

به نام خداوند بخشنده مهربان

پاسخ تکالیف سری دوم پردازش تصویر و بینایی ماشین

سوال اول:

```
close all hidden;
clear all;
clc;
a=imread('leg1.gif');
figure(1);imshow(a);title('original');
a=im2single(a);
%%%%% s=(c*a).^(gamma).    if gamma>1 s=exp    and    if
gamma<1    s=log    %%%%%
c=1;
%%%%%%%%%%%%%% exp %%%%%%%%%%%%%%%
gamma1=2;
s1=(c*a).^(gamma1);
figure(2);imshow(s1);title('exp');
%%%%%%%%%%%%%% log %%%%%%%%%%%%%%%
gamma2=0.5;
s2=(c*a).^(gamma2);
figure(3);imshow(s2);title('log');
```

---

سوال دوم:

```
close all hidden;
clear all;
clc;

a=imread('my barbara.gif');

figure(1);imshow(a);title('my barbara');
imwrite(a,'my barbara 1.jpg','quality',5);
imwrite(a,'my barbara 2.jpg','quality',15);
imwrite(a,'my barbara 3.jpg','quality',25);
imwrite(a,'my barbara 4.jpg','quality',35);
imwrite(a,'my barbara 5.jpg','quality',45);
imwrite(a,'my barbara 6.jpg','quality',55);
```

```
a1=imread('my barbara 1.jpg');  
a2=imread('my barbara 2.jpg');  
a3=imread('my barbara 3.jpg');  
a4=imread('my barbara 4.jpg');  
a5=imread('my barbara 5.jpg');  
a6=imread('my barbara 6.jpg');
```

```
figure();  
subplot(2,3,1);imshow(a1);title('my barbara 1');  
subplot(2,3,2);imshow(a2);title('my barbara 2');  
subplot(2,3,3);imshow(a3);title('my barbara 3');  
subplot(2,3,4);imshow(a4);title('my barbara 4');  
subplot(2,3,5);imshow(a5);title('my barbara 5');  
subplot(2,3,6);imshow(a6);title('my barbara 6');
```

```
horz=(1:1:256);
```

```
figure();  
subplot(2,2,1);imshow(a1);title('my barbara 1');  
subplot(2,2,3)  
h1=imhist(a1);  
h11=h1(1:1:256);  
bar(horz,h11,'b');  
title('HISTOGRAM of my barbara 1 ');  
axis([0 270 0 (1.1*max(h1))] );
```

```
subplot(2,2,2);imshow(a2);title('my barbara 2');  
subplot(2,2,4)  
h2=imhist(a2);  
h22=h2(1:1:256);  
bar(horz,h22,'b');  
title('HISTOGRAM of my barbara 2 ');  
axis([0 270 0 (1.1*max(h2))] );
```

```
figure();  
subplot(2,2,1);imshow(a3);title('my barbara 3');  
subplot(2,2,3)
```

```
h3=imhist(a3);
h33=h3(1:1:256);
bar(horz,h33,'b');
title('HISTOGRAM of my barbara 3 ');
axis([0 270 0 (1.1*max(h3))] );

subplot(2,2,2);imshow(a4);title('my barbara 4');
subplot(2,2,4)
h4=imhist(a4);
h44=h4(1:1:256);
bar(horz,h44,'b');
title('HISTOGRAM of my barbara 4 ');
axis([0 270 0 (1.1*max(h4))] );

figure();
subplot(2,2,1);imshow(a5);title('my barbara 5');
subplot(2,2,3)
h5=imhist(a5);
h55=h5(1:1:256);
bar(horz,h55,'b');
title('HISTOGRAM of my barbara 5 ');
axis([0 270 0 (1.1*max(h5))] );

subplot(2,2,2);imshow(a6);title('my barbara 6');
subplot(2,2,4)
h6=imhist(a6);
h66=h6(1:1:256);
bar(horz,h66,'b');
title('HISTOGRAM of my barbara 6 ');
axis([0 270 0 (1.1*max(h6))] );
```

