Contents

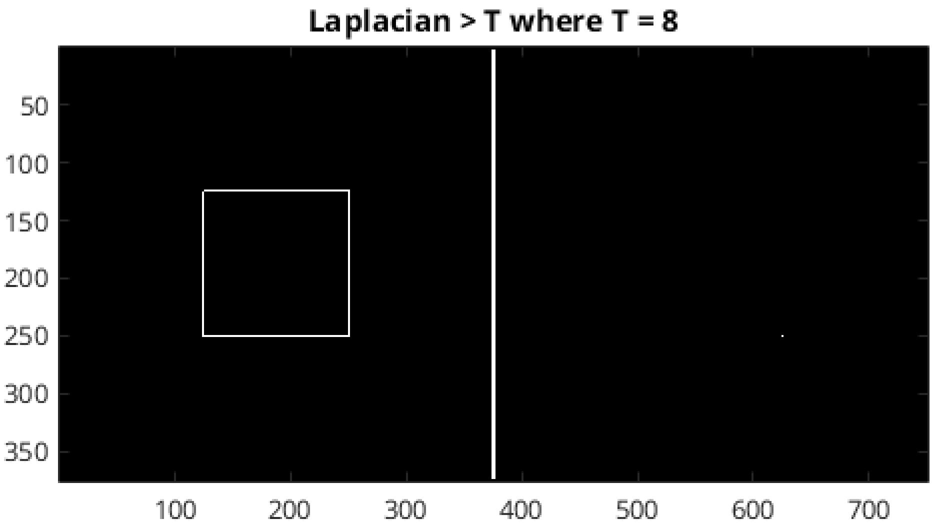
constants

```
Q4_IMAGE = 'simul_cont_squares.tif';
Q5_IMAGE = 'cross.tif';
Q6_IMAGE = 'kofka_ring.tif';

Q10_DATA = 'checkerShadow';
Q11_DATA = 'runner';
Q12_DATA = 'couch';
```

question 4

```
figure();
% read the image & compute laplacian (absolute value)
I = double(imread(Q4_IMAGE));
[m, n] = size(I);
[Ix, Iy] = ImageDerivatives(I);
L = abs(Deriv2Laplace(Ix, Iy));

% define the left/right parts of the image (exclude border ~ 10 pixels
%                                           in the middle)
leftL = L(1:end, 1:(n/2-5));
rightL = L(1:end, (n/2+5):end);

epsilon = 10;
T_space = 1:10;

for T = T_space
    if (length(find(leftL > T)) > epsilon) && ...
       (length(find(rightL > T)) <= epsilon)
        fprintf('Found T = %u\n', T);
        break;  % the result is T = 8
    end
end
fprintf('Number of pixels > T in the left image = %u\n', ...
        length(find(leftL > T)));  % == 1004
fprintf('Number of pixels > T in the right image = %u\n', ...
        length(find(rightL > T))); % == 4
show(L > T);
title(['Laplacian > T where T = ', num2str(T)]);
```

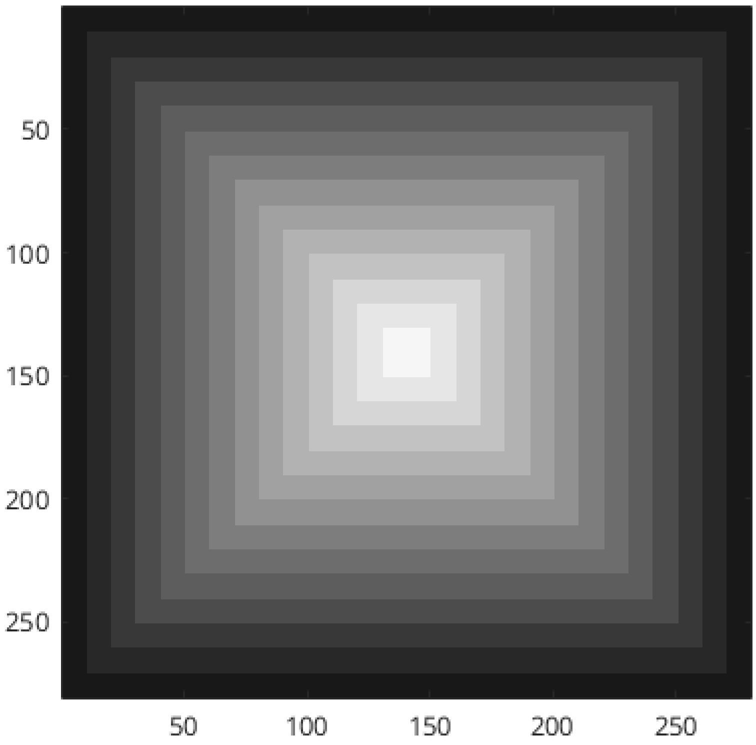
```
Found T = 8
Number of pixels > T in the left image = 1004
Number of pixels > T in the right image = 4
```

