LAMPIRAN A
PROGRAM MATLAB

main

```
clear;
ima=imread('cameraman.tif','tif');
ima=double(ima);
pima=mean(mean(ima.^2));

figure(1),clf;
imshow(ima,[0 255]);

n=length(ima);
v=20;
noi=v*randn(n,n);
iman=ima+noi;%%penambahan noise pada citra
snr=10*log10(pima/v^2)

figure(2),clf;
imshow(iman,[0 255]);

sca=3;
th=getth2d(sca-1);th=th(sca-1);

%%%%%%%%%%%%%%%%%%%%%%%%
maskr=(corr>0);
maskc=(corc>0);
corr=corr.*maskr;
corc=corc.*maskc;
%%%%%%%%%%%%%%%%%%%%%%%%%%%%
k=2;
for con=16:2:26
   [Mod,Ang]=compMA(w2r,w2c,corr,corc,th,v,con);%%mendapatkan tepi citra
dengan threshold berberda
   edmap=nmsupress2d(Mod,Ang);
   k=k+1;figure(k);clf
   imshow(edmap);
end
```

getf2d

```
function [fr,fc]=getf2d(sca)

%%%get filter fr=H0*H0'*H1*H1'*....*Grm%%%%%%%%
%%%get filter fc=H0*H0'*H1*H1'*....*Gcm%%%%%%%%

%sca----skala
%fr-----fr(i,:,:) baris skala flter i, i=1,2,...,sca
```

```
%fc-----fc(i,:,:) kolom skala filter i, i=1,2,...,sca

h=zeros(1,256);
h(128)=1;
h=conv2(h,h');

for i=0:sca-1
   tfr=conv2(h,getg(i));
   tfr=tfr(:,128:127+256);
   fr(i+1,:,:)=tfr;
   tfc=conv2(h,getg(i)');
   tfc=tfc(128:127+256,:);
   fc(i+1,:,:)=tfc;
   h=conv2(h,geth(i));
   h=h(:,128:127+256);
   h=conv2(h,geth(i)');
   h=h(128:127+256,:);
end
```

compMA

```
function [Mod,Ang]=compMA(w1r,w1c,corr,corc,t,v,con)

%corr----korelasi antar baris setelah thresholding
%corc----korelasi antar kolom setelah thresholding

Mod=sqrt(corr+corc);
mask=(Mod>0.8*sqrt(v^2*t*con*2));
Mod=Mod.*mask;

signr=sign(w1r)+0.00001;
%signr(:,1)=signr(:,1)+0.00001;

signc=sign(w1c);
c=sqrt(corc).*signc;
r=sqrt(corr+0.00001).*signr;
Ang=c./r;
return;
```

nmsupress2d

```
function edpoint=nmsupress2d(Mod,Ang)

%%non-maxium supression%%%%%%%%
%%Mod--Modulus Matrix
%%Ang— arah edge
```

```
[n,m]=size(Mod);
edpoint=zeros(n,m);

for i=3:n-2
  for j=3:m-2
    if (Mod(i,j)>0)
    %%%%%%%%%%%%%%%%%%
    if (Ang(i,j)>=-0.4142)&(Ang(i,j)<=0.4142)%%%%arah x%%%%
      if (Mod(i,j)>Mod(i,j-1))&(Mod(i,j)>Mod(i,j+1))
        edpoint(i,j)=1;
      end
    elseif abs(Ang(i,j))>=2.4142%%%%arah y%%%%
      if (Mod(i,j)>Mod(i-1,j))&(Mod(i,j)>Mod(i+1,j))
        edpoint(i,j)=1;
      end
    elseif (Ang(i,j)>0.4142)&(Ang(i,j)<2.4142)%%%%arah xy%%
      if (Mod(i,j)>Mod(i-1,j-1))&(Mod(i,j)>Mod(i+1,j+1))
        edpoint(i,j)=1;
        if (edpoint(i,j-1)==1)&(edpoint(i-1,j)==1)
          edpoint(i,j)=0;
        end
      end
    elseif (Ang(i,j)>-2.4142)&(Ang(i,j)<-0.4142)
      if (Mod(i,j)>Mod(i+1,j-1))&(Mod(i,j)>Mod(i-1,j+1))
          edpoint(i,j)=1;
        if (edpoint(i-1,j-1)==1)
          edpoint(i,j-1)=0;
        end
      end
    end
    %%%%%%%%%%%%%%%%%%
    end
  end
end
return
```

