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ROLL NO:12

T.Y.B.Sc Computer Science

PRACTICAL

Digital Image Processing

CERTIFICATE

Jan Seva Sangh's

Shri Ram College Of Commerce

(Affiliated to the University Of Mumbai)

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This is to certify that the work entered in this journal is the work of

Mr./Miss Akash Lalit Mishra

Who has worked for the practical examination of Digital Image Processing

Year B.S.C (CS) semester 6th of the year 2022-2023 in the college.

Internal |Signature **External Signature**

Date:

College Stamp **Principal**

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Practical – 1

Aim: 2D Linear Convolution, Circular Convolution between two 2D matrices.

(A) 2D Linear Convolution

Code:

```
clc; x =[1 ,2 ,3;4 ,5 ,6;7 ,8 ,9]; h = [1 ,1;1 ,1;1 ,1]; y = conv2(x,h); disp(y,'Linear 2D convolution y=');
```

Output:

Linear 2D convolution y=

1. 3. 5. 3.

5. 12. 16. 9.

12. 27. 33. 18.

11. 24. 28. 15.

7. 15. 17. 9.

(B) Circular Convolution

Code:

```
clc ;

x = input("Enter the values of x(n)"); h =
input("Enter the values of h(n)");

X = fft2(x);

H = fft2(h); Y = X.*H;  y = ifft(Y); disp (y,
'Circular Convolution Result y = ');
```

Output:

Enter the values of x(n)[1,2;3,4]
Enter the values of h(n)[5,6;7,8]
Circular Convolution Result y =
70. 68.
62.60.

Practical – 2

Aim: Circular Convolution expressed as linear convolution plus alias.

Code:

```
clc ; x = [1 ,2;3 ,4]; h = [5 ,6;7 ,8]; y = conv2 (x,h); y1 = [y(:,1)+y(:,$),y(:,2)]; y2 =
[y1(1,:)+y1($,:);y1(2,:)]; disp(y,'Linear Convolution Result y ='); disp(y2,'Circular
Convolution Expressed as Linear Convolution plus alias = ');
```

Output:

Linear Convolution Result y =

5. 16. 12.

22. 60. 40.

21. 52. 32.

Circular Convolution Expressed as Linear Convolution plus alias =

70. 68.

62. 60.

Practical – 3

Aim: Linear Cross correlation of a 2D matrix, Circular correlation between two signals and Linear auto correlation of a 2D matrix. (A) Linear Cross Correlation of a 2D matrix

Code:

```
clc ; x = [3 ,1;2 ,4]; h1 = [1 ,5;2 ,3]; h2 = h1 (:,$ : -
1:1); h = h2($: -1:1 ,:); y = conv2 (x,h); disp(y,
"Linear Cross Correlation Result y = ");
```

Output:

Linear Cross Correlation Result y =

9. 9. 2.

21. 24. 9.

10. 22. 4.

(B) Circular Correlation between two signals

Code:

```
clc ; x = [1 ,5;2
,4]; h = [3 ,2;4 ,1];
h = h(:,$ : -1:1) ; h
= h($: -1:1 ,:); X =
fft2 (x);

H = fft2 (h); Y =
X.*H;

y = ifft (Y); disp(y, "Circular Correlation Result
y = ");
```

Output:

Circular Correlation Result y =

37. 23.
35. 25.

(C) Linear auto Correlation of a 2D matrix

Code:

```
clc ; x1 = [1 ,1;1 ,1]; x2 = x1 (:,$ : -1:1); x2 = x2($: -
1:1 ,:); x = conv2 (x1 ,x2); disp(x, "Linear auto
Correlation Result x = ");
```

Output:

Linear auto Correlation Result x =

1. 2. 1. 2. 4.
2.

1. 2. 1.

Practical – 4

Aim: DFT of 4x4 gray scale image.

Code:

```
clc ;

f = [1 ,1 ,1 ,1;1 ,1 ,1 ,1;1 ,1 ,1 ,1;1 ,1 ,1 ,1]; t =
fft2(f); disp(t, "2D DFT of given 2D image = ");
```

Output:

2D DFT of given 2D image =

16. 0. 0. 0.

