = np.array([0,1,1,0])

epochs = 18

w = np.array([2,1])
b = -2

for _ in range(epochs):
    total_error_in_epoch = 0
    for x, y in zip(x_list, y_list):
        z = np.dot(x, w) + b
        y_pred = 1 if z >= 0 else 0
        E = y - y_pred
        total_error_in_epoch += abs(E)
        print("error : ", E, "<- at epoch", _)
        w += E * x
        b += E
        print(w, b)
```

```
        if total_error_in_epoch == 0:
            print(f"Converged at epoch {_}. No errors found.")
```

```
error :  -1 <- at epoch 10
[-1  0] 0
error :  -1 <- at epoch 11
[-1  0] -1
error :  1 <- at epoch 11
[-1  1] 0
error :  1 <- at epoch 11
[0 1] 1
error :  -1 <- at epoch 11
[-1  0] 0
error :  -1 <- at epoch 12
[-1  0] -1
error :  1 <- at epoch 12
[-1  1] 0
error :  1 <- at epoch 12
[0 1] 1
error :  -1 <- at epoch 12
[-1  0] 0
error :  -1 <- at epoch 13
[-1  0] -1
error :  1 <- at epoch 13
[-1  1] 0
error :  1 <- at epoch 13
[0 1] 1
error :  -1 <- at epoch 13
[-1  0] 0
error :  -1 <- at epoch 14
[-1  0] -1
error :  1 <- at epoch 14
[-1  1] 0
error :  1 <- at epoch 14
[0 1] 1
error :  -1 <- at epoch 14
[-1  0] 0
error :  -1 <- at epoch 15
[-1  0] -1
error :  1 <- at epoch 15
[-1  1] 0
error :  1 <- at epoch 15
[0 1] 1
error :  -1 <- at epoch 15
[-1  0] 0
error :  -1 <- at epoch 16
[-1  0] -1
error :  1 <- at epoch 16
[-1  1] 0
error :  1 <- at epoch 16
[0 1] 1
error :  -1 <- at epoch 16
[-1  0] 0
error :  -1 <- at epoch 17
[-1  0] -1
error :  1 <- at epoch 17
[-1  1] 0
error :  1 <- at epoch 17
[0 1] 1
error :  -1 <- at epoch 17
[-1  0] 0
```