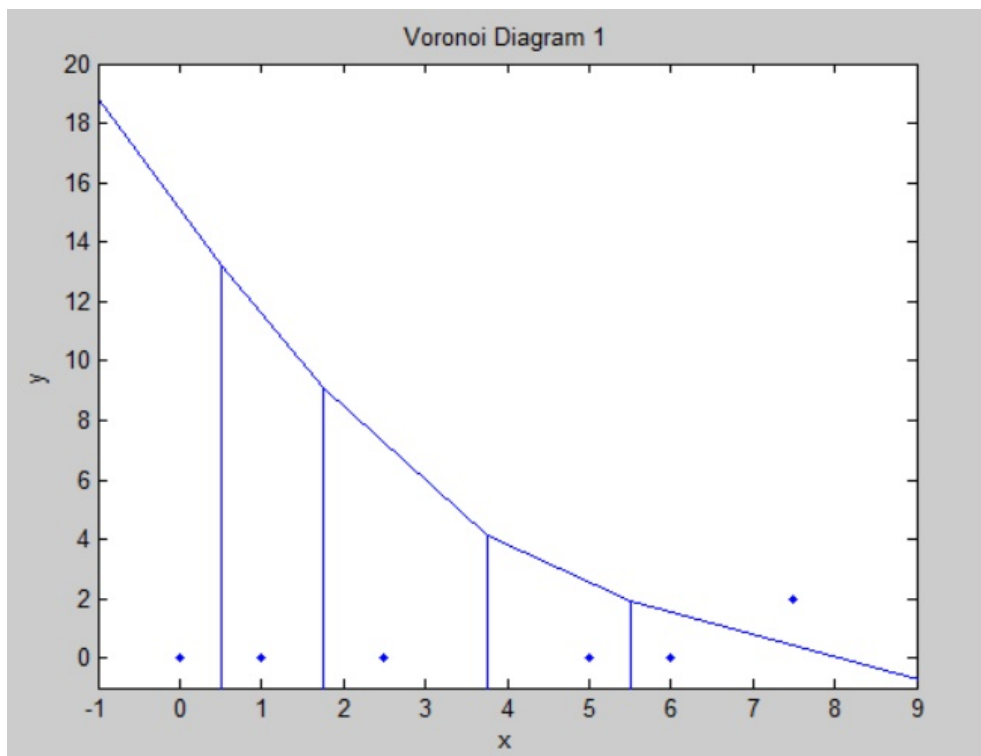


Voronoi Diagrams

1. Draw the Voronoi diagram for the following configuration:
 $x = (0, 1, 2.5, 5, 6, 7.5); \quad y = (0, 0, 0, 0, 0, 2).$

```
clear all
x = [0 1 2.5 5 6 7.5];
y = [0 0 0 0 0 2];
voronoi(x,y)
xlim([-1 9]); ylim([-1 20]);
xlabel('x'); ylabel('y');
title('Voronoi Diagram');
```



2. a) For a Voronoi diagram find the coordinates of the nodes (also, the number of nodes).
b) Given $i \in \{1, 2, \dots, n\}$ say if cell i is bounded or not.
Example: for $x = (0, 2, 3, 2, 1, 1, 2.5)$; $y = (0, 0, 1, 2, 2, 1, 0.75)$

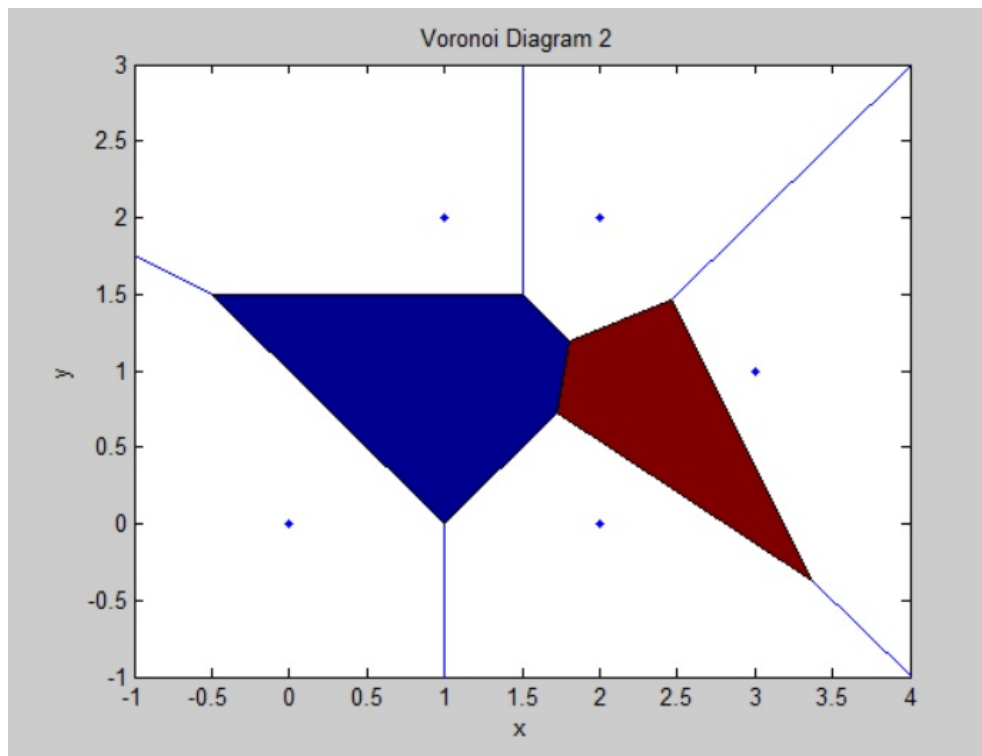
```
clear all
x=[0 2 3 2 1 1 2.5];
y=[0 0 1 2 2 1 0.75];
voronoi(x,y)
xlim([-1 4]); ylim([-1 3]);
xlabel('x'); ylabel('y');
title('Voronoi Diagram 2 ');
X=[x(:) y(:)]
[V,C]=voronoin(X)
N=length(V)-1
for i=1:length(C)
    r=0;
    if all(C{i}~=1)
        patch(V(C{i},1),V(C{i},2),i)
    end
    for j=1:length(C{i})
        if C{i}(j)==1
            r=r+1;
        end
    end
    if(r==0)
        disp('bounded')
    else disp('unbounded')
    end
end
end
```

```
X =
      0      0
 2.0000      0
 3.0000  1.0000
 2.0000  2.0000
 1.0000  2.0000
 1.0000  1.0000
 2.5000  0.7500

V =
      Inf      Inf
 1.0000      0
 1.5000  1.5000
-0.5000  1.5000
 3.3750 -0.3750
 2.4583  1.4583
 1.8036  1.1964
 1.7250  0.7250

C =
 [1x3 double]
 [1x4 double]
 [1x3 double]
 [1x4 double]
 [1x3 double]
 [1x5 double]
 [1x4 double]

N =
      7
unbounded
unbounded
unbounded
unbounded
unbounded
bounded
bounded
```