---

```

close all hidden;
clear all;
clc;

a=imread('pool.png');
figure(1);imshow(a);title('RGB');
r=a(:,:,1);
figure(2);imshow(r);title('RED plane');
g=a(:,:,2);
figure(3);imshow(g);title('GREEN plane');
b=a(:,:,3);
figure(4);imshow(b);title('BLUE plane');

[m,n]=size(r);
%You can use [m,n]=size(g) or [m,n]=size(b)%
horz=(1:1:256);
%%%%%%%%%% stage 1 remove RED plane
%%%%%%%%%%

rr=zeros(m,n);
rr=uint8(rr);
rgb1=cat(3,rr,g,b);
figure(5);imshow(rgb1);title('RED plane removed');

figure(6);
subplot(2,3,1);imshow(rr);title('red1');
subplot(2,3,4)
h1=imhist(rr);
h11=h1(1:1:256);
bar(horz,h11,'b');
title('HISTOGRAM of red1 ');
axis([0 270 0 (1.1*max(h1))]);

subplot(2,3,2);imshow(g);title('green');
subplot(2,3,5)
h2=imhist(g);
h22=h2(1:1:256);
bar(horz,h22,'b');
title('HISTOGRAM of green');
axis([0 270 0 (1.1*max(h2))]);

```

```

subplot(2,3,3);imshow(b);title('blue');
subplot(2,3,6)
h3=imhist(b);
h33=h3(1:1:256);
bar(horz,h33,'b');
title('HISTOGRAM of blue');
axis([0 270 0 (1.1*max(h3))] );

```

%%%%%%%% stage 2 remove GREEN plane %%%%%%%%%

```

gg=zeros(m,n);
gg=uint8(gg);
rgb2=cat(3,r,gg,b);
figure(7);imshow(rgb2);title('GREEN plane removed');

```

```

figure(8);
subplot(2,3,1);imshow(r);title('red');
subplot(2,3,4)
h1=imhist(r);
h11=h1(1:1:256);
bar(horz,h11,'b');
title('HISTOGRAM of red ');
axis([0 270 0 (1.1*max(h1))] );

```

```

subplot(2,3,2);imshow(gg);title('green2');
subplot(2,3,5)
h2=imhist(gg);
h22=h2(1:1:256);
bar(horz,h22,'b');
title('HISTOGRAM of green2');
axis([0 270 0 (1.1*max(h2))] );

```

```

subplot(2,3,3);imshow(b);title('blue');
subplot(2,3,6)
h3=imhist(b);
h33=h3(1:1:256);
bar(horz,h33,'b');
title('HISTOGRAM of blue');
axis([0 270 0 (1.1*max(h3))] );

```

```
%%%%%%%%%% stage 2 remove GREEN plane%%%%%%%%%%
```

```
bb=zeros(m,n);  
bb=uint8(bb);  
rgb3=cat(3,r,g,bb);  
figure(9);imshow(rgb3);title('BLUE plane removed');
```

```
figure(10);  
subplot(2,3,1);imshow(r);title('red');  
subplot(2,3,4)  
h1=imhist(r);  
h11=h1(1:1:256);  
bar(horz,h11,'b');  
title('HISTOGRAM of red');  
axis([0 270 0 (1.1*max(h1))] );
```

```
subplot(2,3,2);imshow(g);title('green');  
subplot(2,3,5)  
h2=imhist(g);  
h22=h2(1:1:256);  
bar(horz,h22,'b');  
title('HISTOGRAM of green');  
axis([0 270 0 (1.1*max(h2))] );
```

```
subplot(2,3,3);imshow(bb);title('blue3');  
subplot(2,3,6)  
h3=imhist(bb);  
h33=h3(1:1:256);  
bar(horz,h33,'b');  
title('HISTOGRAM of blue3');  
axis([0 270 0 (1.1*max(h3))] );
```

---

```
close all hidden;
clear all;
clc;

a=imread('pool.png');
figure(1);imshow(a);title('original image');

[b1,map]=rgb2ind(a,2);
figure(2);imshow(b1,map);title('number of colors =
2');

[b2,map]=rgb2ind(a,22);
figure(3);imshow(b2,map);title('number of colors =
22');

[b3,map]=rgb2ind(a,42);
figure(4);imshow(b3,map);title('number of colors =
42');

[b4,map]=rgb2ind(a,62);
figure(5);imshow(b4,map);title('number of colors =
62');

[b5,map]=rgb2ind(a,82);
figure(6);imshow(b5,map);title('number of colors =
82');

[b6,map]=rgb2ind(a,102);
figure(7);imshow(b6,map);title('number of colors =
102');

[b7,map]=rgb2ind(a,122);
figure(8);imshow(b7,map);title('number of colors =
122');

figure(9);imshow(b1);title('gray picture , number of
intensities = 2');
figure(10);imshow(b2);title('gray picture , number of
intensities = 22');
```

```
figure(11);imshow(b3);title('gray picture , number of
intensities = 42');
figure(12);imshow(b4);title('gray picture , number of
intensities = 62');
figure(13);imshow(b5);title('gray picture , number of
intensities = 82');
figure(14);imshow(b6);title('gray picture , number of
intensities = 102');
figure(15);imshow(b7);title('gray picture , number of
intensities = 122');
```

```
he1=histeq(b1);
figure(16);imshow(he1);title('histogram equalization
of b1');
```

```
he2=histeq(b2);
figure(17);imshow(he2);title('histogram equalization
of b2');
```

```
he3=histeq(b3);
figure(18);imshow(he3);title('histogram equalization
of b3');
```

```
he4=histeq(b4);
figure(19);imshow(he4);title('histogram equalization
of b4');
```

```
he5=histeq(b5);
figure(20);imshow(he5);title('histogram equalization
of b5');
```

```
he6=histeq(b6);
figure(21);imshow(he6);title('histogram equalization
of b6');
```

```
he7=histeq(b7);
figure(22);imshow(he7);title('histogram equalization
of b7');
```

```
horz=(1:1:256);
```



```
figure(23);
subplot(2,2,1);imshow(b1);title('b1 before histogram
equalization');
subplot(2,2,3)
h1=imhist(b1);
h11=h1(1:1:256);
bar(horz,h11,'b');
axis([0 270 0 (1.1*max(h1))] );
```

```
subplot(2,2,2);imshow(he1);title('b1 after histogram
equalization');
subplot(2,2,4)
h2=imhist(he1);
h22=h2(1:1:256);
bar(horz,h22,'b');
axis([0 270 0 (1.1*max(h2))] );
```

```
figure(24);
subplot(2,2,1);imshow(b2);title('b2 before histogram
equalization');
subplot(2,2,3)
h1=imhist(b2);
h11=h1(1:1:256);
bar(horz,h11,'b');
axis([0 270 0 (1.1*max(h1))] );
```

```
subplot(2,2,2);imshow(he2);title('b2 after histogram
equalization');
subplot(2,2,4)
h2=imhist(he2);
h22=h2(1:1:256);
bar(horz,h22,'b');
axis([0 270 0 (1.1*max(h2))] );
```

```
figure(25);
subplot(2,2,1);imshow(b3);title('b3 before histogram
equalization');
subplot(2,2,3)
h1=imhist(b3);
h11=h1(1:1:256);
```

```
bar(horz,h11,'b');
axis([0 270 0 (1.1*max(h1))]);

subplot(2,2,2);imshow(he3);title('b3 after histogram
equalization');
subplot(2,2,4)
h2=imhist(he3);
h22=h2(1:1:256);
bar(horz,h22,'b');
axis([0 270 0 (1.1*max(h2))]);
```

```
figure(26);
subplot(2,2,1);imshow(b4);title('b4 before histogram
equalization');
subplot(2,2,3)
h1=imhist(b4);
h11=h1(1:1:256);
bar(horz,h11,'b');
axis([0 270 0 (1.1*max(h1))]);
```

```
subplot(2,2,2);imshow(he4);title('b4 after histogram
equalization');
subplot(2,2,4)
h2=imhist(he4);
h22=h2(1:1:256);
bar(horz,h22,'b');
axis([0 270 0 (1.1*max(h2))]);
```

```
figure(27);
subplot(2,2,1);imshow(b5);title('b5 before histogram
equalization');
subplot(2,2,3)
h1=imhist(b5);
h11=h1(1:1:256);
bar(horz,h11,'b');
axis([0 270 0 (1.1*max(h1))]);
```

```
subplot(2,2,2);imshow(he5);title('b5 after histogram
equalization');
```

```
subplot(2,2,4)
h2=imhist(he5);
h22=h2(1:1:256);
bar(horz,h22,'b');
axis([0 270 0 (1.1*max(h2))] );
```

```
figure(28);
subplot(2,2,1);imshow(b6);title('b6 before histogram
equalization');
subplot(2,2,3)
h1=imhist(b6);
h11=h1(1:1:256);
bar(horz,h11,'b');
axis([0 270 0 (1.1*max(h1))] );
```

```
subplot(2,2,2);imshow(he6);title('b6 after histogram
equalization');
subplot(2,2,4)
h2=imhist(he6);
h22=h2(1:1:256);
bar(horz,h22,'b');
axis([0 270 0 (1.1*max(h2))] );
```

```
figure(29);
subplot(2,2,1);imshow(b7);title('b7 before histogram
equalization');
subplot(2,2,3)
h1=imhist(b7);
h11=h1(1:1:256);
bar(horz,h11,'b');
axis([0 270 0 (1.1*max(h1))] );
```

```
subplot(2,2,2);imshow(he7);title('b7 after histogram
equalization');
subplot(2,2,4)
h2=imhist(he7);
h22=h2(1:1:256);
bar(horz,h22,'b');
axis([0 270 0 (1.1*max(h2))] );
```

