

ECSE 4540 Image Processing

HW 1

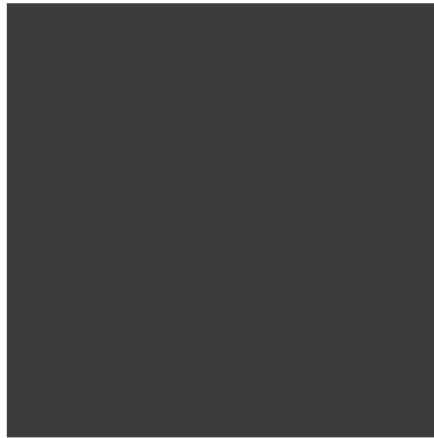
Jan 29, 2018
Daniel Southwick
661542908

```
%% ===== 1.1 =====  
%% a
```

Code

```
im1 = ones(500)*60;  
imshow(im1,[0 255]);
```

Matlab Result

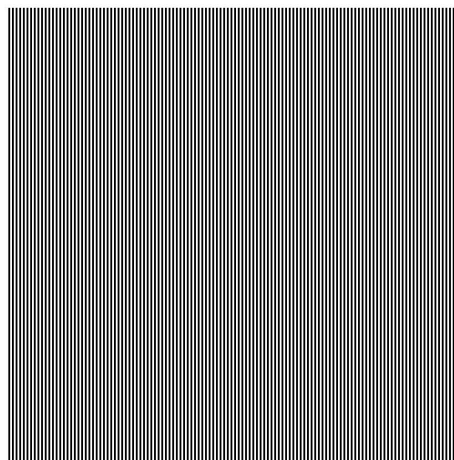


```
%% b
```

Code

```
im2=repmat([0,0,255,255],500,125);  
imshow(im2,[0,255]);
```

Matlab Result

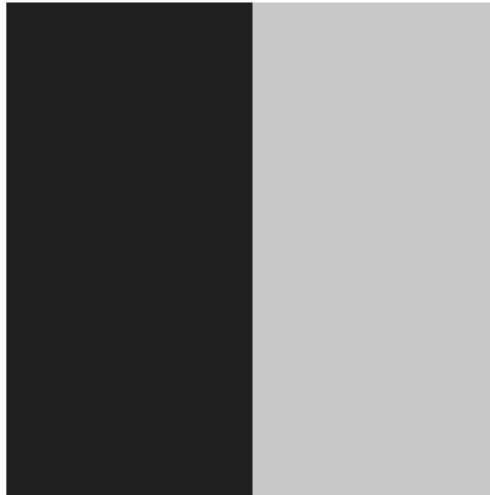


```
%% c
```

Code

```
im3l=ones(1,500) '*32*ones(1,250);  
im3r=ones(1,500) '*200*ones(1,250);  
im3 =horzcat(im3l,im3r);  
imshow(im3,[0,255]);
```

Matlab Result



```
%% d
```

Code

```
im4=[0:0.5:249.5] '*ones(1,500);  
imshow(uint8(im4),[0,255]);
```

Matlab Result

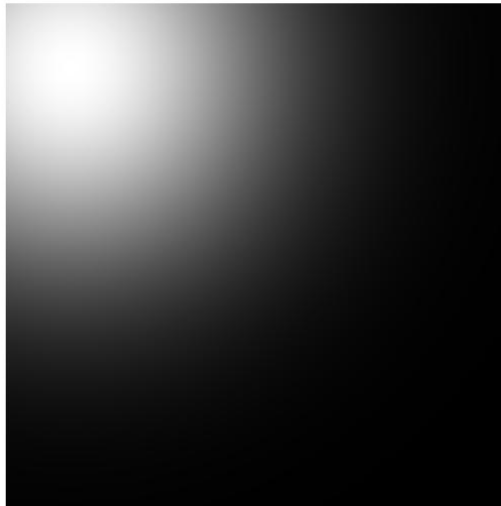


```
%% e
```

Code

```
[y,x] = meshgrid(0:499,0:499);  
I = 255*exp(-(((x-64).^2+(y-64).^2)/(200.^2)));  
imshow(uint8(I),[0,255]);
```

Matlab Result

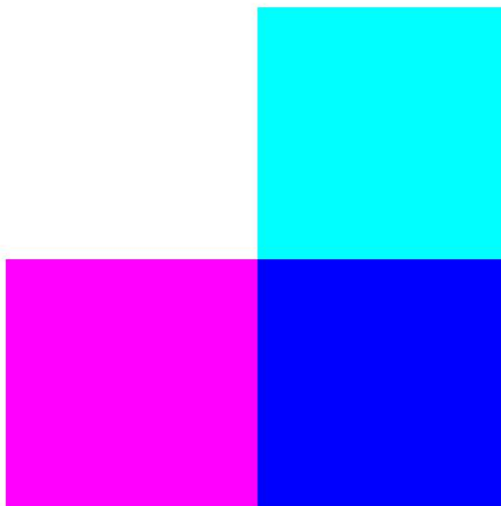


```
%% f
```

Code

```
imc = zeros(500,500,3);  
imc(:,1:250,1)=1;  
imc(1:250,:,2)=1;  
imc(:, :, 3)=1;  
imshow(imc);
```

Matlab Result



1.2

a)

$$48 \text{ min} = 48 \times 60 = 2880 \text{ sec}$$

$$\# \text{ of frames} = 30 \text{ frames/sec} \times 2880 \text{ sec} = 86400 \text{ frames}$$

$$\# \text{ of bits} = 4096 \times 2160 \times 86400 \times 10 \times 3 = 22932357120000 \text{ bits}$$
$$\approx 2.293 \times 10^{13} \text{ bits}$$

b)

of bits/sec of stranger things premier

$$= 4096 \times 2160 \times 30 \times 10 \times 3$$

$$= 7962624000 \text{ bitsps} = 9.95328 \times 10^8 \text{ bps}$$

$$= 995.328 \text{ Mbps}$$

Compression ratio

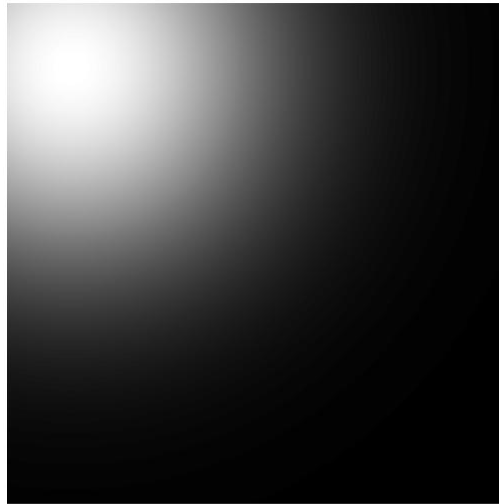
$$= \frac{995.328 \text{ Mbps}}{30 \text{ Mbps}} \approx 33.178$$

```
%% =====1.3=====
%% 128 grey levels
```

Code

```
I128 = round(I/2);
imshow(I128,[0,127]);
```

Matlab Result

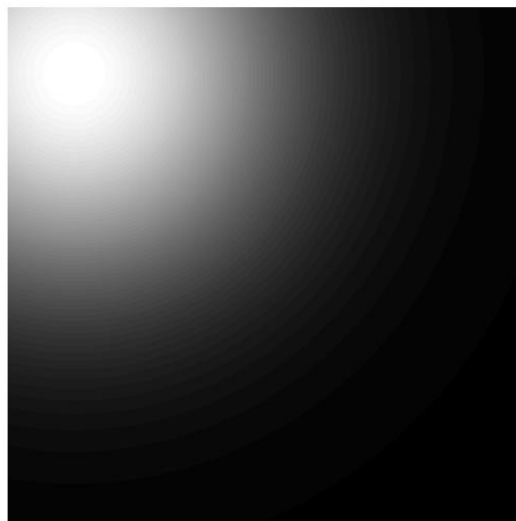


```
%% 64 grey levels
```

Code

```
I64 = round(I128/2);
imshow(I64,[0,63]);
```

Matlab Result

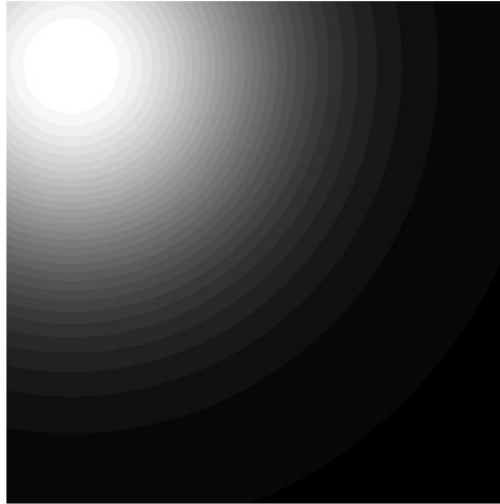


```
%% 32 grey levels
```

```
I32 = round(I64/2);  
imshow(I32,[0,31]);
```