getf

```
function f=getf(sca)

%%%mendapatkan filter f=H0*H1*....*Gm%%%%%%%%
%sca----skala
%f------f(i,:) skala filter i, i=1,2,...,sca
```

```
h=zeros(1,256);
h(128)=1;
for i=0:sca-1
   ff=conv(h,getg(i));
   f(i+1,:)=ff(128:127+256);
   h=conv(h,geth(i));
   h=h(128:127+256);
end
```

getg

```
function a=getg(i)
%%%high pass filter%%%%%
a=zeros(1,256);
a(128)=-2.0;
a(128+2^i)=2.0;
return;
```

getsigma2d

```
function [sigma_z1,sigma_z2]=getsigma2d(sca)

%%%%menghitung cov dari z1 dan z2 pada skala i=1,2,...,sca%%%%%

%sca----------skala
%sigma_z1-----vektor skala, terdiri dari cov of z1 pada skala i=1,2,...,sca
%sigma_z2-----panjang vector skala, terdiri dari cov of z2 pada skala i=1,2,...,sca

[fr,fc]=getf2d(sca+1);
nf=normf2d(sca+1);

for i=1:sca
   taor(i)=2^(i-1);
end

taoc=[0 taor];
for i=1:sca
   fr1=reshape(fr(i,:,:),256,256);
   fr2=reshape(fr(i+1,:,:),256,256);
   tfr2=zeros(256,256);
   tfr2(1:256-taoc(i),1:256-taor(i))=fr2(1+taoc(i):256,1+taor(i):256);
   z1=fr1/nf(i)+tfr2/nf(i+1);
   z2=fr1/nf(i)-tfr2/nf(i+1);

   sigma_z1(i)=sum(sum(z1.^2))/4;
   sigma_z2(i)=sum(sum(z2.^2))/4;
```

```
end
```

getsigmaz1

```
function [sigma_z1,sigma_z2]=getsigmaz1(sca)

%%%%menghitung cov of z1 dan z2 pada skala i=1,2,...,sca%%%%%

%sca----------skala
%sigma_z1-----vektor panjang skala, terdiri dari cov dari z1 pada skala i=1,2,...,sca
%sigma_z2-----vektor panjang skala, terdiri dari cov dari z2 pada skala i=1,2,...,sca

f=getf(sca+1);
nf=normf(sca+1);

for i=1:sca
   tao=2^(i-1);
   tf2=zeros(1,256);
   tf2(1:256-tao)=f(i+1,1+tao:256);
   z1=f(i,:)/nf(i)+tf2/nf(i+1);
   z2=f(i,:)/nf(i)-tf2/nf(i+1);

   sigma_z1(i)=norm(z1)^2/4;
   sigma_z2(i)=norm(z2)^2/4;
end
```

getth

```
function tth=getth(sca)

%%%%compute ||F1||||F2||sigma_z1^2%%%%

%sca-----skala
%tth-----output, panjang vektor skala, terdiri dari threshold pada skala i=1,2,...,sca

nf=normf(sca+1);
[sigma_z1,sigma_z2]=getsigmaz1(sca);

for i=1:sca
   tth(i)=(nf(i)*nf(i+1)*sigma_z1(i));
end
return;
```

getth2d

```
function tth=getth2d(sca)
```

```
%%%%compute ||F1||||F2||sigma_z1^2%%%%
%sca-----skala
%tth-----output, panjang vector skala, terdiri dari threshold pada skala i=1,2,...,sca

nf=normf2d(sca+1);
[sigma_z1,sigma_z2]=getsigma2d(sca);

for i=1:sca
   tth(i)=(nf(i)*nf(i+1)*sigma_z1(i));
end

return;
```