---

```

close all hidden;
clear all;
clc;

a=imread('house.tif');
figure(1);imshow(a);title('original picture');
a=double(a);

%%%%%%%%%%%% SLIDE 16 %%%%%%%%%%%%%

L=256;
p1=round(.3*L);
p2=round(.6*L);

% s1 is approximately (.3*p1) and s2 is approximately
(1.2*p2)

s1=round(.3*p1);
s2=round(1.2*p2);

% point1=(0,0) point2=(p1,s1) point3=(p2,s2)
point4=(L-1,L-1) %

%%%%%%%%%%%%line equation 1%%%%%%%%%%%%

m1=((s1-0)/(p1-0));
% Tr1-s1=m1*(r-p1); -> Tr1=(m1*(r-p1))+s1;

%%%%%%%%%%%% line equation 2
%%%%%%%%%%%%

m2=((s2-s1)/(p2-p1));
% Tr2-s2=m2*(r-p2); -> Tr2=(m2*(r-p2))+s2;

%%%%%%%%%%%% line equation 3 %%%%%%%%%%%%%

m3=((L-1)-s2)/((L-1)-p2);
% Tr3-(L-1)=m3*(r-(L-1)); -> Tr3=(m3*(r-(L-1)))+(L-1);

```

```
%%%%%%%%%
```

```
[m,n]=size(a);  
Tr=zeros(m,n);  
for i=1:m;  
    for j=1:n;  
        r=a(i,j);  
        if r<p1  
            Tr(i,j)=round((m1*(r-p1))+s1);  
        elseif r==p1  
            Tr(i,j)=s1;  
        elseif (r>p1 && r<p2)  
            Tr(i,j)=round((m2*(r-p2))+s2);  
        elseif r==p2  
            Tr(i,j)=s2;  
        else  
            Tr(i,j)=round((m3*(r-(L-1)))+(L-1));  
        end  
    end  
end  
Tr=uint8(Tr);  
figure(2);imshow(Tr);title('slide 16');
```

```
%%%%%%%%% SLIDE 17 %%%%%%%%%%
```

```
Tr=zeros(m,n);
```

```
T1=50;  
T2=100;  
T3=150;  
T4=200;
```

```
A=50;  
B=100;  
C=150;  
D=200;
```

```
for i=1:m;  
    for j=1:n;  
        r=a(i,j);  
        if r<T1  
            Tr(i,j)=0;  
        elseif (r>=T1 && r<T2)  
            Tr(i,j)=A;  
        elseif (r>=T2 && r<T3)
```

```

        Tr(i,j)=B;
    elseif (r>=T3 && r<T4)
        Tr(i,j)=C;
    else
        Tr(i,j)=D;
    end
end
end

Tr=uint8(Tr);
figure(3);imshow(Tr);title('slide 17');