0. 0. 0. 0.

0. 0. 0. 0.

0. 0. 0. 0.

Practical – 5

Aim: Compute discrete cosine transform, Program to perform KL transform for the given 2D matrix

(A) Discrete Cosine transform of an image Code:

```
//OS: Windows 7
//Scilab Version: Scilab 5.4.1 //one
dimensional cosine transform clc; clear
all;
//f=[1 2 4 7];        //Input: A row matrix
//Input ex. f=[1 2 4 7]
N=4;//finding length ofinput sequence
F=zeros(1,N);//cosine transform of input
//C=zeros(N,N); for
k=1:N    for n=1:N
if (k-1)==0
        C(k,n)=inv(sqrt(N));      //cosine transform matrix        else
        C(k,n)=sqrt(2)*inv(sqrt(N))*cos(%pi*(2*(n-1)+1)*(k-1)/(2*N));          end
disp(C(k,n));    end
end
```

Output:

```
  0.5    0.5
  0.5
  0.5
  0.6532815
  0.2705981
  -0.2705981
  -0.6532815
   0.5
```

-0.5

-0.5

0.5

0.2705981

-0.6532815

0.6532815

-0.2705981

(B) KL transform for the given 2D matrix Code:

```
clear ; clc ;

X = [4 ,3 ,5 ,6;4 ,2 ,7 ,7;5 ,5 ,6 ,7];

//X=[4 -2; -1 3];

[m , n ]= size (X) ;

A = [0]; E =

[0];

for i =1: n

   A= A + X (: , i ) ;    E= E + X (: , i )

* X (: , i)'; end

mx = A / n ; //mean ma t ri x

E = E / n;

C = E - mx * mx '; // c o v a r i a n c e ma t ri x C = E[ xx ’] −mx∗mx’ [V , D ] =

spec ( C ) ; // e i g e n v a l u e s and e i g e n v e c t o r s d = diag ( D ) ; // d i a g

o n a l e l e m e n t s od e i g e n v a l u e s disp(d)

[d , i ] = gsort ( d ) ; // s o r t i n g t h e e l e m e n t s of D i n d e s c e n d i n g o r d e r    for j = 1:

length (d )

      T (: , j )= V (: , i ( j ) ) ;      end

T = T'
```

```
disp (d , ' Eig e n Val u e s a r e U = ' ) disp (T , ' The e i g
e n v e c t o r ma t ri x T = ' ) disp (T , ' The KL t r a nf o
rm b a s i s i s = ' )

//KL t r a n sf o r m for i =
1: n
   Y (: , i )= T * X (: , i ) ; end

disp (Y , 'KL t r a n s f o r m a t i o n of t h e i n p u t ma t ri x Y = ' )
// R e c o n s t r u c t i o n for i = 1:
n
   x (: , i )= T'* Y (: , i ) ;
end
disp (x , ' R e c o n s t r u c t ma t ri x of t h e g i v e n sam pl e ma t ri x X = ' )
```

Output:

```
0.0264211
 0.2147417
6.1963372

 Eig e n Val u e s a r e U =

  6.1963372
  0.2147417
  0.0264211

 The e i g e n v e c t o r ma t ri x T =

  0.4384533   0.8471005   0.3002988
  0.4460381  -0.4951684   0.7455591
  -0.780262    0.1929481   0.5949473

 The KL t r a nf o rm b a s i s i s =

  0.4384533   0.8471005   0.3002988
  0.4460381  -0.4951684   0.7455591
```

-0.780262 0.1929481 0.5949473

KL transformation of the input matrix Y =

6.6437095 4.5110551 9.9237632 10.662515 3.5312743
4.0755729 3.2373664 4.4289635

0.6254808 1.0198466 1.0190104 0.8336957

Reconstruct matrix of the given sample matrix X =

4. 3. 5. 6. 4. 2. 7. 7.
5. 5. 6. 7.