normf2d

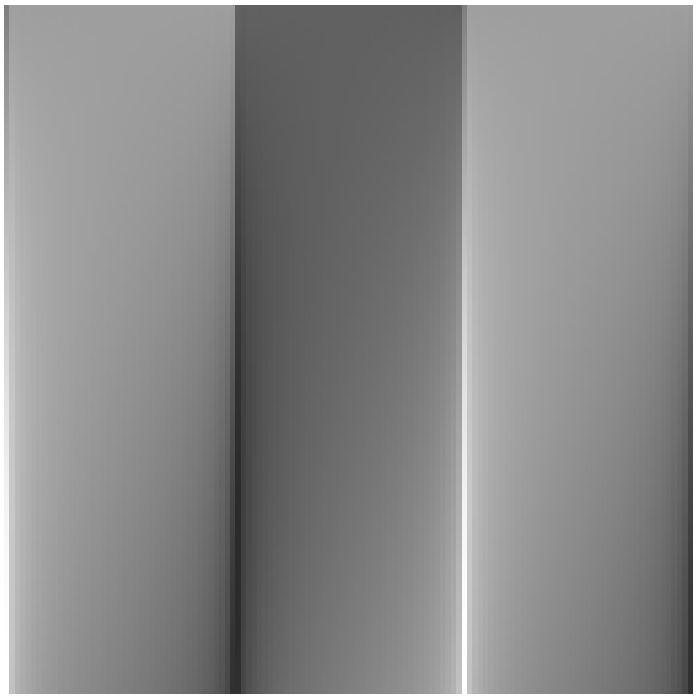
```
function nf=normf2d(sca);

%%%%menghitung ||H0*H0'*H1*H1'...*Grm||%%%%%%%

%sca----skala
%nf-----output arah pada baris dan kolom, vektor panjang skala

th=1;

for i=0:sca-1
  tg=conv(th,getg(i));
  nf(i+1)=norm(tg)*norm(th);
  th=conv(th,geth(i));
end
```

LAMPIRAN B
KUMPULAN CITRA GRAYSCALE

1. **Cameraman.tif**

2. **Barbara.jpg**

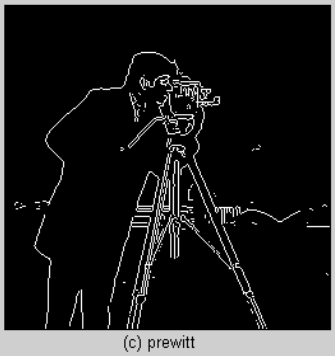
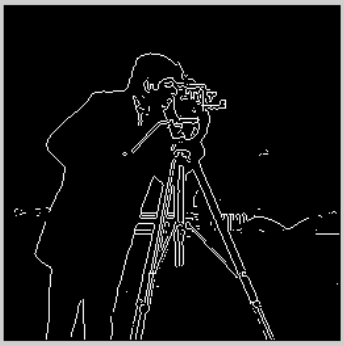
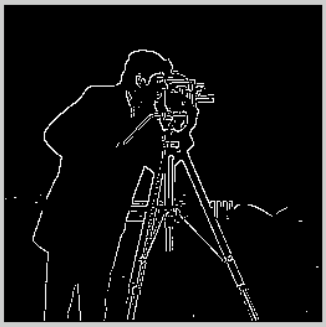
3. **dua.bmp**



LAMPIRAN C
ANGKET

ANGKET

Berikan urutan dari nomor 1 sampai dengan 5 (1 paling baik, 5 paling buruk) untuk gambar hasil pendeteksian tepi berikut:

 (a) citra cameraman.tif	 (b) canny
[citra asli]	[ ]
 (c) prewitt	 (d) sobel
[ ]	[ ]
 (e) Roberts	 (f) SMED
[ ]	[ ]

HASIL ANGKET

Responden	Canny	Prewitt	Sobel	Roberts	SMED
1	5	1	2	3	4
2	5	4	3	2	1
3	1	4	3	5	2
4	1	3	4	5	2
5	1	3	3	4	2
6	5	4	3	2	1
7	1	4	5	3	2
8	2	3	5	4	1
9	2	3	4	5	1
10	4	3	1	5	2
11	1	5	4	3	2
12	1	4	2	5	3
13	2	4	3	5	1
14	5	2	4	3	2
15	3	2	5	4	1
16	5	4	3	2	1
17	4	3	5	2	1
18	3	4	5	3	2
19	2	5	4	3	1
20	1	5	4	3	2

- 45% responden memberikan urutan pertama (deteksi tepi paling baik) pada SMED, dan 35% responden memberikan urutan pertama (deteksi tepi paling baik) pada Canny konvensional, sisanya 23% memberikan urutan pertama pada detektor tepi lainnya.