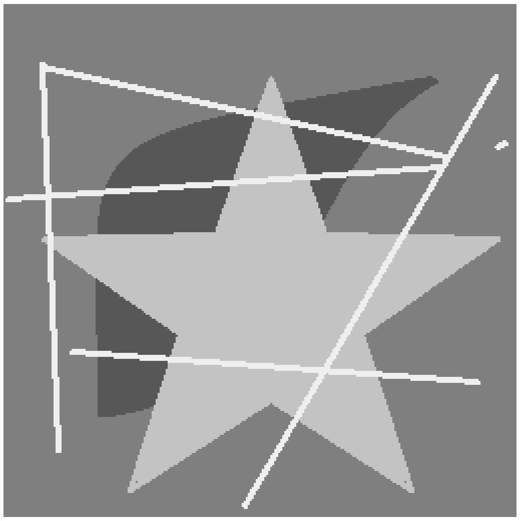
Prednaska 8

Redundance - kodovani

```
I1 = rgb2gray(imread('red1.png'));
figure, imshow(I1);
```



```
[M,N] = size(I1);
```

Pocet barev v obraze

```
unique(I1)
```

```
ans = 4×1 uint8 column vector
    87
   127
   195
   239
```

Pravdepodobnost kazde barvy

```
n = imhist(I1);
p = n/(M*N);
p(unique(I1)+1)
```

```
ans = 4×1
    0.1031
    0.6026
    0.2455
    0.0488
```

Kodovani

pocet bitu pouzitych k zakodovani

```
l1 = 8*ones(256,1);

l1_avg = sum(l1.*p);
display(l1_avg);
```

```
l1_avg = 8
```

```
% Kodovani barev nestejne dlouhym kodem - pocet bitu
```

- 87 : 000
- 127 : 1
- 195 : 01
- 239 : 001

```
l2 = zeros(256,1);
l2(88)=3;
l2(128) = 1;
l2(196) = 2;
l2(240) = 3;

l2_avg = sum(l2.*p);
display(l2_avg);
```

```
l2_avg = 1.5493
```

Komprese a relativni redundance

```
b1 = M*N*l1_avg;
b2 = M*N*l2_avg;

% komprese
C = b1/b2;
display(C);
```

```
C = 5.1637
```

```

% relativni redundance
R = 1-(1/C);
display(R);
```

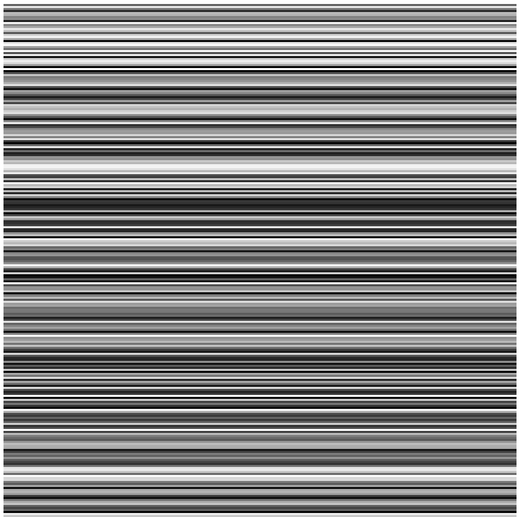
```
R = 0.8063
```

UKOL

Spocitejte kompresi a relativni redundanci pokud pro obrazek red1.png (I1) vezmeme, ze kazda barva je kodovana 2 bity.