```

%%%%%%%%%%%% SLIDE 18 %%%%%%%%%%

%%diagonal line start point and end point are  
 respectively (0,0) and approximately (.9\*L,.6\*L)%%

```

s1=0;
r1=0;

```

```

s2=round(.6*L);
r2=round(.9*L);

```

```

m1=(s2-s1)/(r2-r1);

```

%  $Tr1 - s1 = m1 * (r - r1)$ ;  $\rightarrow Tr1 = (m1 * (r - r1)) + s1$ ; %%%%%%%%%

```

Tr=zeros(m,n);
for i=1:m;
    for j=1:n;
        r=a(i,j);
        if (r>50 && r<130)
            Tr(i,j)=s2;
        else
            Tr(i,j)=round((m1*(r-r1))+s1);
        end
    end
end
end

Tr=uint8(Tr);
figure(4);imshow(Tr);title('slide 18');

```

%%%%%%%%%%%% SLIDE 19 %%%%%%%%%%

%%horizontal line start point and end point are  
%respectively (.05\*L) and approximately  
%(.8\*L,.05\*L)%%  
%%s1,s2,r1,r2 and r3 are approximately .035\*L,.4\*L  
,.2\*L ,.5\*L and .9\*L %%%%

```
s1= round(.035*L);  
s2= round(.4*L);  
r1=round(.2*L);  
r2=round(.5*L);  
r3=round(.9*L);  
Tr=zeros(m,n);  
for i=1:m;  
    for j=1:n;  
        r=a(i,j);  
        if (r<r1 || (r>r2 && r<r3))  
            Tr(i,j)=round(s1);  
        elseif r>r3  
            Tr(i,j)=0;  
        else  
            Tr(i,j)=s2;  
        end  
    end  
end  
Tr=uint8(Tr);  
figure(5);imshow(Tr);title('slide 19');
```

---

```

close all hidden;
clear all;
clc;
a=imread('cameraman.tif');
figure(1);imshow(a);title('original picture')
a=double(a);

%%%%%%%% bit planes extraction%%%%%%%%

b0=rem(a,2);

b1=rem((fix(a/2)),2);

b2=rem((fix(a/4)),2);

b3=rem((fix(a/8)),2);

b4=rem((fix(a/16)),2);

b5=rem((fix(a/32)),2);

b6=rem((fix(a/64)),2);

b7=rem((fix(a/128)),2);

figure(2);imshow(b0);title('bit plane 0');
figure(3);imshow(b1);title('bit plane 1');
figure(4);imshow(b2);title('bit plane 2');
figure(5);imshow(b3);title('bit plane 3');
figure(6);imshow(b4);title('bit plane 4');
figure(7);imshow(b5);title('bit plane 5');
figure(8);imshow(b6);title('bit plane 6');
figure(9);imshow(b7);title('bit plane 7');
%%%%%%%% reconstructing original picture by means of
bit planes %%%%

original_picture=(b7*(2^7)+(b6*(2^6)+(b5*(2^5)+(b4
*(2^4)+(b3*(2^3)+(b2*(2^2)+(b1*(2^1)+(b0*(2^0)));
original_picture=uint8(original_picture);
figure(10);imshow(original_picture);title('reconstruc
ted original picture');