Practical – 6

Aim: Brightness enhancement of an image, Contrast Manipulation, image negative.

(A) Brightness enhancement of an image

Code:

```
clc;

a = imread ("C:\Users\sushil\Downloads\children_bag.jpg"); b =
double (a) +50; b = uint8 (b); figure (1) imshow (uint8(a)); title ( '
Original Image ' ) figure (2) imshow (uint8(b)); title ( ' Enhanced
Image ' )
```

Output:

(B) Contrast Manipulation

Code:

```
clc ; close ;

a = imread ("C:\Users\sushil\Downloads\children_bag.jpg"); a =
rgb2gray (a); b = double (a) *0.5; b = uint8 (b); c = double (b) *2.5; c
= uint8 (c); figure (1) imshow(uint8(a));

title ( 'Original Image' );
figure (2) imshow(b);

title ( 'Decrease in Contrast' ); figure (3)

imshow(c);

title ( 'Increase in Contrast' );
```

Output:



(C) Image Negative

Code:

```
clc ; close ;

a = imread ("C:\Users\sushil\Downloads\children_bag.jpg");

k = 255 - double (a); k = uint8 (k);
figure(1); imshow (uint8(a)); title (
'Original Image' ); figure(2); imshow (k);
title ( 'Negative of Original Image' );
```

Output:


Practical – 7

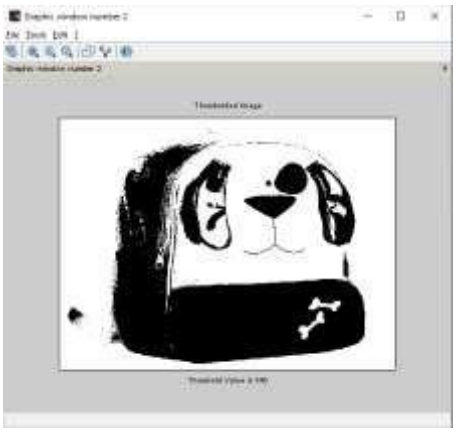
Aim: Perform threshold operation, perform gray level slicing without background.

(A) Perform threshold operation

Code:

```
clc ;

a = imread ("C:\Users\sushil\Downloads\children_bag.jpg"); a =
rgb2gray (a); [m n] = size (a);

t = input("Enter the threshold parameter "); for i
= 1:m     for j = 1:n        if(a(i,j)<t)          b(i,j)=0;
else          b(i,j) =255;       end

   end end figure (1) imshow(uint8(a)); title ( '
Original Image ' ) figure (2) imshow(uint8(b)); title
( ' Thresholded Image ' ) xlabel ( sprintf (
'Threshold Value is %g ' ,t))
```

Output:



(B) Perform gray level slicing without background

Code:

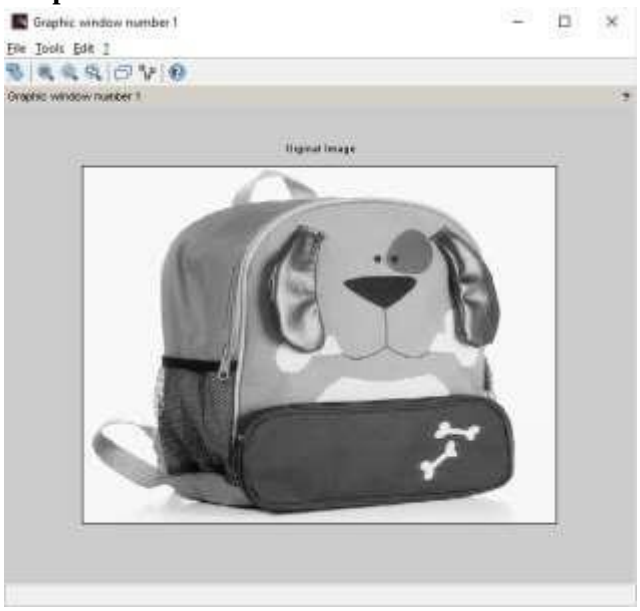
```
clc ;

x = imread ("C:\Users\sushil\Downloads\children_bag.jpg"); x =
rgb2gray(x); y = double(x);  [m n] = size(y); L = max(x); a =
round(L/2); b = L; for i =1: m     for j =1: n        if(y(i,j) >=a & y(i,j)
<=b)

         z(i,j) = L;
else          z(i,j)=0;
end

   end end z =
uint8 (z);
```

