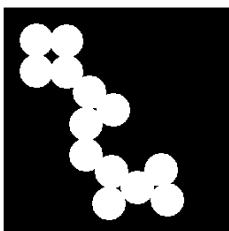


Lab 3 Report

Name: Grant Beatty SID: 862037946

EE146 Section (022)

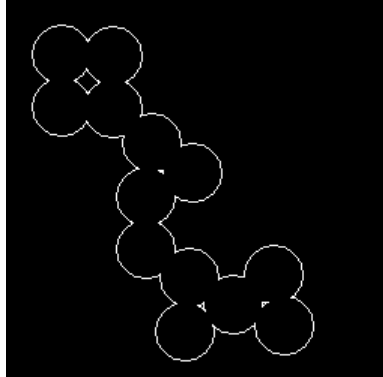
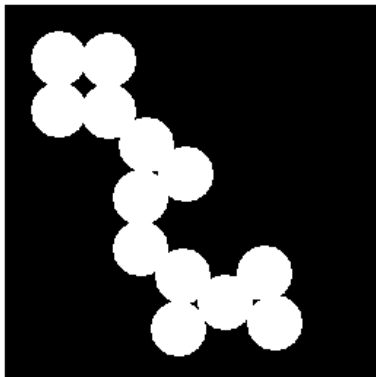
1)



	Dilate	Erode	Close	Open
$H1 = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix};$				
$H2 = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix};$				
$H3 = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 1 & 1 \\ 0 & 1 & 0 \end{bmatrix};$				
$H4 = \begin{bmatrix} 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 \end{bmatrix};$				

2)

<p>Im1</p> <p>I = 8x8</p> <pre> 0 0 1 0 0 1 1 1 0 1 0 0 1 1 1 1 1 0 0 0 0 0 1 1 1 0 0 1 1 1 1 1 1 0 0 1 1 1 </pre> <p>first run</p> <p>I = 8x8</p> <pre> 0 0 2 0 0 3 3 3 0 2 0 0 2 2 2 2 2 0 0 0 0 0 2 2 2 0 0 4 4 4 2 2 2 0 0 4 4 4 </pre> <p>second run</p> <p>I = 8x8</p> <pre> 0 0 2 0 0 2 2 2 0 2 0 0 2 2 2 2 2 0 0 0 0 0 2 2 2 0 0 4 4 4 2 2 2 0 0 4 4 4 </pre>	<p>Im2</p> <p>I = 8x8</p> <pre> 1 1 0 1 1 1 0 1 1 1 0 1 0 1 0 1 1 1 1 1 0 0 0 1 0 0 0 0 0 0 0 1 1 1 1 1 0 1 0 1 0 0 0 1 0 1 0 1 1 1 0 1 0 0 0 1 1 1 0 1 0 0 0 1 1 1 0 1 0 1 1 1 </pre> <p>first run</p> <p>I = 8x8</p> <pre> 2 2 0 3 3 3 0 4 2 2 0 3 0 3 0 4 2 2 2 2 0 0 0 4 0 0 0 0 0 0 0 4 5 5 5 5 0 6 0 4 0 0 0 5 0 6 0 4 7 7 0 5 0 0 0 4 7 7 0 5 0 0 0 4 </pre> <p>second run</p> <p>I = 8x8</p> <pre> 2 2 0 2 2 2 0 4 2 2 0 2 0 2 0 4 2 2 2 2 0 0 0 4 0 0 0 0 0 0 0 4 5 5 5 5 0 6 0 4 0 0 0 5 0 6 0 4 7 7 0 5 0 0 0 4 7 7 0 5 0 0 0 4 </pre>
---	---



Area: 14134

Perimeter: 1081.7 or 1027.6

Centroid: (135.0756, 106.6583)