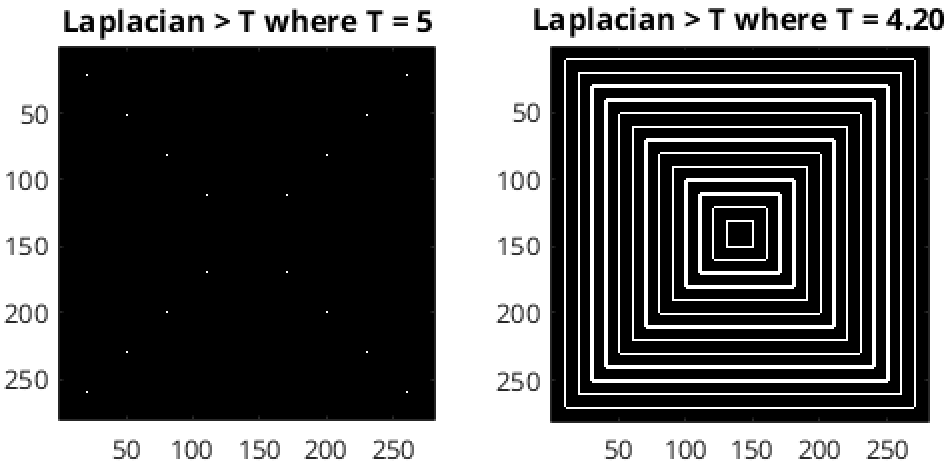


question 5

```
figure();
I = double(imread(Q5_IMAGE));
show(I, [0 255]);
[Ix, Iy] = ImageDerivatives(I);
L = abs(Deriv2Laplace(Ix, Iy));
Diag = logical(eye(length(L)));
Diag = Diag | rot90(Diag);
noDiag = not(Diag);
T_space = 1:10;
epsilon = 0.8;

figure();
for T = T_space
    if (~isempty(find(L(Diag) > T, 1))) && ...
         isempty(find(L(noDiag) > T, 1))
        fprintf('Found T = %u\n', T);
        break;
    end
end
% T = 0.017;

% show that this threshold is tight:
subplot(1, 2, 1);
show(L > T);
title(sprintf('Laplacian > T where T = %u', T));
subplot(1, 2, 2);
show(L > (T-epsilon));
title(sprintf('Laplacian > T where T = %.2f', T-epsilon));
% number of pixels > T on every part of the image
fprintf('Number of pixels > T on diagonal = %u\n', ...
    length(find(L(Diag) > T)));  % == 52
fprintf('Number of pixels > T NOT on diagonal = %u\n', ...
    length(find(L(noDiag) > T)));  % == 0
```

```
Found T = 5
Number of pixels > T on diagonal = 52
Number of pixels > T NOT on diagonal = 0
```