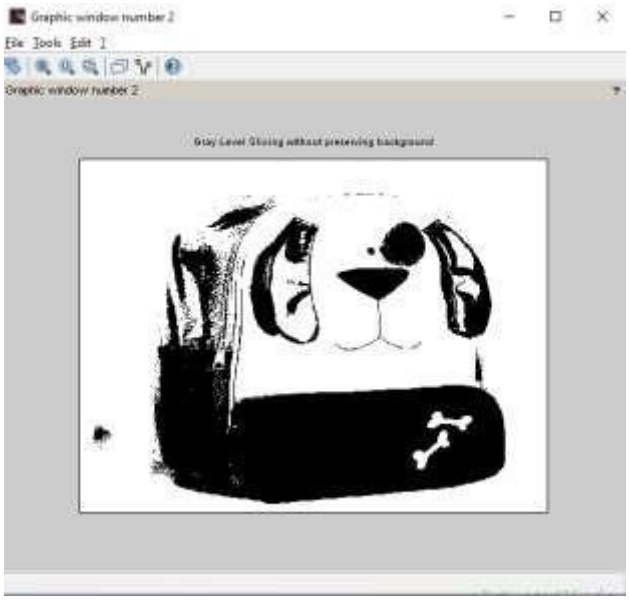
figure (1)

imshow(x)

title (' Orginal Image ') figure (2) imshow(z); title ('Gray Level Slicing without preserving background ')

Output:





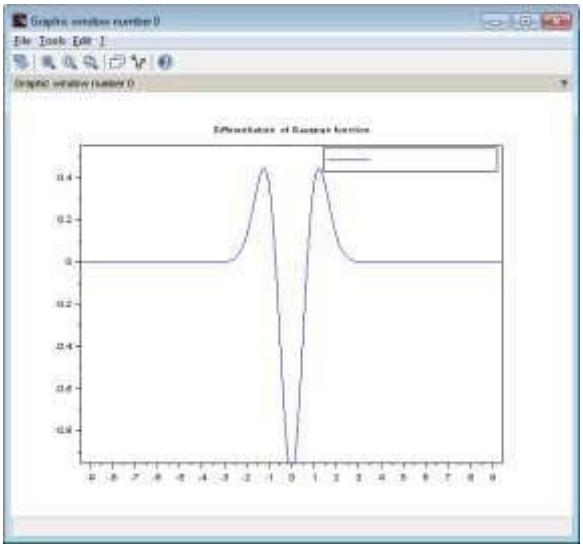
Practical – 8

Aim: Image Segmentation. Differentiation of Gaussian function

Code:

```
sigma=input(' Enter the value of sigma : ') i= -
10:.1:10; j= -10:.1:10; r=sqrt(i.*i+j.*j);

y=(1/( sigma ^2))*(((r.*r)/sigma ^2) -1).*exp(-r.*r/2*sigma ^2); plot(i,y)

legend(sprintf(' The sigma value is %g ',sigma)) xtitle('
Differentiation of Gaussian function ')
```

Output:

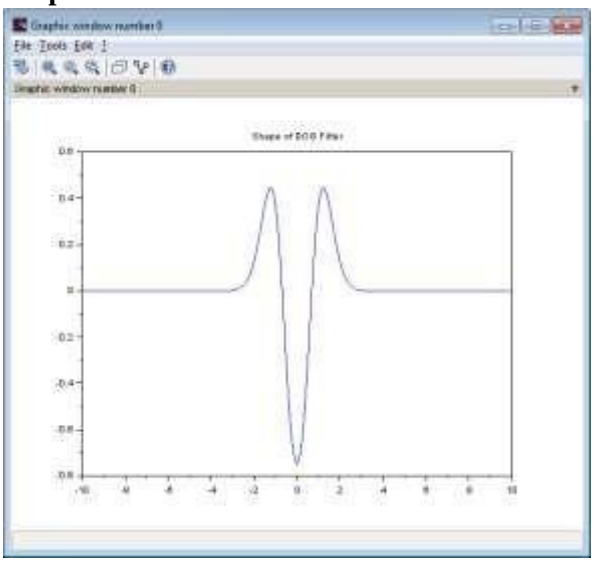


Shape of DOG Filter Code:

```
sigma1 =input(' Enter the value of sigma1 : ') sigma2
=input(' Enter the value of sigma2 : ') i= -10:.1:10;
j= -10:.1:10; r=sqrt(i.*i+j.*j);

y1 = (1/( sigma1 ^2))*(((r.*r)/sigma1 ^2) -1).*exp(-r.*r/2* sigma1 ^2); y2 = (1/(
sigma2 ^2))*(((r.*r)/sigma2 ^2) -1).*exp(-r.*r/2* sigma2 ^2); y = y1 -y2;
plot(i,y)
```

xtitle(' Shape of DOG Filter ')

Output:



Edge Detection

Code:

```
img = imread("D:\\Picture1.png");
img=rgb2gray(img);
c=edge(img,'sobel',0.5)
d=edge(img,'prewitt')
e=edge(img,'canny') f=edge(img,'log')
figure(1) imshow(img)

title('Original Image')
figure(2) imshow(c)

title('Sobel') figure(3)
imshow(d)

title('Prewitt') figure(4)
imshow(e)

title('Canny') figure(5)
imshow(f) title('LOG')
```

Practical – 9

Aim: Image

Compression

Aim: Image

Compression

Arithmetic coding Code:

```
clc; clear all;

n=input("Enter the no. of symbols : "); for i =
1:n

   printf("\nEnter the probability(<=1) of symbol %d: ",i);//Input: Taking the probability of occurence
p(i)=input(""); end

printf("\nThe cdf of symbol 1: %.3f ",p(1));
c(1)=p(1); for i = 2:n      c(i)=p(i)+c(i-1);

   printf("\nThe cdf of symbol %d: ",i);
printf("%.3f",c(i)); end

s=input("Enter the no. of symbols in sequence");/
printf("Enter the sequence "); for j = 1:s

b(j)=input("");//Inserting the sequence end
//Setting the lower and upper limit for 1st stage if b(1)
== 1 then l(1)=0; u(1)=c(b(1));

else l(1)=c(b(1)-1);
u(1)=c(b(1)); end

//Calculating lower and upper limits for 2nd stage and ahead for k =
2:s if b(k) == 1 then l(k)=l(k-1);
u(k)=l(k-1)+((u(k-1)-l(k-1))*c(b(k))); else
```

```
l(k)=l(k-1)+((u(k-1)-l(k-1))*c(b(k)-1));
u(k)=l(k-1)+((u(k-1)-l(k-1))*c(b(k))); end end

tag=(l(s)+u(s))/2;//Generating tag
printf("The tag of the sequence is= %.10f",tag);//Output: The tag of the sequence //Output for ex
tag=0.1375781250
```

Output:

Note: for inputs refer the solved example of DIP book page 457

```
Enter the no. of symbols : 4

Enter the probability(<=1) of symbol 1: --> 0.4

Enter the probability(<=1) of symbol 2: --> 0.2

Enter the probability(<=1) of symbol 3:
--> 0.1

Enter the probability(<=1) of symbol 4: --> 0.3

The cdf of symbol 1: 0.400
The cdf of symbol 2: 0.600
The cdf of symbol 3: 0.700
The cdf of symbol 4: 1.000
Enter the no. of symbols in sequence3
Enter the sequence
--> 4
--> 1
--> 4
```

The tag of the sequence is= 0.8020000000

Run length Coding

Code:

```
clc; clear; close; in=input('Enter squares
matrix::::'); [m,n]=size(in); y=0; tx(1)=0;
o=1 for j=1:m
   for k=1:n
x=in(j,k);        if x==y
tx(o)=tx(o)+1;        else
o=o+1;          tx(o)=1;
end        y=x;     end end
disp('code sucsess');
disp(tx); Output:
```

Enter squares matrix::::[2 2 2;1 1 1;3 3 1]

code sucsess

3.