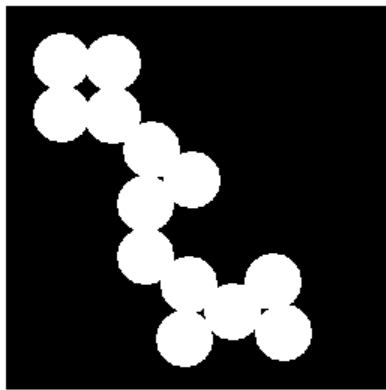
Circularity: 0.1518 or 0.1682

Lab 3 Code

```
clear all;  
close all;
```

Problem 1

```
G=imread('circles.png');  
imshow(G)
```

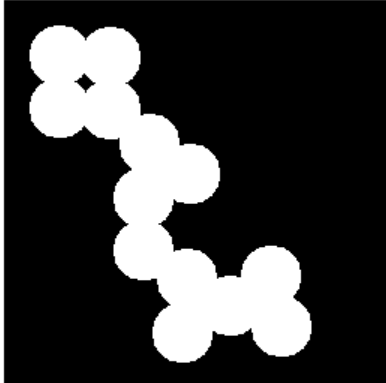


```
H1=[1 1 1  
    1 1 1  
    1 1 1];  
H2=[1 1 1 1 1  
    1 1 1 1 1  
    1 1 1 1 1  
    1 1 1 1 1  
    1 1 1 1 1];  
H3=[0 1 0  
    1 1 1  
    0 1 0];  
H4=[0 0 0 1 0 0 0  
    0 0 1 1 1 0 0  
    0 1 1 1 1 1 0  
    1 1 1 1 1 1 1  
    0 1 1 1 1 1 0  
    0 0 1 1 1 0 0  
    0 0 0 1 0 0 0];
```

```
disp('dilate')
```

dilate

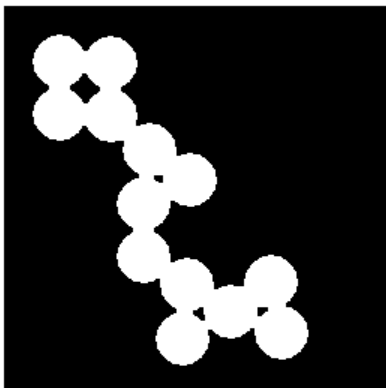
```
g1=imdilate(G,H1);  
imshow(g1)
```



```
disp('erode')
```

erode

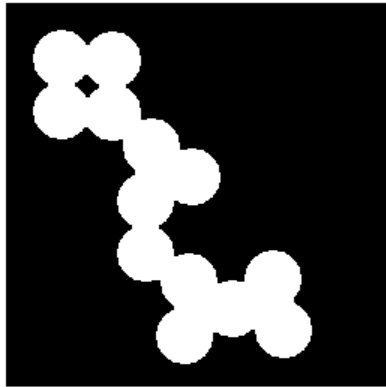
```
g2=imerode(G,H1);  
imshow(g2)
```



```
disp('closing')
```

closing

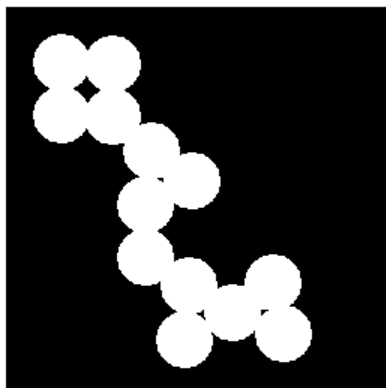
```
g3=imerode(g1,H1);  
imshow(g3)
```



```
disp('opening')
```

opening

```
g4=imdilate(g2,H1);  
imshow(g4)
```



```
disp('dilate')
```

dilate

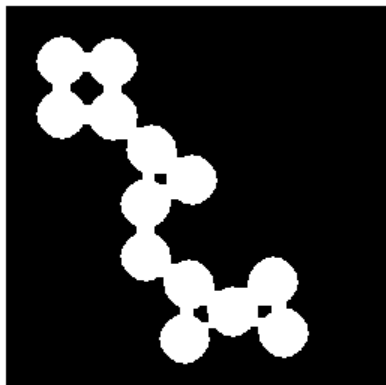
```
g1=imdilate(G,H2);  
imshow(g1)
```



```
disp('erode')
```