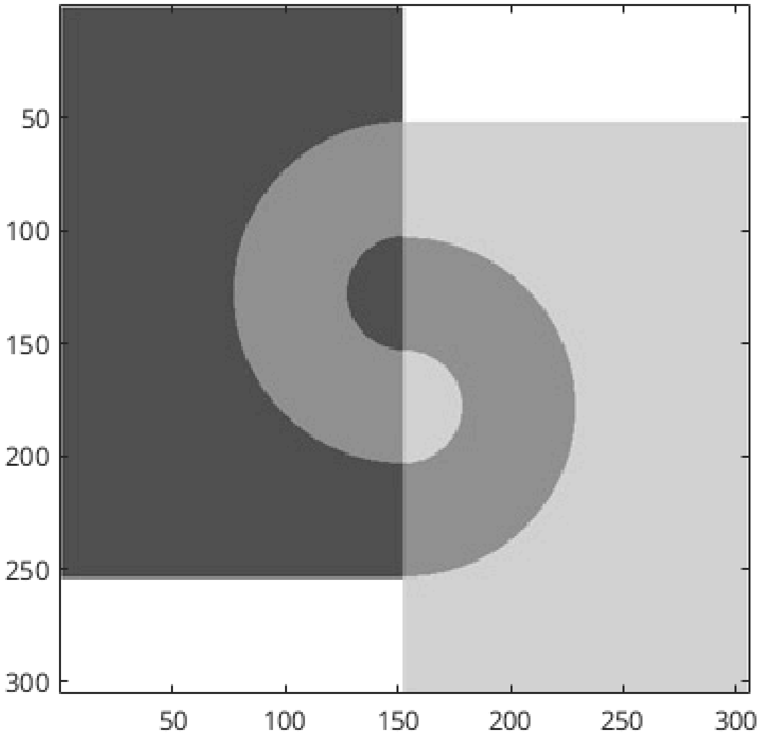


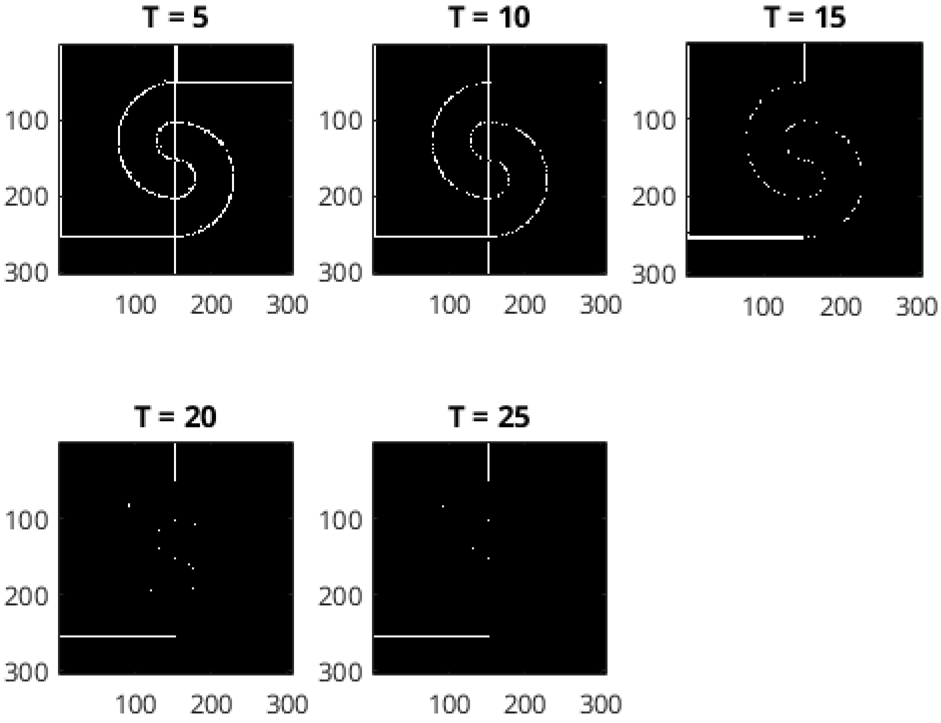


question 6

```
figure();
I = double(imread(Q6_IMAGE));
```

```
show(I, [0 255]);
[Ix, Iy] = ImageDerivatives(I);
L = abs(Deriv2Laplace(Ix, Iy));

figure();
T_space = 5:5:25;
k = numel(T_space);
rows = 2;
cols = ceil(k/2);

for i = 1:k
    subplot(rows, cols, i);
    T = T_space(i);
    show(L > T);
    title(sprintf('T = %u', T));
end
```