3.

2.

1.

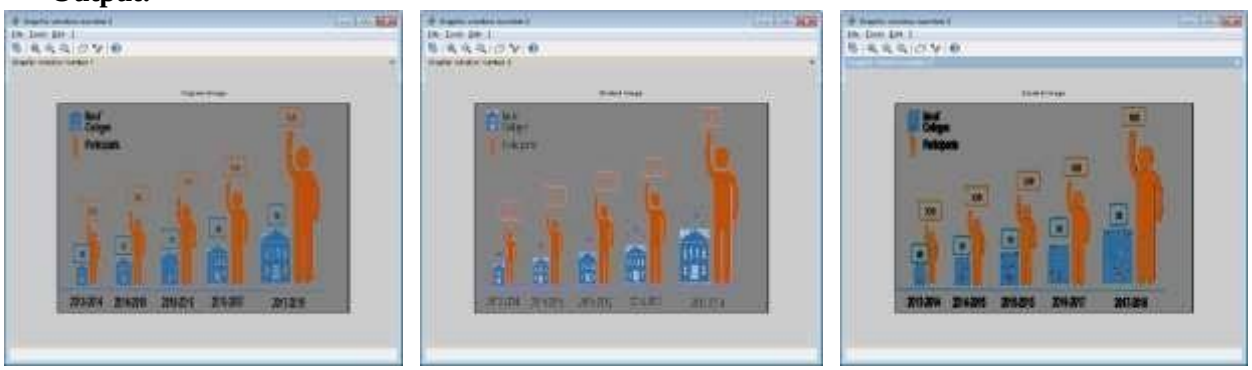
Practical – 10

Aim: Binary Image Processing and Colour Image processing.

(A) Binary Image Processing-Dilation and Erosion Code:

```
a=imread('D:\\Picture1.png');
//se=CreateStructureElement('square',3);
se=imcreatese('cross',3,3); a1=imdilate(a,se);
a2=imerode(a,se); figure(1) imshow(a);

title('Original Image');
figure(2) imshow(a1);

title('Dilated Image');
figure(3) imshow(a2);
title('Eroded Image');
```

Output:

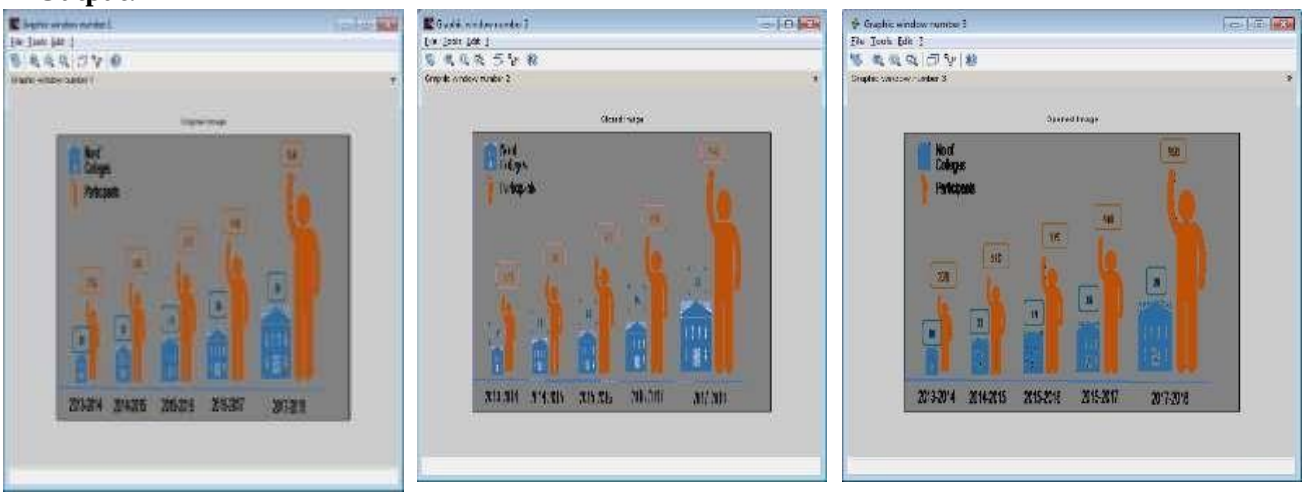


Binary Image Processing-Opening and closing Code:

```
a=imread('D:\\Picture1.png');
//se=CreateStructureElement('square',3); se=imcreatese('rect',3,3);

//Code for Closeing image
a1=imdilate(a,se); a2=imerode(a1,se);

figure(1) imshow(a);
title('Original Image');
figure(2) imshow(a2);
title('Closed Image');

//Code for Opening image
a1=imerode(a,se);
```

```
a2=imdilate(a1,se); figure(3)
imshow(a2); title('Opened
Image');
```

Output:



(B) Colour Image processing Code:

```
img=imread('D:\\Picture1.png'); histB=calcHist(img,0,[],1,32,[0
256]);

scf(); bar(histB(:),'blue');

histG=calcHist(img,1,[],1,32,[0 256]);

scf(); bar(histG(:),'blue');

histR=calcHist(img,2,[],1,32,[0 256]);

scf(); bar(histB(:),'red');
```

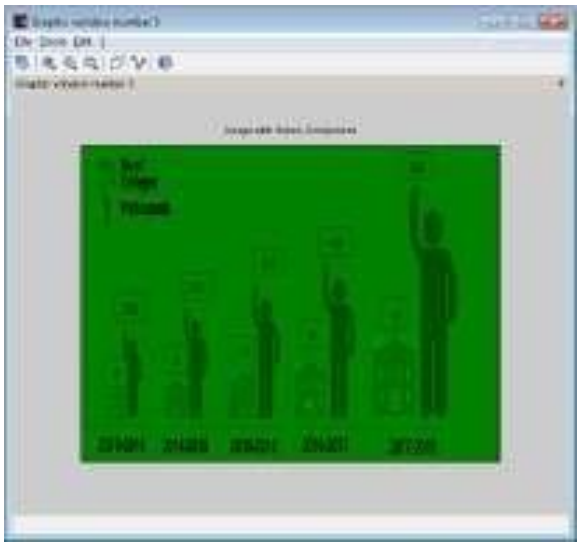
Output:

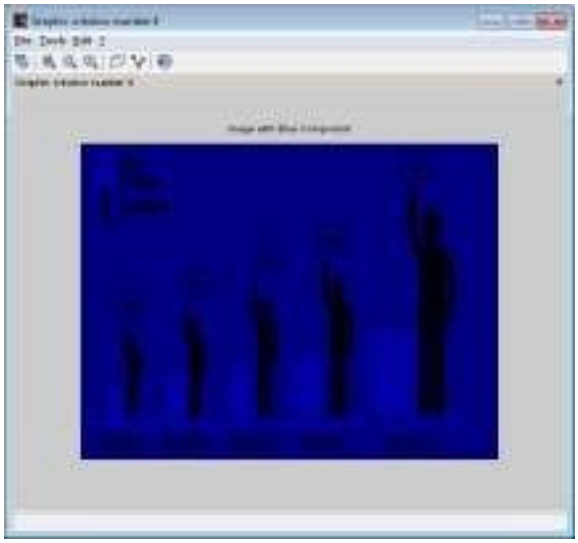
Image with RED Green Blue Component

```
RGB=imread('D:\\Picture1.png');

R=RGB; G=RGB;

B=RGB;

R(:,:,2)=0;

R(:,:,3)=0;

G(:,:,1)=0;

G(:,:,3)=0;
```

```
B(:,:,1)=0; B(:,:,2)=0;
figure(1)

imshow(RGB)

title('Original Image') figure(2)
imshow(R ) title('Image with Red Component')
figure(3)

imshow(G) title('Image with Green Component')

figure(4)

imshow(B) title('Image with Blue Component')
```