erode

```
g2=imerode(g1,H2);  
imshow(g2)
```

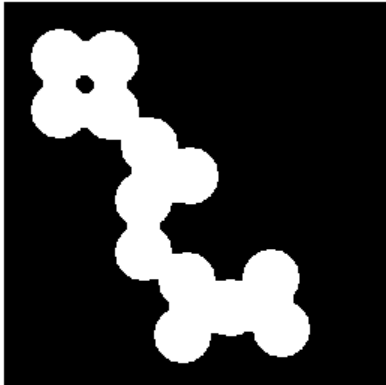


```
disp('closing')
```

closing

```
g3=imerode(g1,H2);
```

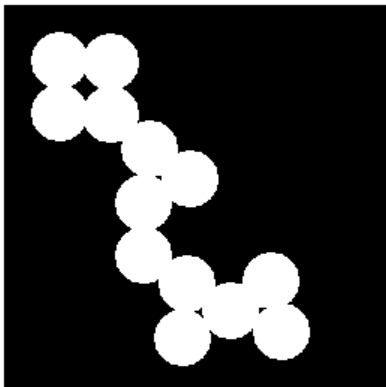
```
imshow(g3)
```



```
disp('opening')
```

opening

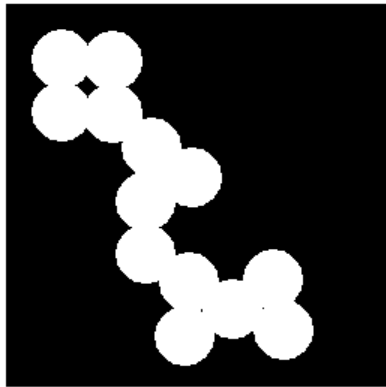
```
g4=imdilate(g2,H2);  
imshow(g4)
```



```
disp('dilate')
```

dilate

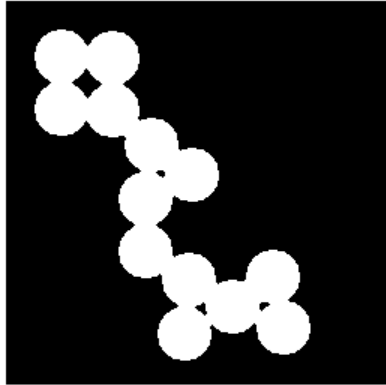
```
g1=imdilate(G,H3);  
imshow(g1)
```

```
disp('erode')
```

erode

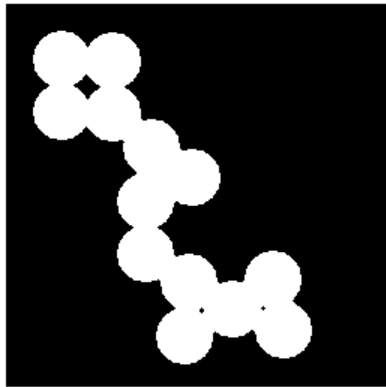
```
g2=imerode(G,H3);  
imshow(g2)
```



```
disp('closing')
```

closing

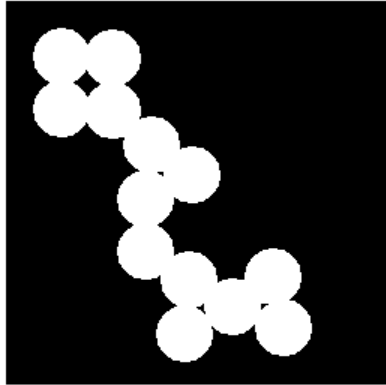
```
g3=imerode(g1,H3);  
imshow(g3)
```



```
disp('opening')
```

opening

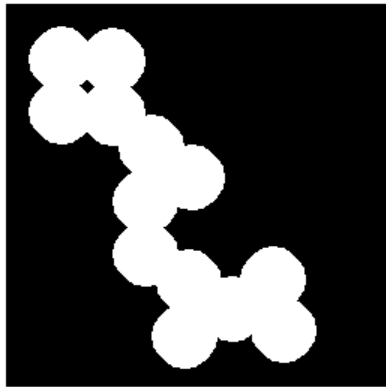
```
g4=imdilate(g2,H3);  
imshow(g4)
```



```
disp('dilate')
```

dilate

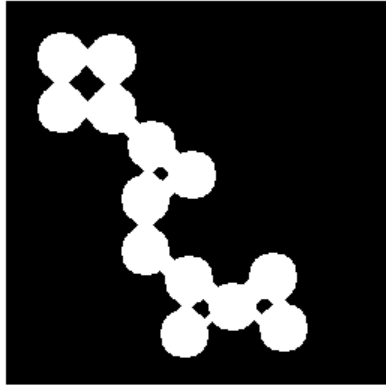
```
g1=imdilate(G,H4);  
imshow(g1)
```



```
disp('erode')
```

erode

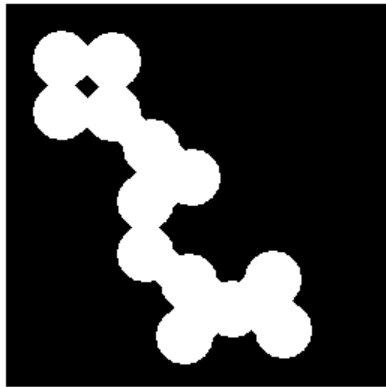
```
g2=imerode(G,H4);  
imshow(g2)
```



```
disp('closing')
```

closing

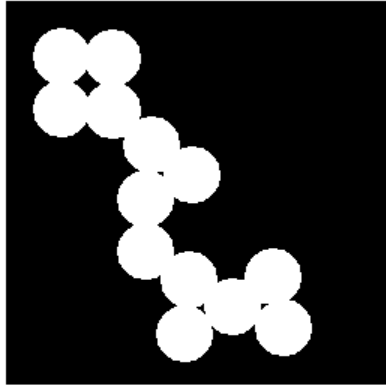
```
g3=imerode(g1,H4);  
imshow(g3)
```



```
disp('opening')
```

opening

```
g4=imdilate(g2,H4);  
imshow(g4)
```



Problem 2

1st part

```
Im1 = [0 0 1 0 0 1 1 1
0 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1
1 1 1 1 0 0 1 1
1 1 1 0 0 0 0 0
1 1 1 0 0 1 1 1
1 1 1 0 0 1 1 1]
```

Im1 = 8×8

0	0	1	0	0	1	1	1
0	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1
1	1	1	1	0	0	1	1
1	1	1	0	0	0	0	0
1	1	1	0	0	1	1	1
1	1	1	0	0	1	1	1

```
Im2 = [1 1 0 1 1 1 0 1
1 1 0 1 0 1 0 1
1 1 1 1 0 0 0 1
0 0 0 0 0 0 0 1
1 1 1 1 0 1 0 1
0 0 0 1 0 1 0 1
1 1 0 1 0 0 0 1
1 1 0 1 0 1 1 1]
```