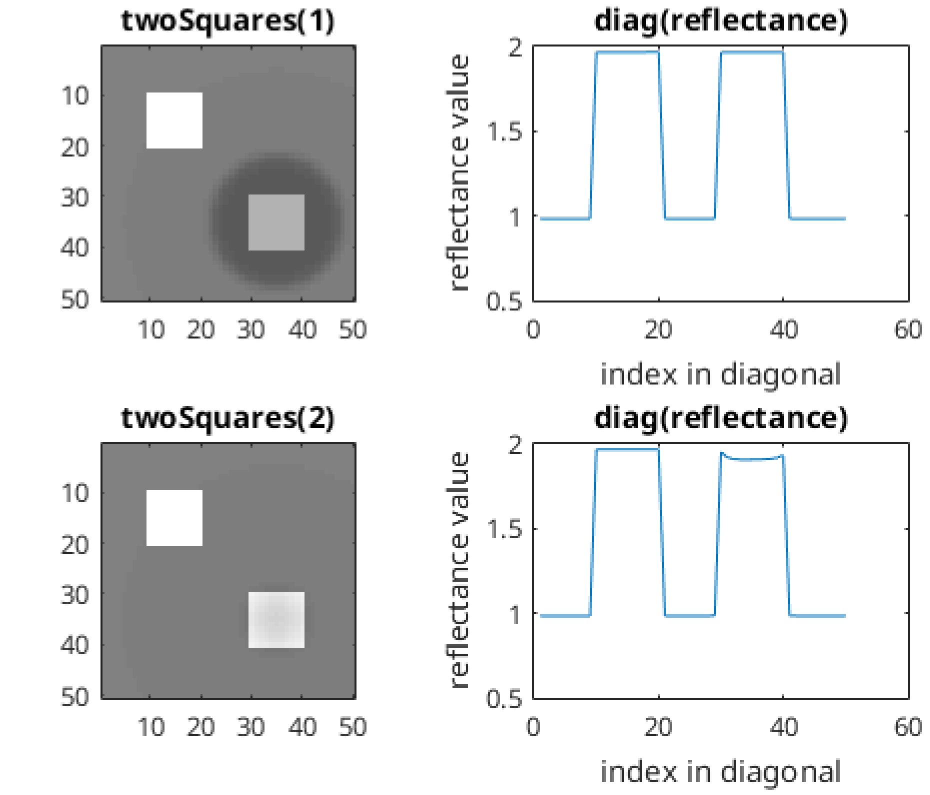


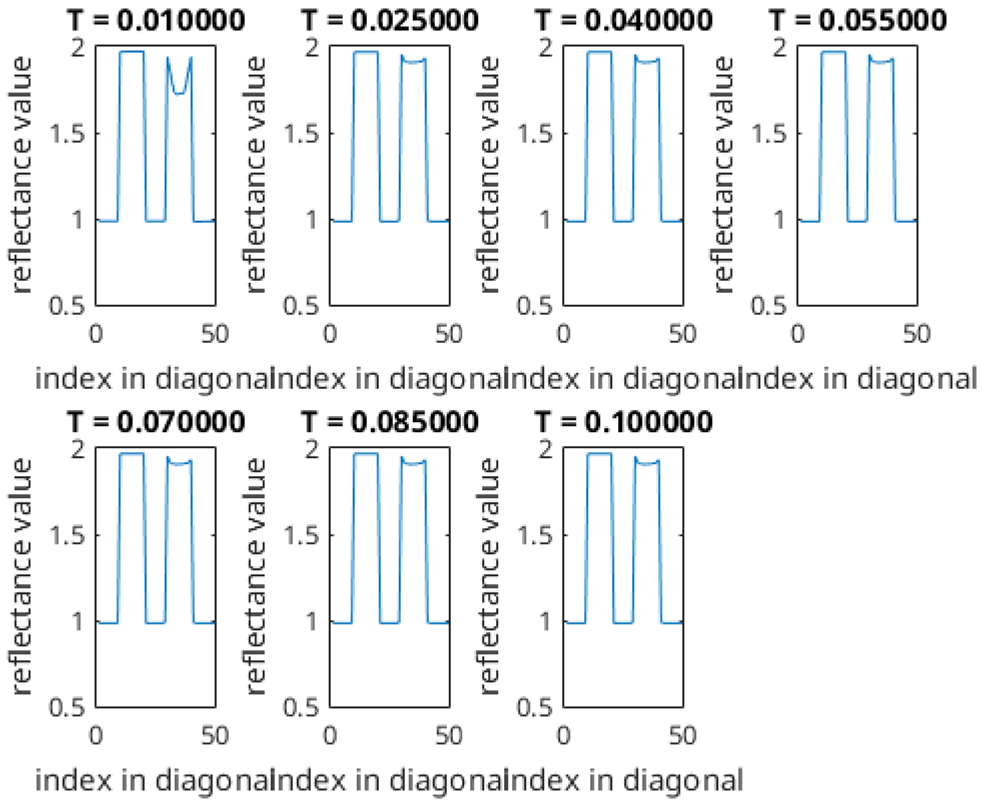
question 9

generate & show the stimuli

```
figure();
I1 = twoSquares(1);
I2 = twoSquares(2);

subplot(2, 2, 1);
show(I1, [0 2]);
```

```
title('twoSquares(1)');
subplot(2, 2, 3);
show(I2, [0 2]);
title('twoSquares(2)');

% run retinex
T = 0.07;
[R1, L1] = do_retinex(I1, T);
subplot(2, 2, 2);
plot(diag(R1));
title('diag(reflectance)');
xlabel('index in diagonal');
ylabel('reflectance value');

[R2, L2] = do_retinex(I2, T);
subplot(2, 2, 4);
plot(diag(R2));
title('diag(reflectance)');
xlabel('index in diagonal');
ylabel('reflectance value');

% check if changing T helps

figure();
T_space = 0.01:0.015:0.1;
k = numel(T_space);

for i = 1:k
    T = T_space(i);
    [R, ~] = do_retinex(I2, T);
    subplot(2, ceil(k/2), i);
    plot(diag(R));
    title(sprintf('T = %f', T));
    xlabel('index in diagonal');
    ylabel('reflectance value');
end

% it does not.
```