Prostorova redundance

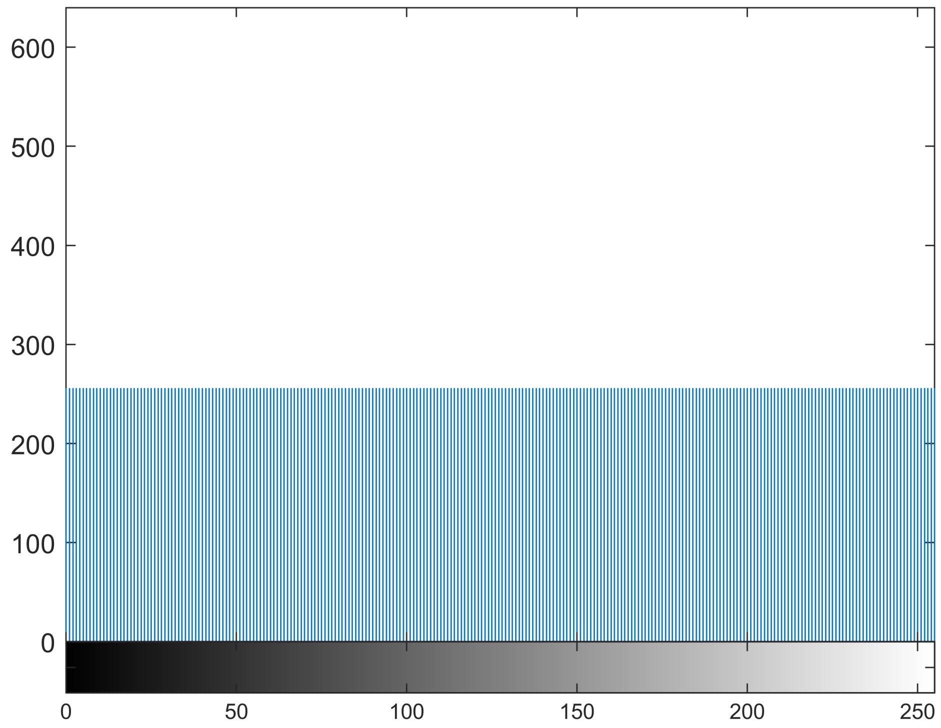
```
I2 = imread('red2.png');
figure, imshow(I2);
```



```
[M,N] = size(I2);
```

Histogram

```
figure, imhist(I2);
```



Pravdepodobnost kazde barvy

```
n = imhist(I2);
p = n/(M*N)
```

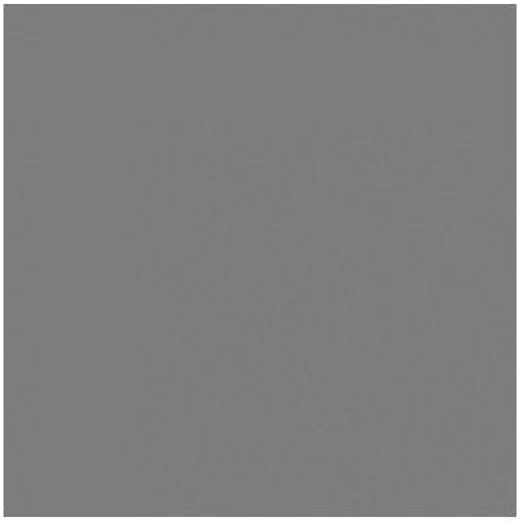
```
p = 256×1
    0.0039
    0.0039
    0.0039
    0.0039
    0.0039
    0.0039
    0.0039
    0.0039
    0.0039
    0.0039
      ⋮
```

UKOL

Spocitejte kompresi a relativni redundanci, pokud obray red2.png (I2) kodujeme 8 bity na intenzitu a pokud pouzijeme pro kazdy radek 1 byte pro intenzitu a 1 byte pro pocet opakujicich se prvku.

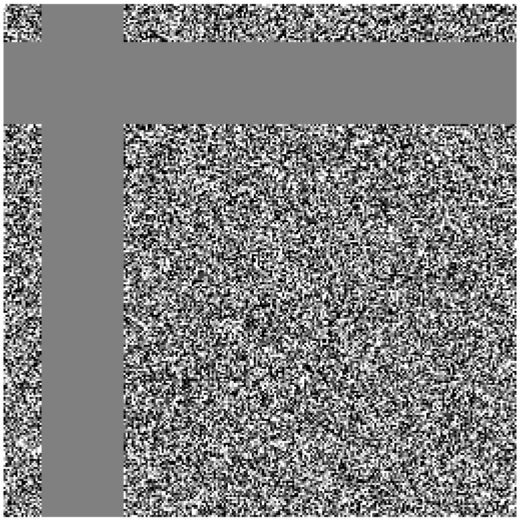
Nerelevantni informace

```
I3 = imread('red3.png');

figure, imshow(I3);
```



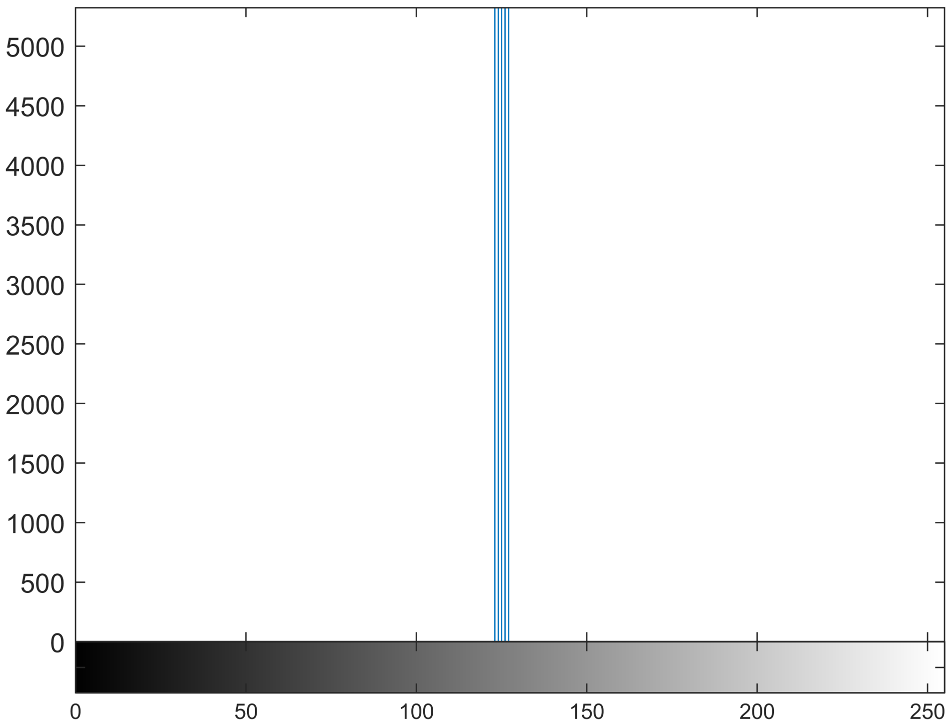
Obrazek s roztazenym kontrastem

```
figure, imshow(I3,[]);
```



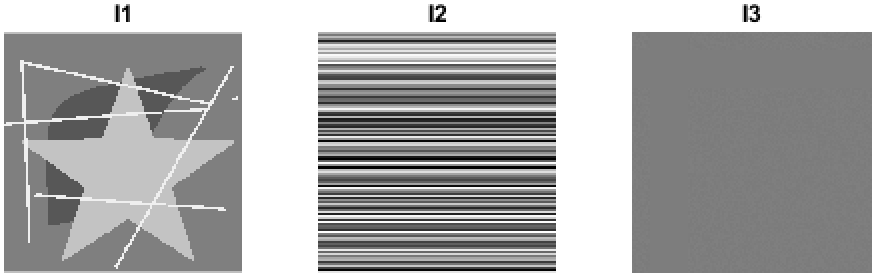
Histogram

```
figure, imhist(I3,256);
```



Entropie

```
I1 = imread('red1.png');
figure,
subplot(1,3,1), imshow(I1);
title("I1");
I2 = imread('red2.png');
subplot(1,3,2),  imshow(I2);
title("I2");
I3 = imread('red3.png');
subplot(1,3,3),  imshow(I3);
title("I3");
```



```
J1 = entropy(I1);
J2 = entropy(I2);
J3 = entropy(I3);

display(J1);
```

```
J1 = 1.4884
```

```
display(J2);
```

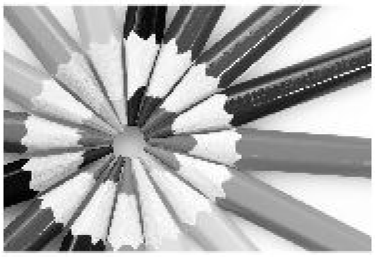
```
J2 = 8
```

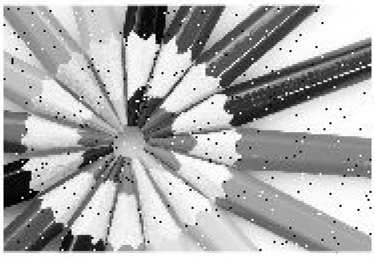
```
display(J3);
```

```
J3 = 2.1142
```

Mean-squared error

```
I = imread('pastelkygray.jpg');
I_noise = imnoise(I,'salt & pepper', 0.02);

figure,
subplot(1,2,1), imshow(I);
subplot(1,2,2), imshow(I_noise);
```





```
% immse = Mean-Squared Error.
mse = immse(I, I_noise);
display(mse);
```

```
mse = 456.7864
```

```
% root mean-squared error

rmse = sqrt(immse(I, I_noise));
display(rmse);
```