Im2 = 8×8

1	1	0	1	1	1	0	1
1	1	0	1	0	1	0	1
1	1	1	1	0	0	0	1
0	0	0	0	0	0	0	1
1	1	1	1	0	1	0	1
0	0	0	1	0	1	0	1
1	1	0	1	0	0	0	1
1	1	0	1	0	1	1	1

```
Im3 = imread('coins.png');
Im3 = imbinarize(Im3);
Im3=double(Im3);
mcell={Im1 Im2 Im3};
for cnut=1:3
objnum=2;
words=sprintf('Im%d',cnut);
disp(words)
```

```

I=mcell{cnut}
for x=1:height(I)
for y=1:width(I)
Nx=I(x,y);
if((x>1)&&(y<width(I)))
N1=I((x-1),(y+1));
else
N1=-1;
end
if(x>1)
N2=I((x-1),y);
else
N2=-1;
end
if(x>1&&y>1)
N3=I((x-1),(y-1));
else
N3=-1;
end
if(y>1)
N4=I(x,(y-1));
else
N4=-1;
end

arraymin=[N1 N2 N3 N4];
arraymin=arraymin(arraymin>0);
minimum=min(arraymin);
if((N1>1) || (N2>1) || (N3>1) || (N4>1))
if(N1==1)
I((x-1),(y+1))=minimum;
end
if(N2==1)
I((x-1),y)=minimum;
end
if(N3==1)
I((x-1),(y-1))=minimum;
end
if(N4==1)
I(x,(y-1))=minimum;
end
if(Nx==1)
I(x,y)=minimum;
end
end
if((Nx==1)&&(N1<=1)&&(N2<=1)&&(N3<=1)&&(N4<=1))

```

```

I(x,y)=objnum;
if(N1==1)
I((x-1),(y+1))=objnum;
end
if(N2==1)
I((x-1),y)=objnum;
end
if(N3==1)
I((x-1),(y-1))=objnum;
end
if(N4==1)
I(x,(y-1))=objnum;
end
objnum=objnum+1;
end

end
end
disp('first run')
I %im1 first pass

```

```

%-----

```

```

for x=1:height(I)
for y=1:width(I)
Nx=I(x,y);
if(y<width(I))
N0=I(x,(y+1));
else
N0=0;
end
if(x>1&&y<width(I))
N1=I((x-1),(y+1));
else
N1=0;
end
if(x>1)
N2=I((x-1),y);
else
N2=0;
end
if(x>1&&y>1)
N3=I((x-1),(y-1));
else
N3=0;
end

```

```

end
if(y>1)
N4=I(x,(y-1));
else
N4=0;
end
if(x<height(I)&&y>1)
N5=I((x+1),(y-1));
else
N5=0;
end
if(x<height(I))
N6=I((x+1),y);
else
N6=0;
end
if(x<height(I)&&y<width(I))
N7=I((x+1),(y+1));
else
N7=0;
end

d0=Nx-N0;
d1=Nx-N1;
d2=Nx-N2;
d3=Nx-N3;
d4=Nx-N4;
d5=Nx-N5;
d6=Nx-N6;
d7=Nx-N7;

if(Nx>0)
if((N0>0)&&(d0~=0))
I(I==Nx)=min([N0 Nx]);
I(I==N0)=min([N0 Nx]);
end
if((N1>0)&&(d1~=0))
I(I==Nx)=min([N1 Nx]);
I(I==N1)=min([N1 Nx]);
end
if((N2>0)&&(d2~=0))
I(I==Nx)=min([N2 Nx]);
I(I==N2)=min([N2 Nx]);
end
if((N3>0)&&(d3~=0))
I(I==Nx)=min([N3 Nx]);

```



```

        I(I==N3)=min([N3 Nx]);
    end
    if((N4>0)&&(d4~=0))
        I(I==Nx)=min([N4 Nx]);
        I(I==N4)=min([N4 Nx]);
    end
    if((N5>0)&&(d5~=0))
        I(I==Nx)=min([N5 Nx]);
        I(I==N5)=min([N5 Nx]);
    end
    if((N6>0)&&(d6~=0))
        I(I==Nx)=min([N6 Nx]);
        I(I==N6)=min([N6 Nx]);
    end
    if((N7>0)&&(d7~=0))
        I(I==Nx)=min([N7 Nx]);
        I(I==N7)=min([N7 Nx]);
    end

end
end
end
disp('second run')
I %second run pass
end