Output:

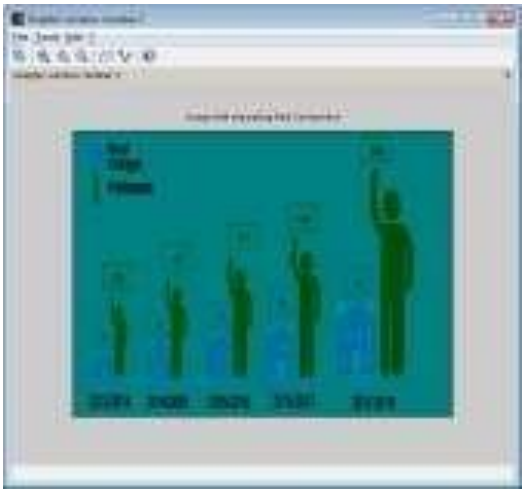


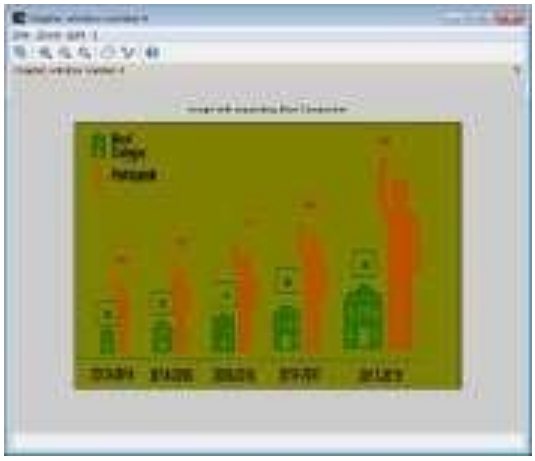


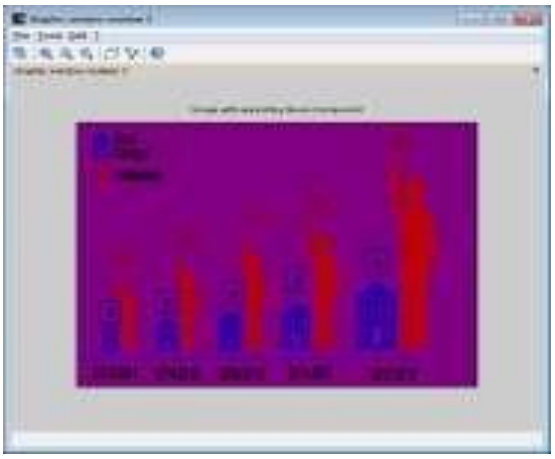
'Histogram equalised Image' Code:

```
a=imread('D:\\Picture1.png');
b=rgb2ntsc(a);
b(:,:,1)=imhistequal(b(:,:,1));
c=ntsc2rgb(b); figure(1)
imshow(a)

title('Original Image')

figure(2) imshow(c) title('Histogram
equalised Image')


RGB=imread('D:\\Picture1.png');
a1=RGB; a2=RGB; a3=RGB;

a1(:,:,1)=0; a2(:,:,2)=0;
a3(:,:,3)=0; figure(1)

imshow(RGB)

title('Original Image')
figure(2) imshow(a1)

title('Image with separating Red Component')

figure(3) imshow(a2)

title('Image with separating Green Component')

figure(4) imshow(a3) title('Image with separating
Blue Component')
```

Output:







Histogram of gray image Code:

```
a=imread('D:\\Picture1.png');
[count1, cells]=imhist(a(:,:));
figure(1);plot(count1)
b=imhistequal(a(:,:)) figure(2)
imshow(b) figure(3) imshow(a)

title('Original Image') [count,
cells]=imhist(b(:,:));
figure(4);plot(count)
```

Output: