Question 5

A beginner MATLAB programmer wrote the code below to darken a grayscale image by reducing the intensity of each pixel by half. Please retype and run their code and answer the following questions:

```matlab
close all; clear; clc;
I = imread('coins.png');
[height, width]= size(I);
J = uint8(zeros(size(I)));
for i =1:height
    for j =1:width
        J(i,j) = 0.5 * I(i,j);
    end
end
imshow(I); title('Original Image');
figure, imshow(J); title('Darkened Image (Original)');
```


Original Image

Darkened Image (Original)

a. Does the script work as expected?

Yes, the intesity of each pixel is reduced by half, making the image darker.

b. Will it still work if you remove the uint8 typecasting in line 3? Why (not)?

No, the zeros function creates a matrix of zeros, making the whole image black

c. What is the main problem with this code? Be specific!

The code is inefficient because it attempts to convert each pixels, one at a time, rather than use a function to darken the whole image at once.

d. Rewrite the code to improve its efficiency while keeping it readable.

```
clear; clc;
I = imread('coins.png');
J = imadjust(I,stretchlim(I),[0 .5]);
figure, imshow(J); title('Darkened Image (New)');
```

Darkened Image (New)

e. Compare the performance of the original code against the modified version you wrote, using tic and toc.

```
clear;
tic
I = imread('coins.png');
[height, width]= size(I);
J = uint8(zeros(size(I)));
for i =1:height
    for j =1:width
        J(i,j) = 0.5 * I(i,j);
    end
end
imshow(I); title('Original Image');
figure, imshow(J); title('Darkened Image (Original)');
t = toc;
elapsed = sprintf('The elapsed time of the original code is');
disp(elapsed)
disp(t)

%
clear;
tic
I = imread('coins.png');
J = imadjust(I,stretchlim(I),[0 .5]);
figure, imshow(J); title('Darkened Image (New)');
t = toc;
elapsed = sprintf('The elapsed time of the new code is');
disp(elapsed)
```

```
disp(t)
```

The elapsed time of the original code is
    0.8567

The elapsed time of the new code is
    0.6098

Original Image

Darkened Image (Original)

Darkened Image (New)

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