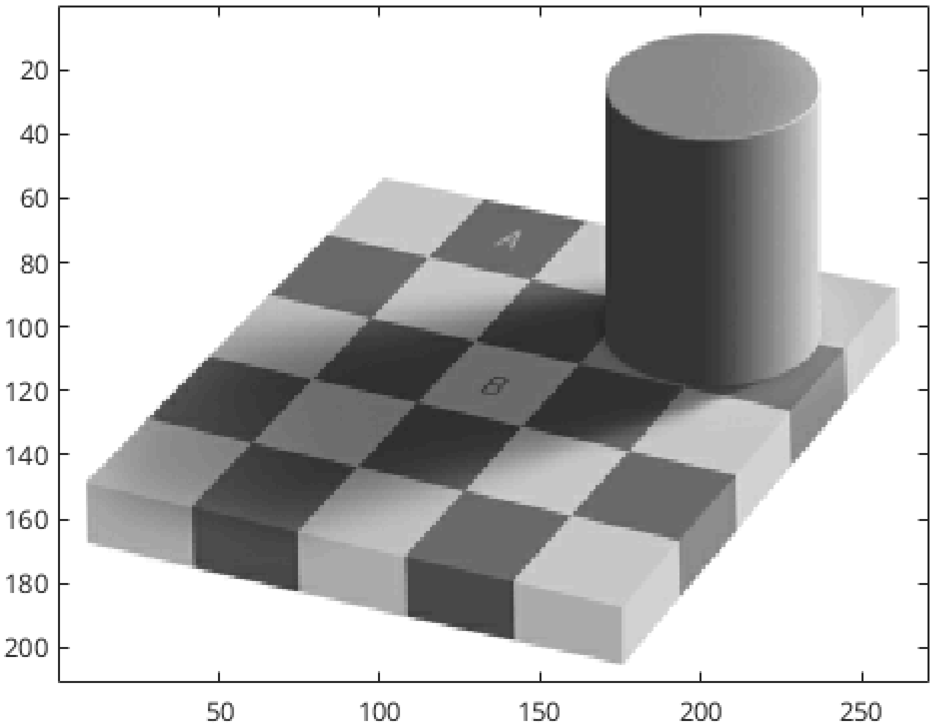


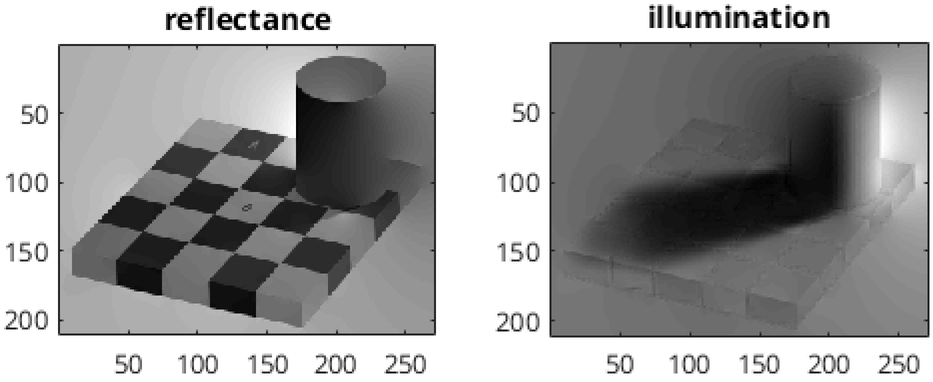
qeustion 10

```
figure();
checker = load(Q10_DATA);
show(checker.im1, [0 1]);
x1 = checker.x1; x2 = checker.x2;
y1 = checker.y1; y2 = checker.y2;
fprintf('A = %f \t B = %f\n', checker.im1(y1,x1), checker.im1(y2,x2));
% indeed, A = B = 0.419608
T = 0.07;
```

```
[R, L] = do_retinex(checker.im1, T);
fprintf('R(A) = %f \t R(B) = %f\n', R(y1,x1), R(y2,x2));
% as perceived: R(A) = 0.566 < 0.876 = R(B)
figure();
subplot(1, 2, 1);
show(R);
title('reflectance');
subplot(1, 2, 2);
show(L);
title('illumination');
```

```
A = 0.419608     B = 0.419608
R(A) = 0.566459          R(B) = 0.876770
```