```

---



```
close all hidden;
clear all;
clc;

a=imread('peppers.gif');
a1=imread('peppers1.gif');
a2=imread('peppers2.gif');
a3=imread('peppers3.gif');
a4=imread('peppers4.gif');
a5=imread('peppers5.gif');

a=double(a);
a1=double(a1);
a2=double(a2);
a3=double(a3);
a4=double(a4);
a5=double(a5);

[m,n]=size(a);

numerator1=0;
numerator2=0;
numerator3=0;
numerator4=0;
numerator5=0;

for i=1:m;
    for j=1:n;
        numerator1=numerator1+((abs(a(i,j))-
a1(i,j)))^2);
        numerator2=numerator2+((abs(a(i,j))-
a2(i,j)))^2);
        numerator3=numerator3+((abs(a(i,j))-
a3(i,j)))^2);
        numerator4=numerator4+((abs(a(i,j))-
a4(i,j)))^2);
        numerator5=numerator5+((abs(a(i,j))-
a5(i,j)))^2);
    end
end
```

```

MSE1=round( numerator1 / (m*n) );
MSE2=round( numerator2 / (m*n) );
MSE3=round( numerator3 / (m*n) );
MSE4=round( numerator4 / (m*n) );
MSE5=round( numerator5 / (m*n) );

PSNR1=round( 10 * (log10( (255^2) / MSE1)) );
PSNR2=round( 10 * (log10( (255^2) / MSE2)) );
PSNR3=round( 10 * (log10( (255^2) / MSE3)) );
PSNR4=round( 10 * (log10( (255^2) / MSE4)) );
PSNR5=round( 10 * (log10( (255^2) / MSE5)) );

a=uint8(a);
a1=uint8(a1);
a2=uint8(a2);
a3=uint8(a3);
a4=uint8(a4);
a5=uint8(a5);

figure(1); imshow(a); title('original picture');

z1=num2str(MSE1);
y1=char('MSE1= ');
z2=num2str(PSNR1);
y2=char(' PSNR1=');
figure(2); imshow(a1); title(strcat(y1,z1,y2,z2));

z1=num2str(MSE2);
y1=char('MSE2= ');
z2=num2str(PSNR2);
y2=char(' PSNR2=');
figure(3); imshow(a2); title(strcat(y1,z1,y2,z2));

z1=num2str(MSE3);
y1=char('MSE3= ');
z2=num2str(PSNR3);
y2=char(' PSNR3=');
figure(4); imshow(a3); title(strcat(y1,z1,y2,z2));

z1=num2str(MSE4);
y1=char('MSE4= ');
z2=num2str(PSNR4);
y2=char(' PSNR4=');

```

```

figure(5);imshow(a4);title(strcat(y1,z1,y2,z2));

z1=num2str(MSE5);
y1=char('MSE5= ');
z2=num2str(PSNR5);
y2=char(' PSNR5=');
figure(6);imshow(a5);title(strcat(y1,z1,y2,z2));

```

---

سوال هشتم:

```

close all hidden;
clear all;
clc;

a=imread('lake.tif');
figure(1);imshow(a);title('original picture');

horz=(1:1:256);

figure(2);
h=imhist(a);
hh=h(1:1:256);
bar(horz,hh,'b');
title('histogram of original picture');
axis([0 270 0 (1.1*max(h))]);

h1=h;
h2=h;
h3=h;

%%%%%%%%%%%% histogram matching 1 %%%%%%%%%%%%%
h1([1:100 200:250])=0;
figure(3);
plot(h1);title('optional histogram 1');

g1=histeq(a,h1);
figure(4);imshow(g1);title('applying " histogram
matching 1 " ');
figure(5);
g11=imhist(g1);
g111=g11(1:1:256);
bar(horz,g111,'b');

```

```
title('image histogram after applying " histogram  
matching 1 "');  
axis([0 270 0 (1.1*max(g11))] );
```

```
%%%%%%%%%%%% histogram matching 2 %%%%%%%%%%
```

```
h2([50:100 150:200])=0;  
figure(6);  
plot(h2);title('optional histogram 2');
```

```
g2=histeq(a,h2);  
figure(7);imshow(g2);title('applying " histogram  
matching 2 "');  
figure(8);  
g22=imhist(g2);  
g222=g22(1:1:256);  
bar(horz,g222,'b');  
title('image histogram after applying " histogram  
matching 2 "');  
axis([0 270 0 (1.1*max(g22))] );
```

```
%%%%%%%%%%%% histogram matching 3 %%%%%%%%%%
```

```
h3([1:20 60:80 120:140 180:200 220:240])=0;  
figure(9);  
plot(h3);title('optional histogram 3');
```

```
g3=histeq(a,h3);  
figure(10);imshow(g3);imshow(g3);title('applying "  
histogram matching 3 "');  
figure(11);  
g33=imhist(g3);  
g333=g33(1:1:256);  
bar(horz,g333,'b');  
title('image histogram after applying " histogram  
matching 3 "');  
axis([0 270 0 (1.1*max(g33))] );
```