```

Im1

I = 8×8

0	0	1	0	0	1	1	1
0	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1
1	1	1	1	0	0	1	1
1	1	1	0	0	0	0	0
1	1	1	0	0	1	1	1
1	1	1	0	0	1	1	1

first run

I = 8×8

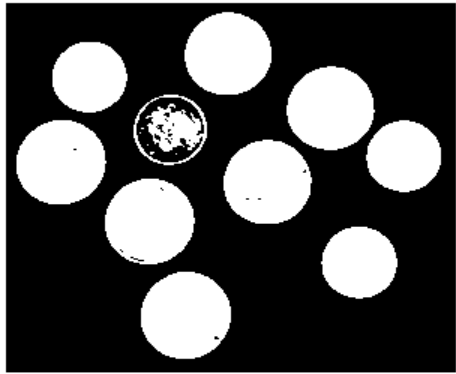
0	0	2	0	0	3	3	3
0	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2
2	2	2	2	0	0	2	2
2	2	2	0	0	0	0	0
2	2	2	0	0	4	4	4
2	2	2	0	0	4	4	4

second run

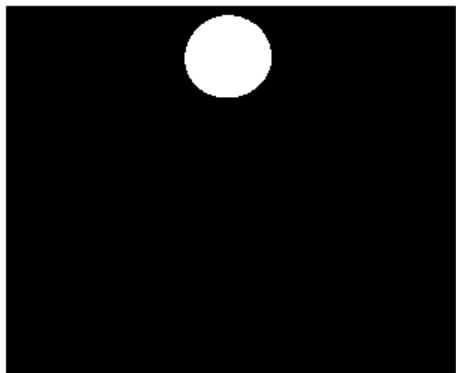
I = 8×8

0	0	2	0	0	2	2	2
0	2	2	2	2	2	2	2

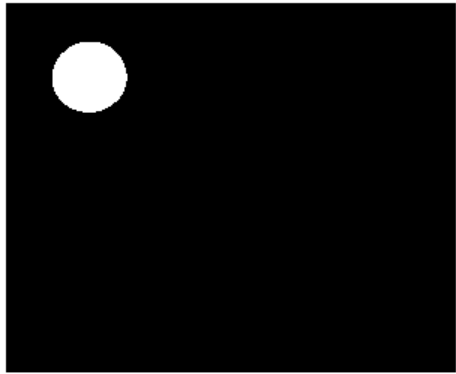
[illegible]



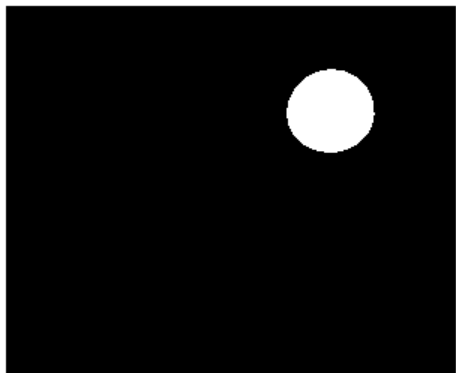
```
pic2=I;  
pic2(pic2~=2)=0;  
pic2(pic2==2)=1;  
imshow(pic2);
```



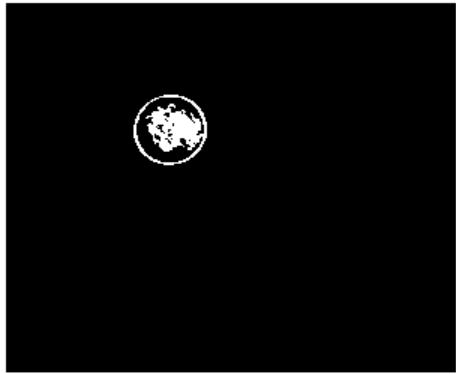
```
pic2=I;  
pic2(pic2~=8)=0;  
pic2(pic2==8)=1;  
imshow(pic2);
```



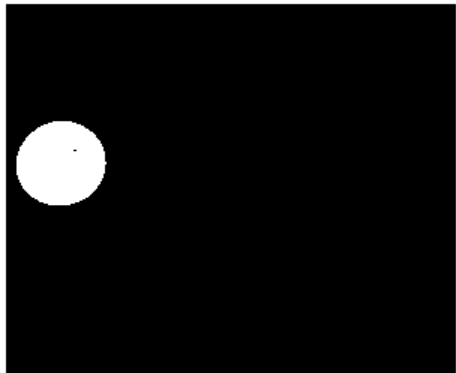
```
pic2=I;  
pic2(pic2~=13)=0;  
pic2(pic2==13)=1;  
imshow(pic2);
```



```
pic2=I;  
pic2(pic2~=19)=0;  
pic2(pic2==19)=1;  
imshow(pic2);
```



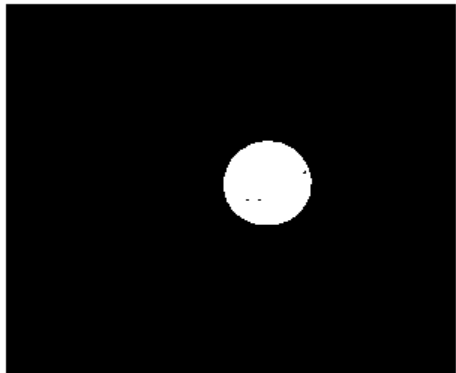
```
pic2=I;  
pic2(pic2~=31)=0;  
pic2(pic2==31)=1;  
imshow(pic2);
```



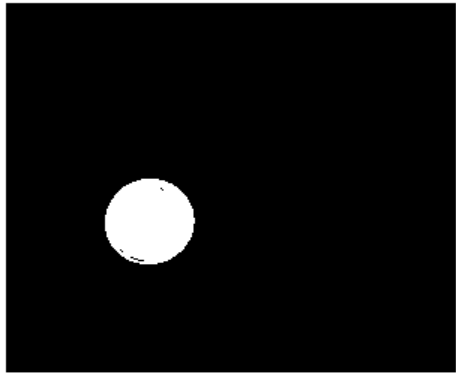
```
pic2=I;  
pic2(pic2~=32)=0;  
pic2(pic2==32)=1;  
imshow(pic2);
```



```
pic2=I;  
pic2(pic2~=46)=0;  
pic2(pic2==46)=1;  
imshow(pic2);
```



```
pic2=I;  
pic2(pic2~=59)=0;  
pic2(pic2==59)=1;  
imshow(pic2);
```



```
pic2=I;  
pic2(pic2~=65)=0;  
pic2(pic2==65)=1;  
imshow(pic2);
```



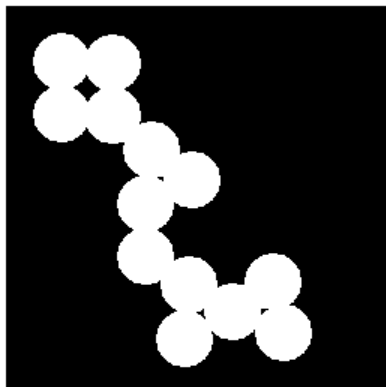
```
pic2=I;  
pic2(pic2~=70)=0;  
pic2(pic2==70)=1;  
imshow(pic2);
```




2nd part

Area

```
I=imread('circles.png');  
imshow(I);
```



```
Area=nnz(I)
```

```
Area = 14134
```

Centroid

```
c=1;
```

```

for x=1:height(I)
for y=1:width(I)
if(I(x,y)==1)
    xcord(c)=x;
    ycord(c)=y;
    c=c+1;
end
end
end
ravg=mean(xcord)

```

```

ravg = 135.0756

```

```

cavg=mean(ycord)

