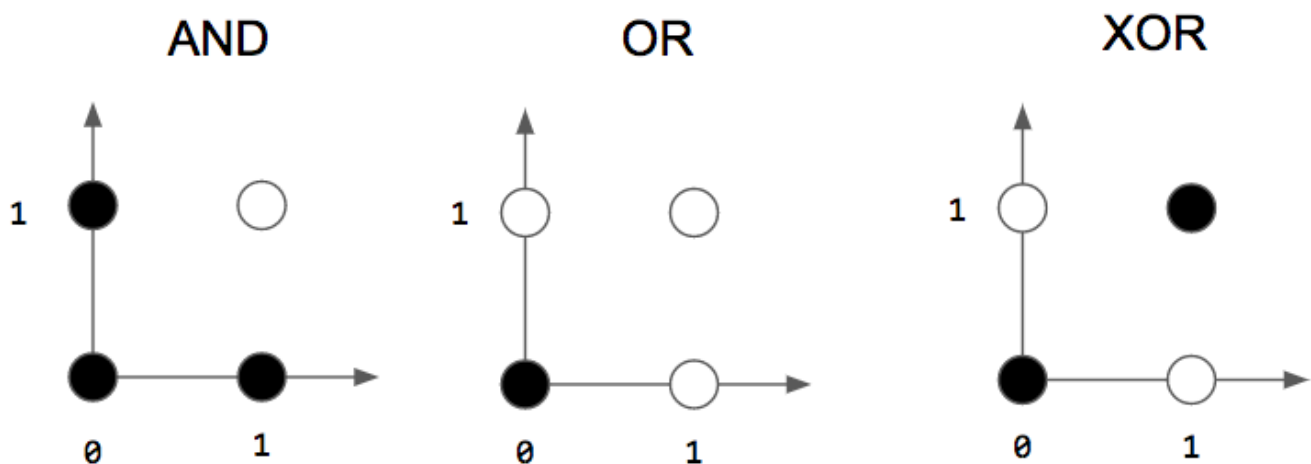


Implementing basic Logic functions using Single Neuron Model

1. rosen blatt Neuron
2. weights represents importance of input
3. perceptron (i.e. simple neural network)

Exercise I

Let w_1 and w_2 be the weights of a perceptron (i.e. simple neural network) with two inputs x_1 and x_2 . Let $\text{AND}(x_1, x_2)$ be the "logical and" function, let $\text{OR}(x_1, x_2)$ be the "logical or" function and let $\text{NOT}(x)$ be the logical NOT function. Plot constellation diagram for these logic gates. Are the data points linearly separable? If yes, what is its significance with respect to perceptron?



Exercise II

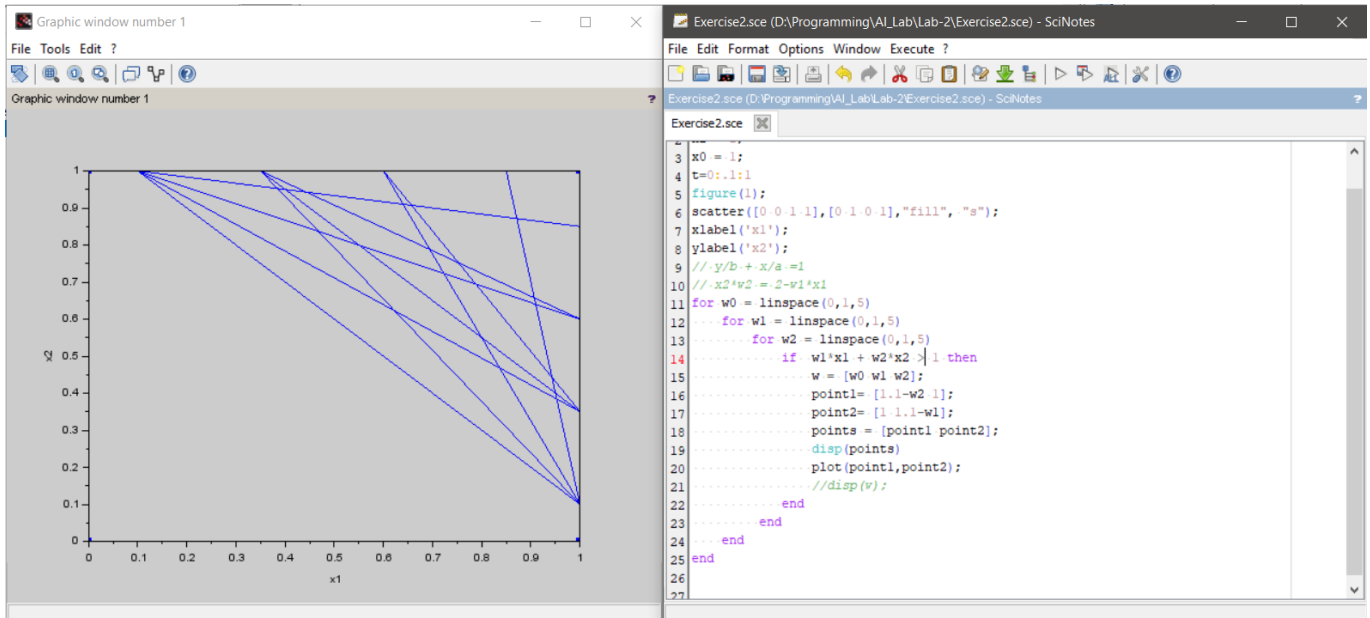
Design three single-neuron models which correspond to the logical AND, OR and NOT functions respectively. Assume threshold activation function at the output of the Neuron.

```
x1 = input('Enter Value of x1 : ');
x2 = input('Enter Value of x2 : ');
x0 = 1;
t=0:.1:1
figure(1);
scatter([0 0 1 1],[0 1 0 1],"fill", "s");
for w0 = linspace(0,1,10)
    for w1 = linspace(0,1,10)
        for w2 = linspace(0,1,10)
            if w0*x0 + w1*x1 + w2*x2 >= 1 then
                w = [w0 w1 w2];
                y = w0*x0
```

```

disp(w);
end
end
end
end