3. Given i and j ($i, j \in \{1, 2, \dots, n\}$) say if the two cells V_i and V_j are neighbours.

Example: for $i = 2; j = 4$

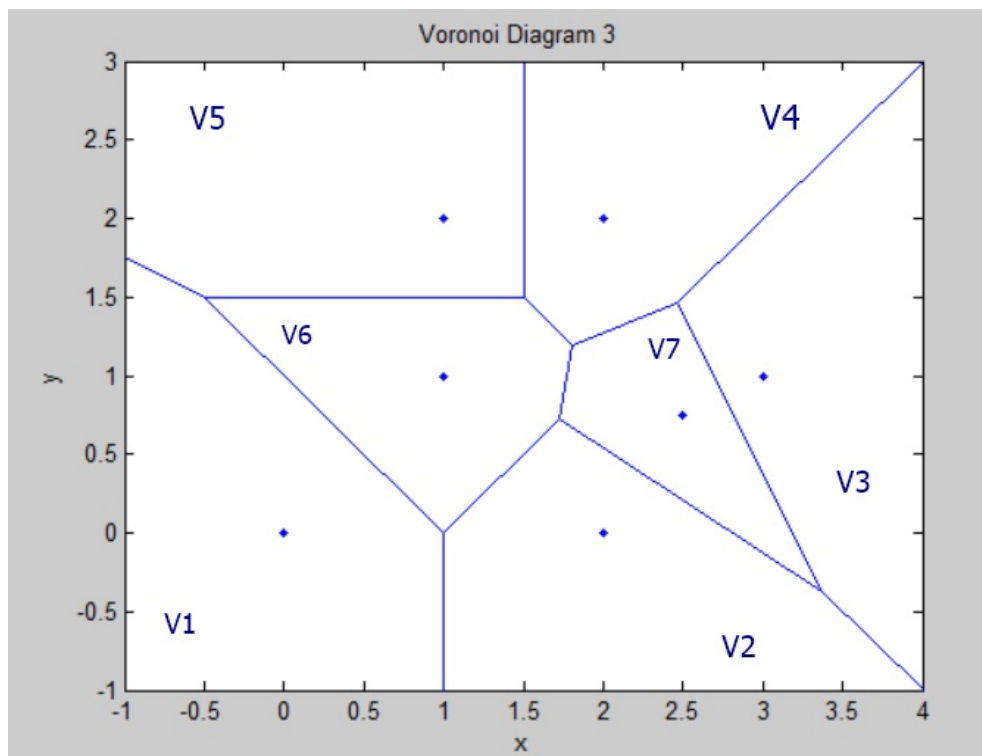
```
clear all
x=[0 2 3 2 1 1 2.5];
y=[0 0 1 2 2 1 0.75];

voronoi(x,y)
xlim([-1 4]); ylim([-1 3]);
xlabel('x'); ylabel('y');
title('Voronoi Diagram 3 ');
X=[x(:) y(:)];
[V C]=voronoin(X);
N=length(V)-1;
i=2;j=4;
u=C{i}
v=C{j}
r=0;
```

```
for k=1:length(u)
    for l=1:length(v)
        if u(k)==v(l)
            r=r+1
        end
    end
end
end
if r==2 disp ('neighbours')
else disp(' are not ')
end
```

MATLAB answer:

```
u =
     8     2     1     5
v =
     7     3     1     6
r =
     1
are not neighbours
```



4. Find all neighbours of a given cell.
Example: for V_4 - diagram from ex. 3

```
clear all
x=[0 2 3 2 1 1 2.5];
y=[0 0 1 2 2 1 0.75];
axis equal
voronoi(x,y)
xlim([-1 4]); ylim([-1 3]);
X=[x(:) y(:)];
[V,C]=voronoin(X);
N=length(V)-1;
i=4;
for j=1:N
    r=0;
    u=C{i};
    v=C{j};
    for k=1:length(u)
        for l=1:length(v)
            if u(k)==v(l)
                r=r+1;
            end
        end
    end
    if r==2 disp(j)
end
end
```

MATLAB answer:

```
3
5
6
7
```