```

```

cavg = 106.6583

```

```

%Centroid:(135.0756,106.6583)

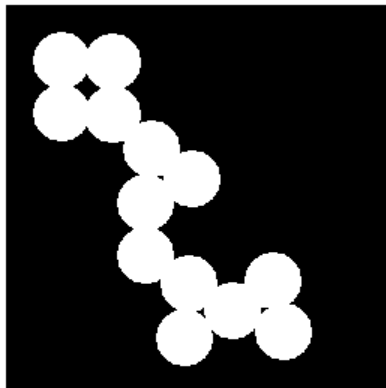
```

Perimeter

```

I=imread('circles.png');
imshow(I)

```



```

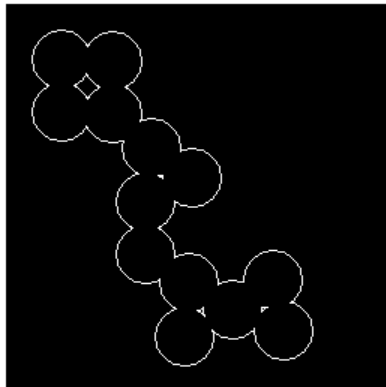
peri=I*0;
c=1;
for x=1:height(I)
for y=1:width(I)

```

```

if(I(x,y)==1)
    xcord(c)=x;
    ycord(c)=y;
    c=c+1;
end
if((x>1)&&(y>1)&&(x<height(I))&&(y<height(I)))
peri(x,y)=createline(I,x,y);
end
end
end
peri(peri<2)=0;
peri(peri ~=0)=1;
imshow(peri)

```



```

number_of_pixels=nnz(peri)

```

```

number_of_pixels = 929

```

```

perimeter=0;
for k=1:20
for x=1:height(peri)
for y=1:width(peri)
if(peri(x,y)==1)
var1=x;
var2=y;
end
end
end
x=var1;
y=var2;

```

```

while(peri(x,y))

if(peri((x-1),(y+1)))
    peri(x,y)=0;
    x=x-1;
    y=y+1;
    perimeter=perimeter+2^0.5;
elseif(peri(x,(y+1)))
    peri(x,y)=0;
    y=y+1;
    perimeter=perimeter+1;
elseif(peri((x+1),(y+1)))
    peri(x,y)=0;
    x=x+1;
    y=y+1;
    perimeter=perimeter+2^0.5;
elseif(peri((x+1),y))
    peri(x,y)=0;
    x=x+1;
    perimeter=perimeter+1;
elseif(peri((x+1),(y-1)))
    peri(x,y)=0;
    x=x+1;
    y=y-1;
    perimeter=perimeter+2^0.5;
elseif(peri(x,(y-1)))
    peri(x,y)=0;
    y=y-1;
    perimeter=perimeter+1;
elseif(peri((x-1),(y-1)))
    peri(x,y)=0;
    x=x-1;
    y=y-1;
    perimeter=perimeter+2^0.5;
elseif(peri((x-1),y))
    peri(x,y)=0;
    x=x-1;
    perimeter=perimeter+1;
else
    peri(x,y)=0;
end
end

```

```
end  
imshow(peri)
```



```
perimeter
```

```
perimeter = 1.0817e+03
```

```
corrected_perimeter=0.95*perimeter
```

```
corrected_perimeter = 1.0276e+03
```

Circularity

```
circularity=4*pi*(Area/(perimeter^2))
```

```
circularity = 0.1518
```

```
corrected_circularity=4*pi*(Area/(corrected_perimeter^2))
```

```
corrected_circularity = 0.1682
```

```
function line = createline(image,x,y)
```

```
Nx=-8*image(x,y);
```

```
N0=image(x,(y+1));
```

```
N1=image((x-1),(y+1));
```

```
N2=image((x-1),y);
```

```
N3=image((x-1),(y-1));
```

```
N4=image(x,(y-1));
```

```
N5=image((x+1),(y-1));
```

```
N6=image((x+1),y);
```

```
N7=image((x+1),(y+1));
```

```
line=Nx+N0+N1+N2+N3+N4+N5+N6+N7;
```

end