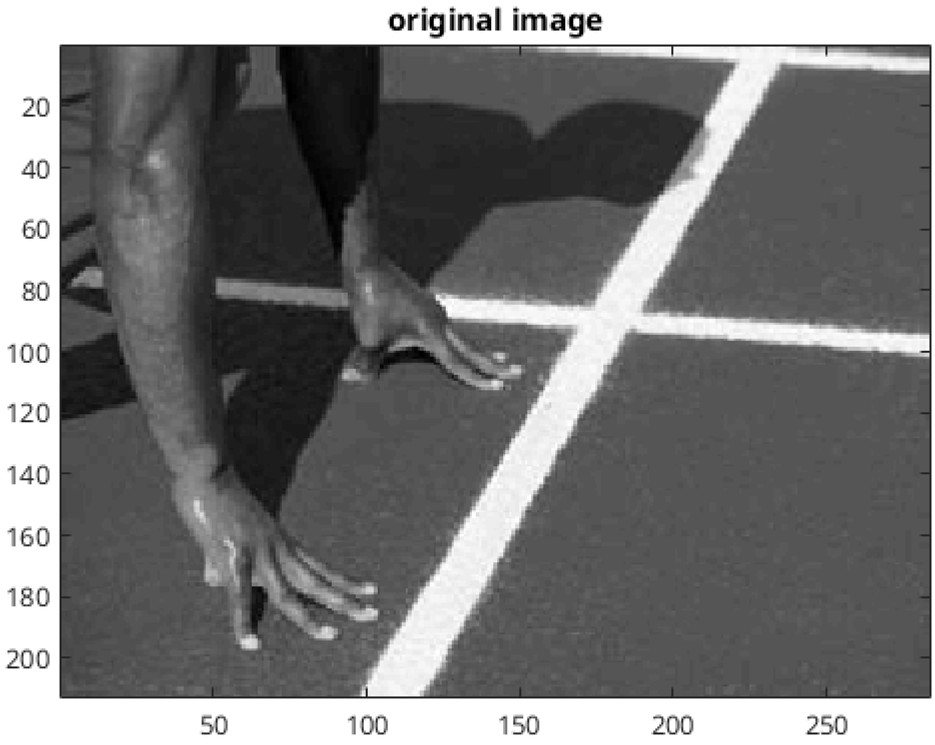

reflectance

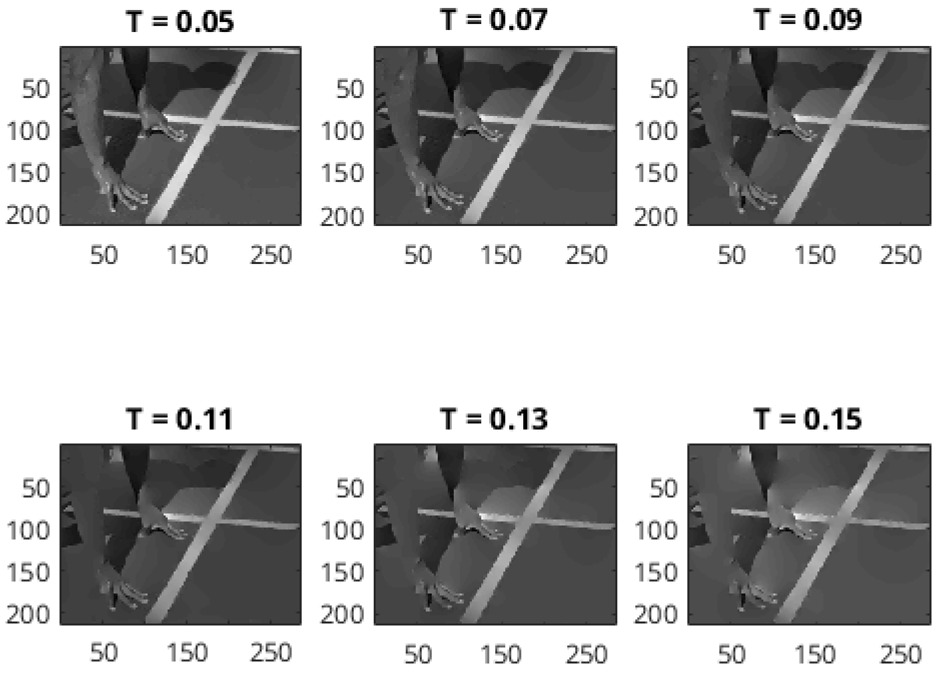
illumination

question 11

```
figure();
runner = load(Q11_DATA);
show(runner.im1);
title('original image');
T_space = 0.05:0.02:0.15;
k = numel(T_space);

figure();
```

```
for i = 1:k
    subplot(2, ceil(k/2), i);
    T = T_space(i);
    [R, L] = do_retinex(runner.im1, T);
    show(R);
    title(['T = ' num2str(T)]);
end
```