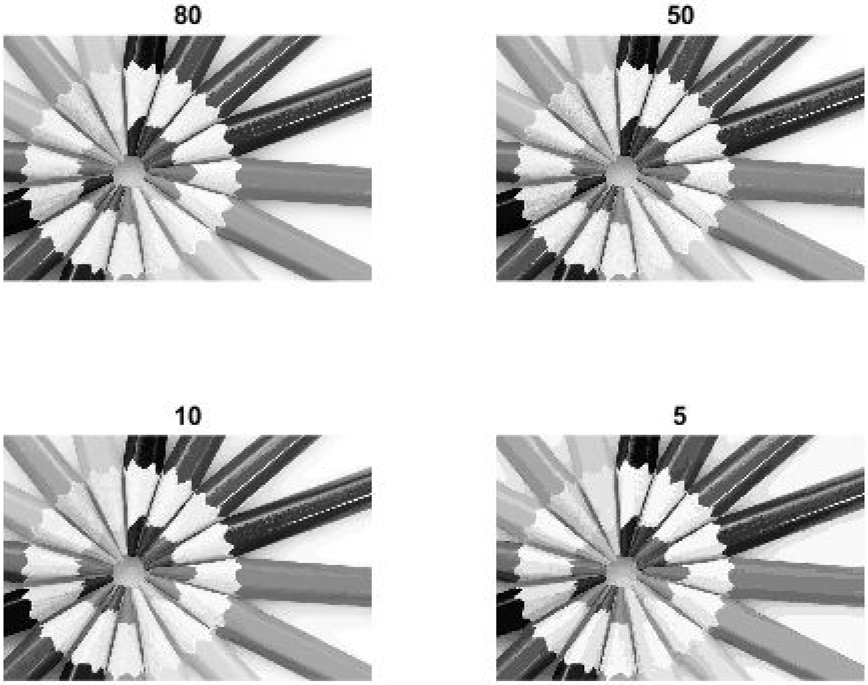
```
rmse = 21.3726
```

UKOL

Spocitejte chybu pro obrazek red3.png (I3) a jeho upravu, kdy je nahrazen jednou hodnotou (Kazdy pixel ma hodnotu 125).

JPEG komprese

```
I = imread('pastelkygray.jpg');

imwrite(I,'p100.jpg','Quality', 100);
imwrite(I,'p80.jpg','Quality', 80);
imwrite(I,'p50.jpg','Quality', 50);
imwrite(I,'p10.jpg','Quality', 10);
imwrite(I,'p5.jpg','Quality', 5);

I1 = imread('p100.jpg');
I2 = imread('p80.jpg');
I3 = imread('p50.jpg');
I4 = imread('p10.jpg');
I5 = imread('p5.jpg');

figure,
subplot(2,2,1), imshow(I2);
title("80");
subplot(2,2,2), imshow(I3);
title("50");
subplot(2,2,3), imshow(I4);
title("10");
subplot(2,2,4), imshow(I5);
title("5");
```



```
imfinfo('p100.jpg')
```

```
ans = struct with fields:
           Filename: 'C:\Skola\vyuka2022-2023\ZS\POGR\matlab\pr8\p100.jpg'
        FileModDate: '17-Nov-2022 13:32:26'
           FileSize: 372656
             Format: 'jpg'
      FormatVersion: ''
              Width: 1400
             Height: 933
           BitDepth: 8
```

```
          ColorType: 'grayscale'
    FormatSignature: ''
    NumberOfSamples: 1
       CodingMethod: 'Huffman'
      CodingProcess: 'Sequential'
            Comment: {}
```

```
imfinfo('p5.jpg')
```

```
ans = struct with fields:
           Filename: 'C:\Skola\vyuka2022-2023\ZS\POGR\matlab\pr8\p5.jpg'
        FileModDate: '17-Nov-2022 13:32:26'
           FileSize: 22772
             Format: 'jpg'
      FormatVersion: ''
              Width: 1400
             Height: 933
           BitDepth: 8
          ColorType: 'grayscale'
    FormatSignature: ''
    NumberOfSamples: 1
       CodingMethod: 'Huffman'
      CodingProcess: 'Sequential'
            Comment: {}
```

Rasterizace primky

DDA algoritmus

1. Z koncovych bodu [x1, y1] a [x2, y2] urci smernici m.
2. Inicializuj bod [x, y] hodnotou [x1, y1].
3. Dokud je x <= x2 opakuj:

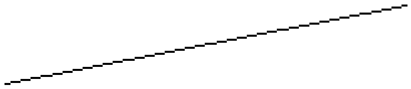
- Vykresli bod [x, zaokrouhlene(y)]

- x = x + 1

- y = y + m

Tento algoritmus je jen pro 0 <= m <=1 pro ostatní m je potřeba upravit. pro I m I > 1 se usecka primyka k y a tak se y zvetsuje o 1 a x o 1/m

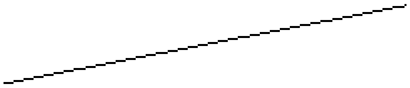
```
usecka = DDA([-100,1], [100,40],[300,300]);

figure, imshow(usecka);
```



Bresenhamuv algoritmus

bresenhamuv_algoritmus.m -- pro nazornost jen pro primky prichylujici se k ose x.

