1.

```python
# Perceptron NOT
from math import *
import random

eta=0.1
w=random.uniform(-0.1,0.1)
w0=random.uniform(-0.1,0.1)

HIGH=0.9
LOW=0.1

def logistic(w, w0, x):
    return 1/(1+exp(-w*x - w0))
```

```python
input=[0.1, 0.9]
desire=[HIGH, LOW]
for i in range(1000):
    for idx in range(2):
        x = random.gauss(input[idx], 0.1)
        output = logistic(w, w0, x)

        w -= eta*(output-desire[idx])*x
        w0 -= eta*(output-desire[idx])*1

    if i%100==0:
        error=0
        for idx in range(2):
            error += (logistic(w, w0, input[idx]) - desire[idx])**2
        #print(f"iteration = {i}, error = {error}")

print(f"w = {w}, w0 = {w0}")
for i in range(2):
    output=logistic(w, w0, input[i])
    print(f"x = {input[i]}, output = {output}")
```

```
w = -5.116330795815446, w0 = 2.496733802358526
x = 0.1, output = 0.8792238526924491
x = 0.9, output = 0.10832517723549069
```

2.

```python
# Perceptron AND
from math import *
import random
import matplotlib.pyplot as plt

eta=0.1
w1=random.uniform(-0.1,0.1)
w2=random.uniform(-0.1,0.1)
w0=random.uniform(-0.1,0.1)

HIGH=0.9
LOW=0.1

def logistic(w1, w2, w0, x1, x2):
    return 1/(1+exp(-w1*x1 - w2*x2 - w0))
```

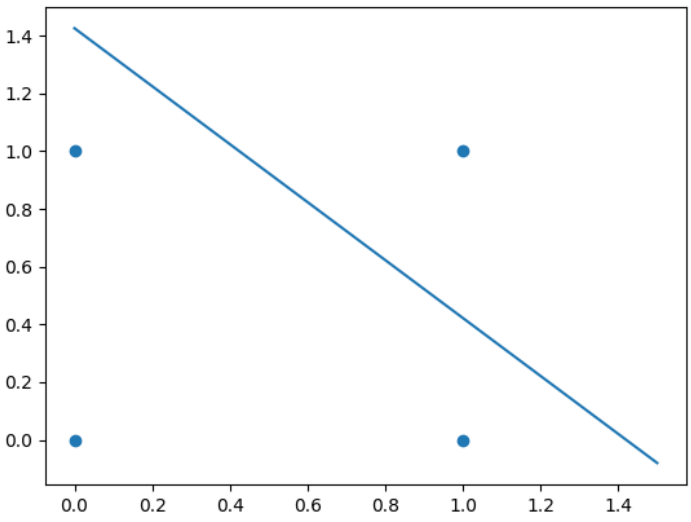
```python
input=[(0.1, 0.1), (0.9, 0.1), (0.1, 0.9), (0.9, 0.9)]  # (x1, x2)
desire=[LOW, LOW, LOW, HIGH]    # desire answers
for i in range(1000):
    for idx in range(4):
        x1 = random.gauss(input[idx][0], 0.1)
        x2 = random.gauss(input[idx][1], 0.1)
        output = logistic(w1, w2, w0, x1, x2)

        w1 -= eta*(output-desire[idx])*x1
        w2 -= eta*(output-desire[idx])*x2
        w0 -= eta*(output-desire[idx])*1

    if i%100==0:
        error=0
        for idx in range(4):
            error += (logistic(w1, w2, w0, input[idx][0], input[idx][1]) - desire[idx])**2
        #print(f"iteration = {i}, error = {error}")

print(f"w1 = {w1}, w2 = {w2}, w0 = {w0}")
for i in range(4):
    output = logistic(w1, w2, w0, input[i][0], input[i][1])
    print(f"(x1, x2) = ({input[i][0]}, {input[i][1]}), output = {output}")
```

```
w1 = 3.287264796264187, w2 = 3.273981789590363, w0 = -4.668532846714406
(x1, x2) = (0.1, 0.1), output = 0.017768353556926804
(x1, x2) = (0.9, 0.1), output = 0.20059233806696306
(x1, x2) = (0.1, 0.9), output = 0.1988937605106724
(x1, x2) = (0.9, 0.9), output = 0.7749697363683644
```


1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4