```



2)

```

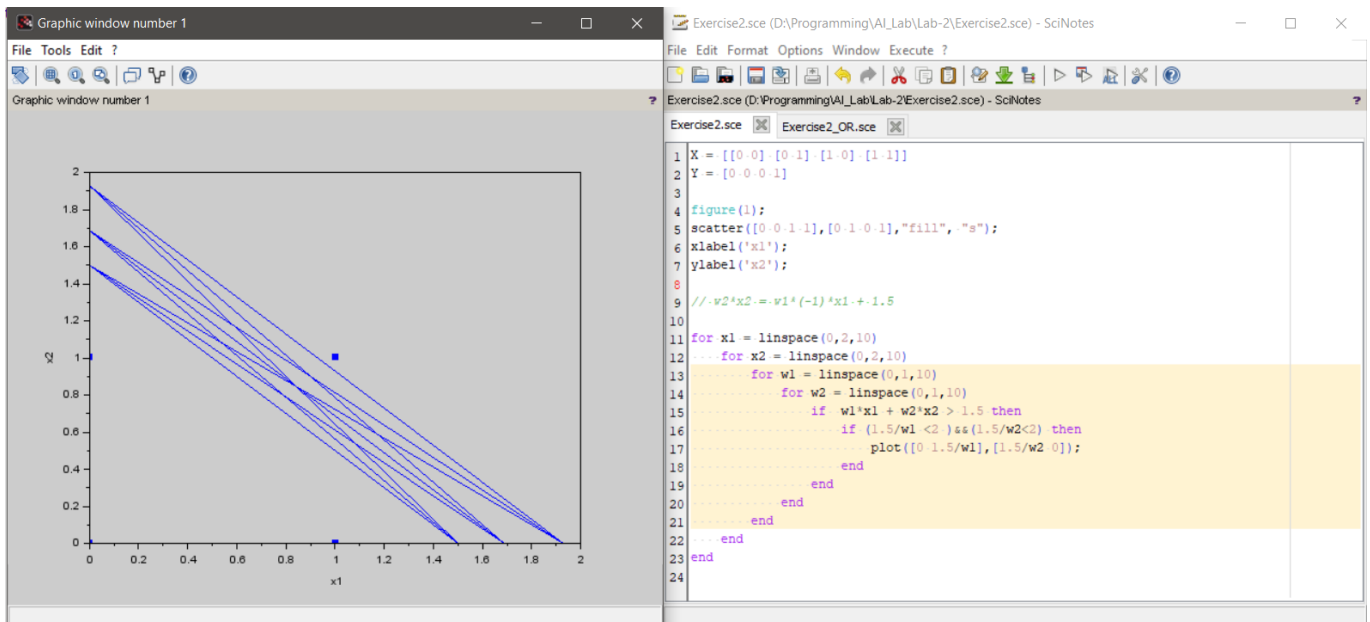
X = [[0 0] [0 1] [1 0] [1 1]]
Y = [0 0 0 1]

figure(1);
scatter([0 0 1 1],[0 1 0 1],"fill", "s");
xlabel('x1');
ylabel('x2');

// w2*x2 = w1*(-1)*x1 + 1.5

for x1 = linspace(0,2,10)
    for x2 = linspace(0,2,10)
        for w1 = linspace(0,1,10)
            for w2 = linspace(0,1,10)
                if w1*x1 + w2*x2 > 1.5 then
                    if (1.5/w1 < 2 )&&(1.5/w2<2) then
                        plot([0 1.5/w1],[1.5/w2 0]);
                    end
                end
            end
        end
    end
end
end
end
end