original image


T = 0.05

T = 0.07

T = 0.09

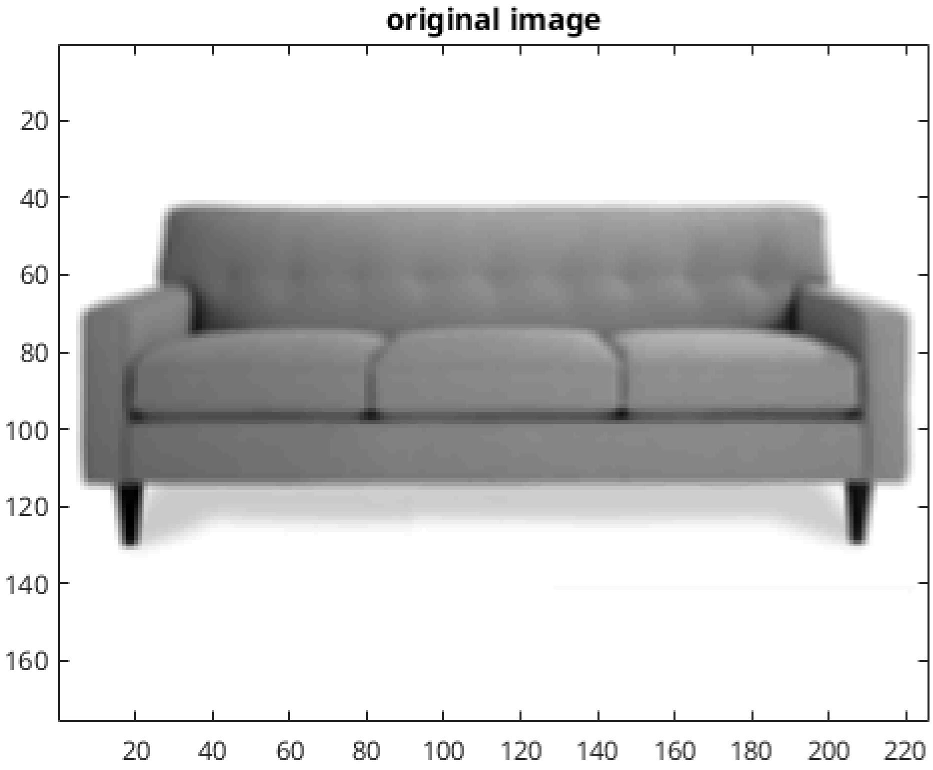
T = 0.11

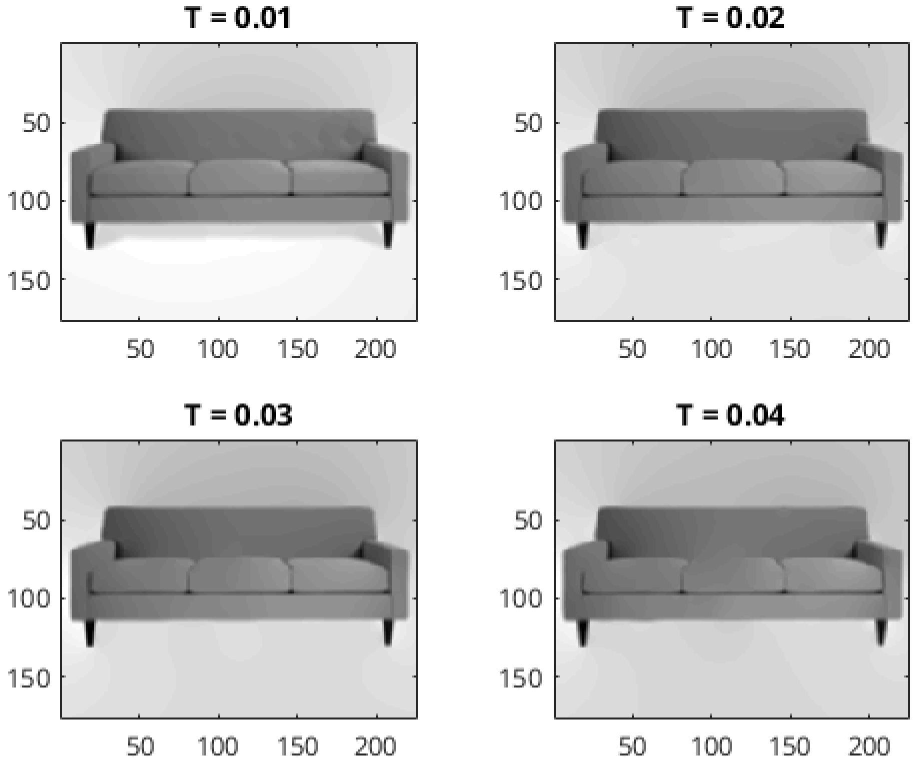
T = 0.13

T = 0.15

question 12

```
figure();
couch = load(Q12_DATA);
show(couch.im1);
title('original image');
T_space = 0.01:0.01:0.04;
k = numel(T_space);

figure();
for i = 1:k
    subplot(2, ceil(k/2), i);
    T = T_space(i);
    [R, L] = do_retinex(couch.im1, T);
    show(R);
    title(['T = ' num2str(T)]);
end
```





Published with MATLAB® R2015a