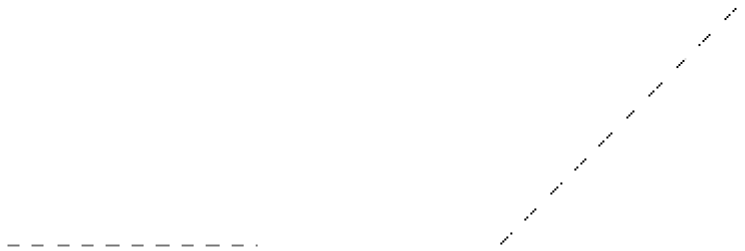
```
  usecka = bresenhamuv_algoritmus([-100,1], [100,40],[300,300]);

  figure, imshow(usecka);
```



Bresenhamuv algoritmus - prerusovana cara

ba_prerusovana.m -- pro nazornost jen pro primky prichylujici se k ose x

```
usecka = ba_prerusovana([-100,1], [100,1],[300,300], 10);  % posledni argument = delka useku
usecka2 = ba_prerusovana([-100,-100], [100,99],[300,300], 10);  % posledni argument = delka us

figure,
subplot(1,2,1), imshow(usecka);
subplot(1,2,2), imshow(usecka2);
```



Bresenhamuv algoritmus - prerusovana cara stejna delka useku

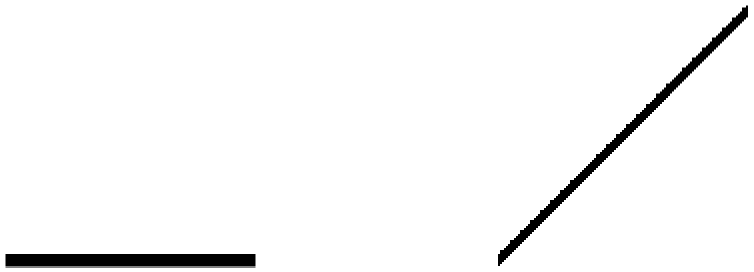
ba_prerusovana2.m -- pro nazornost jen pro primky prichylujici se k ose x

```
usecka = ba_prerusovana2([-100,1], [100,1],[300,300], 10);  % posledni argument = delka useku
usecka2 = ba_prerusovana2([-100,-100], [100,99],[300,300], 10);  % posledni argument = delka us

figure,
subplot(1,2,1), imshow(usecka);
subplot(1,2,2), imshow(usecka2);
```

Bresenhamuv algoritmus - silna cara

ba_silna.m -- pro nazornost jen pro primky prichylujici se k ose x

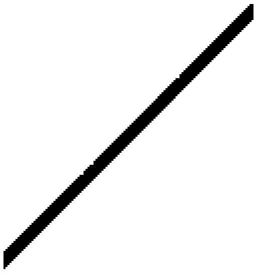
```
usecka = ba_silna([-100,1], [100,1],[300,300], 10);  % posledni argument = tlousktka
usecka2 = ba_silna([-100,-100], [100,99],[300,300], 10);  % posledni argument = tlousktka

figure,
subplot(1,2,1), imshow(usecka);
subplot(1,2,2), imshow(usecka2);
```



Bresenhamuv algoritmus - silna cara - stejna tloustka

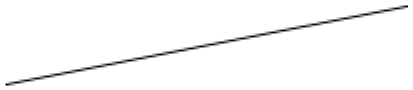
ba_silna2.m -- pro nazornost jen pro primky prichylujici se k ose x

```
usecka = ba_silna2([-100,1], [100,1],[300,300], 10);  % posledni argument = tlousktka
usecka2 = ba_silna2([-100,-100], [100,99],[300,300], 10);  % posledni argument = tlousktka

figure,
subplot(1,2,1), imshow(usecka);
subplot(1,2,2), imshow(usecka2);
```



DDA antialias

```
usecka = DDAalias([-100,1], [100,40],[300,300]);

figure, imshow(usecka);
```



Rasterizace kruznice

ba_kruznice.m -- podivejte se na kod

```
kruznice = ba_kruznice(40, [50,50], [100,100]);
figure, imshow(kruznice);
```