```



OR Gate

```

X = [[0 0] [0 1] [1 0] [1 1]]
Y = [0 1 1 1]

```

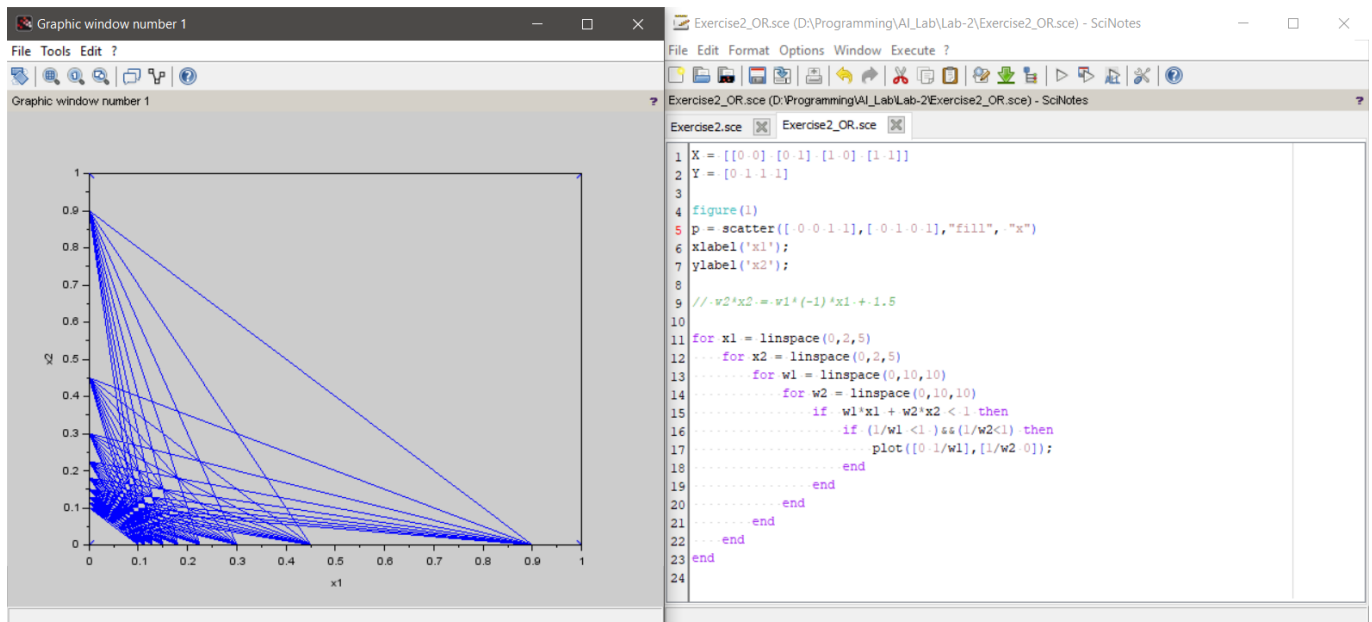
```

figure(1)
p = scatter([ 0 0 1 1],[ 0 1 0 1],"fill", "x")
xlabel('x1');
ylabel('x2');

// w2*x2 = w1*(-1)*x1 + 1.5

for x1 = linspace(0,2,5)
    for x2 = linspace(0,2,5)
        for w1 = linspace(0,10,10)
            for w2 = linspace(0,10,10)
                if w1*x1 + w2*x2 < 1 then
                    if (1/w1 < 1) && (1/w2 < 1) then
                        plot([0 1/w1],[1/w2 0]);
                    end
                end
            end
        end
    end
end
end
end
end

```



Exercise III

Can we design a model that implements XOR(x_1, x_2) logic function with single neuron? Justify your answer with necessary decision graph.

Ans

no we can't