Code

Matlab Result

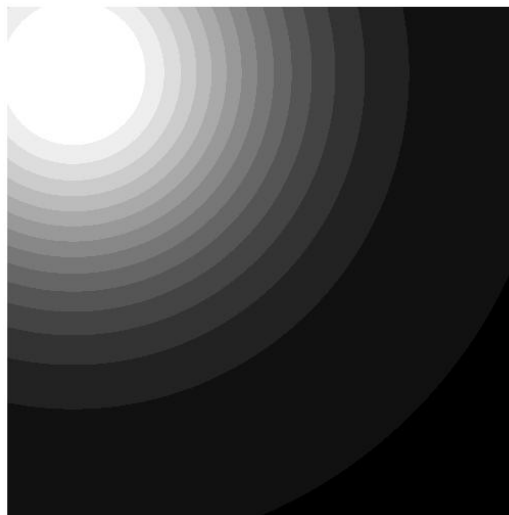


```
%% 16 grey levels
```

```
I16 = round(I32/2);  
imshow(I16,[0,15]);
```

Code

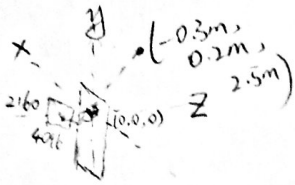
Matlab Result



At 32 grey level we can visually detect false contouring

1.4

$$F = 28 \text{ mm} = 0.028 \text{ m}$$



$$x = F \cdot \frac{x}{z}$$

$$= 0.028 \text{ m} \cdot \frac{-0.05 \text{ m}}{2.5 \text{ m}}$$

$$= -0.00056 \text{ m}$$

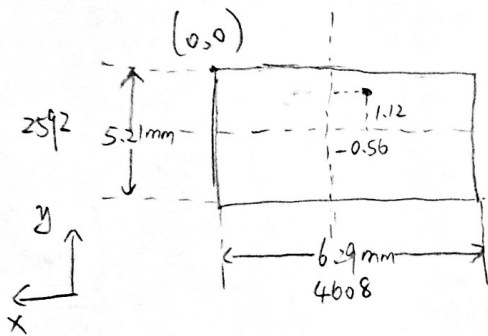
$$= -0.56 \text{ mm}$$

$$y = F \cdot \frac{y}{z}$$

$$= 0.028 \text{ m} \cdot \frac{0.1 \text{ m}}{2.5 \text{ m}}$$

$$= 0.00112 \text{ m}$$

$$= 1.12 \text{ mm}$$



$$x_{\text{pixel}} = \frac{\left(\frac{6.29}{2} + 0.56\right)}{6.29} \times 4608 \approx 2714$$

$$y_{\text{pixel}} = \frac{\left(\frac{5.21}{2} - 1.12\right)}{5.21} \times 2592 \approx 739$$

\therefore Image pixel is at (2714, 739)

1.5

a)

$$R = 10 \times 16 + 8 = 168 ; \quad \frac{168}{255} = 0.659$$

$$G = 13 \times 16 + 0 = 208 ; \quad \frac{208}{255} = 0.816$$

$$B = 14 \times 16 + 8 = 232 ; \quad \frac{232}{255} = 0.910$$

$$\boxed{RGB(0.659, 0.816, 0.910)}$$

b)

$$C = 1 - \left(\frac{R}{255}\right) = 1 - 0.659 = 0.341$$

$$M = 1 - \left(\frac{G}{255}\right) = 1 - 0.816 = 0.184$$

$$Y = 1 - \left(\frac{B}{255}\right) = 1 - 0.910 = 0.090$$

$$\boxed{CMY(0.341, 0.184, 0.090)}$$

c)

$$\theta = \cos^{-1} \left[\frac{\frac{1}{2}[(R-G) + (R-B)]}{(R-G)^2 + (R-B)(G-B)} \right] = \cos^{-1} \left(\frac{\frac{1}{2}[(0.659 - 0.816) + (0.659 - 0.910)]}{[(0.659 - 0.816)^2 + (0.659 - 0.910)(0.816 - 0.910)]} \right)$$

$$= \cos^{-1}(-0.92878) = 158.245^\circ, B > G, 180^\circ - 158.245^\circ = 201.755^\circ$$

$$\boxed{Hue = 201.755^\circ}$$

$$S = 1 - \frac{3}{(R+G+B)} \cdot \min(R, G, B)$$

$$= 1 - \frac{3}{0.659 + 0.816 + 0.910} \cdot 0.659 = 0.171$$

$$\boxed{Saturation = 0.171}$$

$$I = \frac{1}{3}(R+G+B) = \frac{1}{3}(0.659 + 0.910 + 0.816) = 0.795$$

$$\boxed{Intensity = 0.795}$$

d)

Hue: 120° Green 240° Blue

201.755° , between Green and Blue Cyan to Blue

Saturation: 0.171, not polluted from white color. Deep

Intensity: 0.795, close to 1, white intensity. light

A light, deep Blue