Sushitha Hanumanthappa Rajeeva
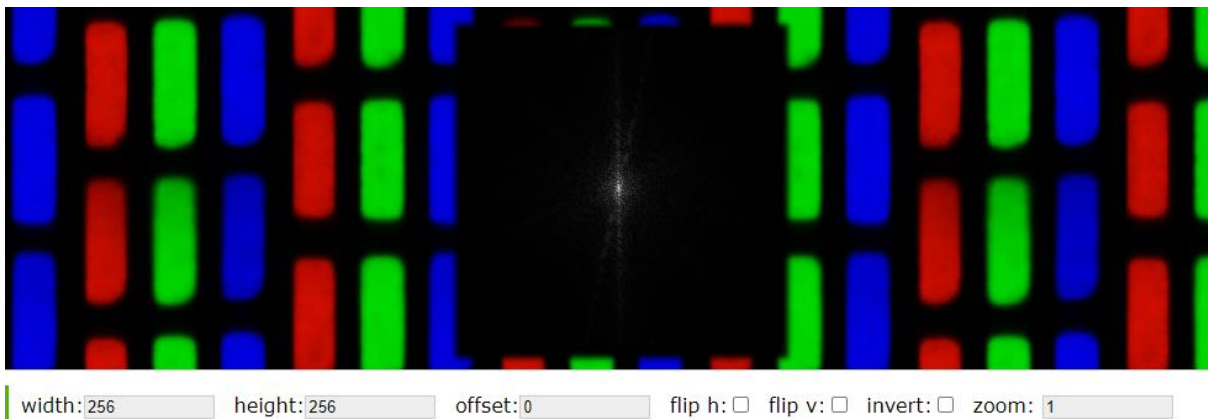
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CS825 Term Project
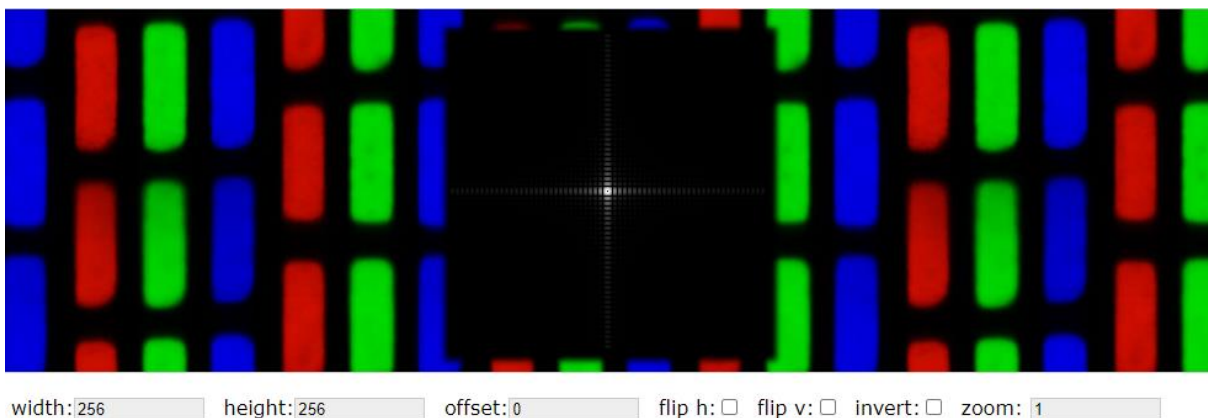
Question1:

Write a complete program that implements the FFT algorithm. Test your program with two input images:

Picture1: output image of car.raw grayscale image

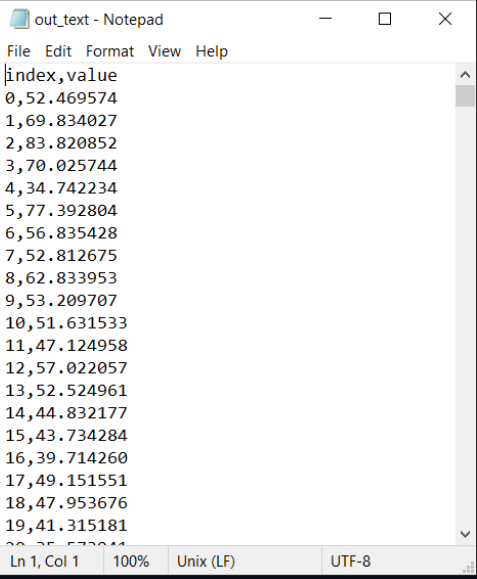Picture2: output image of square256.raw grayscale image

Question2:

Feature Vectors in Frequency Domain Fourier Transform of an image contains complete information of the image. Fourier spectrum offers an alternative domain for pattern classification and recognition. Since Fourier spectrum is a 2D array, it is potentially beneficial to derive 1D feature vectors from it for the purpose of preliminary classification with significantly reduced computational cost.

