Problem 1.

```
clear
load('hw3.mat');
x1=hw3_2_1;
x2=hw3_2_2;

l = 0;
for i = -4:0.1:8
    l = l+1;
    m=0;
    for j = -4:0.1:8
        m=m+1;
        p1(l,m) = 0;
        p2(l,m) = 0;
        [neighbors1, maxDis1] = getNeighbors(x1, [i;j], 10);
        [neighbors2, maxDis2] = getNeighbors(x2, [i;j], 10);
        V1 = pi * maxDis1^2;
        V2 = pi * maxDis2^2;
        p1(l,m) = 10/100/V1;
        p2(l,m) = 10/100/V2;
    end
end

figure(1);
mesh(p1);
figure(2);
mesh(p2);

function [neighbors, maxDis] = getNeighbors(dataSet, Instance, k)
    distances = [];
    for i = 1:size(dataSet,2)
        dist = Distance(Instance, dataSet(:,i));
        distances = [distances;dist];
    end
    [B, I] = sort(distances);
    neighbors = [];
    for i = 1:k
        neighbors = [neighbors, dataSet(:,I(i))];
    end
    maxDis = Distance(Instance, neighbors(:,end));
end
```
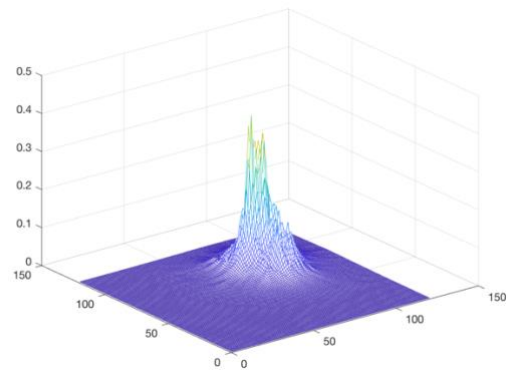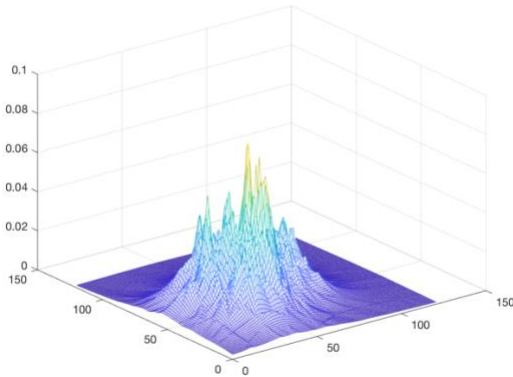
```matlab
function y = Distance(instance1, instance2)
    distance = 0;
    for i = 1:2
        distance = distance + (instance1(i) - instance2(i))^2;
    end
    y = sqrt(distance);
end
```



```matlab
if i==1 && j==-2
    p1(l,m)
    p2(l,m)
end
```

```
ans =

    0.0276


ans =

    0.0010
```

Due to

$$p(w_1 \,|\, x) \propto p(x \,|\, w_1) \times p(w_1)$$
$$p(w_2|x) \propto p(x|w_2) \times p(w_2)$$
$$p(w_1) = p(w_2) = 0.5$$

Thus, $p(x|w_1) > p(x|w_2)$ the test data is classified to w_1.

Problem 2

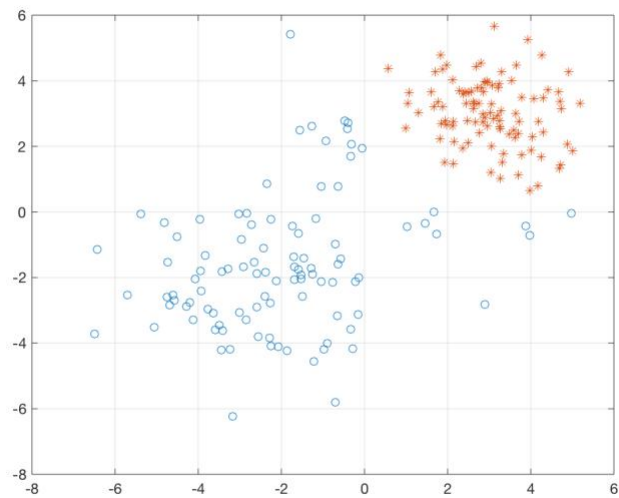**1.** ```clear```
```matlab
load('hw4.mat');
```

```
x1=hw4_2_1;
x2=hw4_2_2;

figure(1);
plot(x1(1,:), x1(2,:), 'o', x2(1,:), x2(2,:), '*')
grid on
```
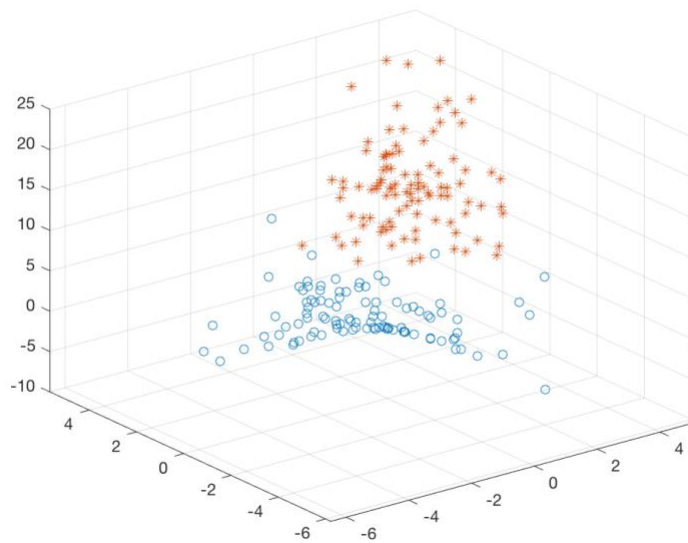


```
 2.figure(2);
plot3(x1(1,:),x1(2,:),x1(1,:).*x1(2,:),'o',x2(1,:),
x2(2,:),x2(1,:).*x2(2,:), '*')
grid on
```

```matlab
3.y1 = [ones(1,100); x1; x1(1,:).*x1(2,:)];
y2 = [ones(1,100); x2; x2(1,:).*x2(2,:)];
y=[y1, -y2];
theta=1;
ita=1
a=sum(y,2);

while true
    misCla = find((a'*y)<0)
    a=a+ita*sum(y(:,misCla),2);
    if abs(ita*sum(y(:,misCla),2))<theta
        break
    end
end
a

a =

   482.0000
   -95.4434
  -212.9730
   -63.8152
```