```
using Statistics
using Random

N = 256
x_n = 11
y_idx = 12

function pla(; M = N, x0 = 1, ud = 0, err = 0, w0dotx0 = 0, scale = 1)
    x = []
    datafile = open("hw1_13.txt","r") #read the data
    lines = readlines(datafile)

    close(datafile)
    for (i, line) in enumerate(lines)
        append!(x,[parse.(Float64, split(line,"\t"))])
        insert!(x[i],1,x0)
    end
    error=zeros(1000)*1
    update=zeros(1000)*1
    w0 = zeros(1000)*1

    if scale>1
        for i in 1:N
            x[i][1:x_n] = x[i][1:x_n]/scale
        end
    end
    for i in 1:1000
        Random.seed!(i)
        #@show i
        #print(error)
        cnt = 0
        w = [0 for i in 1:x_n]
        #print("aaa")
        upd = 0
        while cnt < M
            ranum = Int(ceil(rand()*1000%N))
            if (sum(w.*x[ranum][1:x_n])>=0 && x[ranum][y_idx]==1)
                cnt+=1
            elseif (sum(w.*x[ranum][1:x_n])<0 && x[ranum][y_idx]==-1)
                cnt+=1
            else
                #println("here")
                cnt=0
                upd += 1
                w = w .+ x[ranum][y_idx]*x[ranum][1:x_n]
            end
            #println(cnt)
        end
        if err == 1
            e = 0
            for j in 1:N
                if((sum(w.*x[j][1:x_n])>=0 && x[j][y_idx]==1) || (sum(w.*x[j][1:x_
                    a=1
                else
                    e+=1
                end
            end
            error[i] = e/N
        end
        update[i] = upd
        w0[i] = w[1]*x0
    end
    if err==1
        println(sum(error)/1000)
    end
    if ud==1
        println(median(update))
    end
    if w0dotx0 ==1
        println(median(w0))
    end
    return
end
```

```
#13
ans13 = pla(M = N/2, x0 = 1, ud = 0, err = 1, w0dotx0 = 0, scale = 0)
#14
ans14 = pla(M = 4*N, x0 = 1, ud = 0, err = 1, w0dotx0 = 0, scale = 0)
#15
ans15 = pla(M = 4*N, x0 = 1, ud = 1, err = 0, w0dotx0 = 0, scale = 0)
#16
ans16 = pla(M = N*4, x0 = 1, ud = 0, err = 0, w0dotx0 = 1, scale = 0)
#17
ans17 = pla(M = N*4, x0 = 1, ud = 1, err = 0, w0dotx0 = 0, scale = 2)
#18
ans18 = pla(M = N*4, x0 = 0, ud = 1, err = 0, w0dotx0 = 0, scale = 0)
#19
ans19 = pla(M = N*4, x0 = -1, ud = 0, err = 0, w0dotx0 = 1, scale = 0)
#20
ans20 = pla(M = N*4, x0 = 0.1126, ud = 0, err = 0, w0dotx0 = 1, scale = 0)
```

```
0.01958984375
0.00014453125
445.0
34.0
445.0
439.0
34.0
0.4310778400000001
```