   a) One is to divide the spectrum into a set of rings

Set of Rings Methods- Part of computation performed with input car image

```
> clang-7 -pthread -lm -o main main.c
> ./main
Usage: ./main in.img out.img
exit status 1
> ./main car.raw out_text.text 256 256
... Load input original image
... Save the output text file
>
```
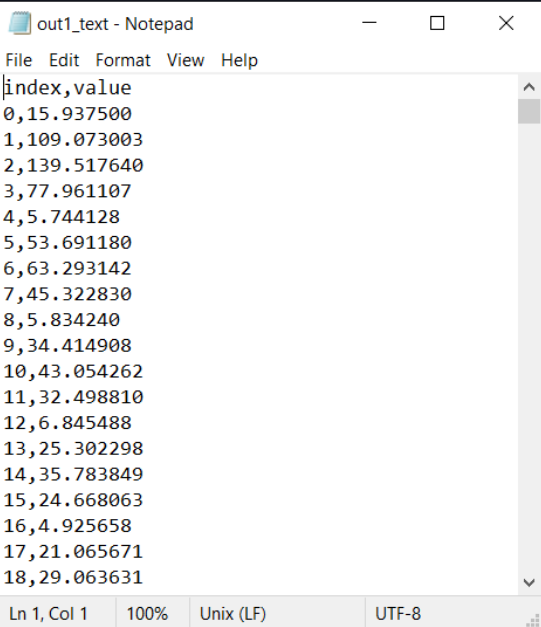
out_text - Notepad

File Edit Format View Help

```
index,value
0,52.469574
1,69.834027
2,83.820852
3,70.025744
4,34.742234
5,77.392804
6,56.835428
7,52.812675
8,62.833953
9,53.209707
10,51.631533
11,47.124958
12,57.022057
13,52.524961
14,44.832177
15,43.734284
16,39.714260
17,49.151551
18,47.953676
19,41.315181
```

Ln 1, Col 1   100%   Unix (LF)   UTF-8

Set of Rings Method – Frequency Histogram using set of rings for car image

Frequency histogram of spectrun using Ring Scanning
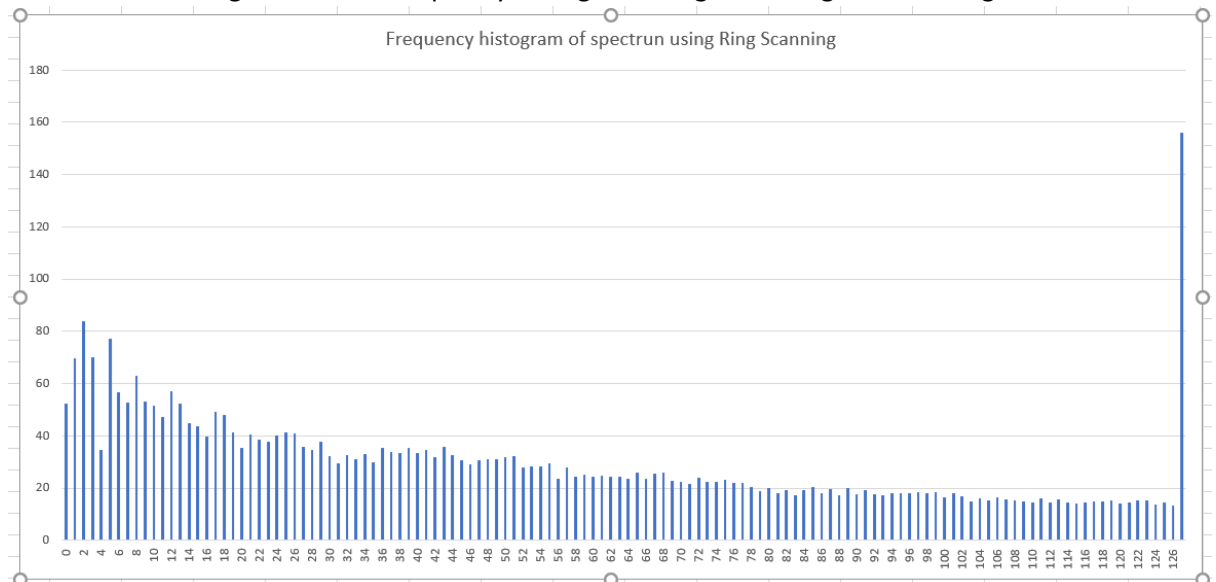
Set of Rings Methods- Part of computation performed with input square image

```
> ./main square256.raw out1_text.text 256 256
... Load input original image
... Save the output text file
>
```

out1_text - Notepad

File Edit Format View Help

```
index,value
0,15.937500
1,109.073003
2,139.517640
3,77.961107
4,5.744128
5,53.691180
6,63.293142
7,45.322830
8,5.834240
9,34.414908
10,43.054262
11,32.498810
12,6.845488
13,25.302298
14,35.783849
15,24.668063
16,4.925658
17,21.065671
18,29.063631
```

Ln 1, Col 1   100%   Unix (LF)   UTF-8

Set of Rings Method – Frequency Histogram using set of rings for Square image

Frequency histogram of spectrun using Ring Scanning
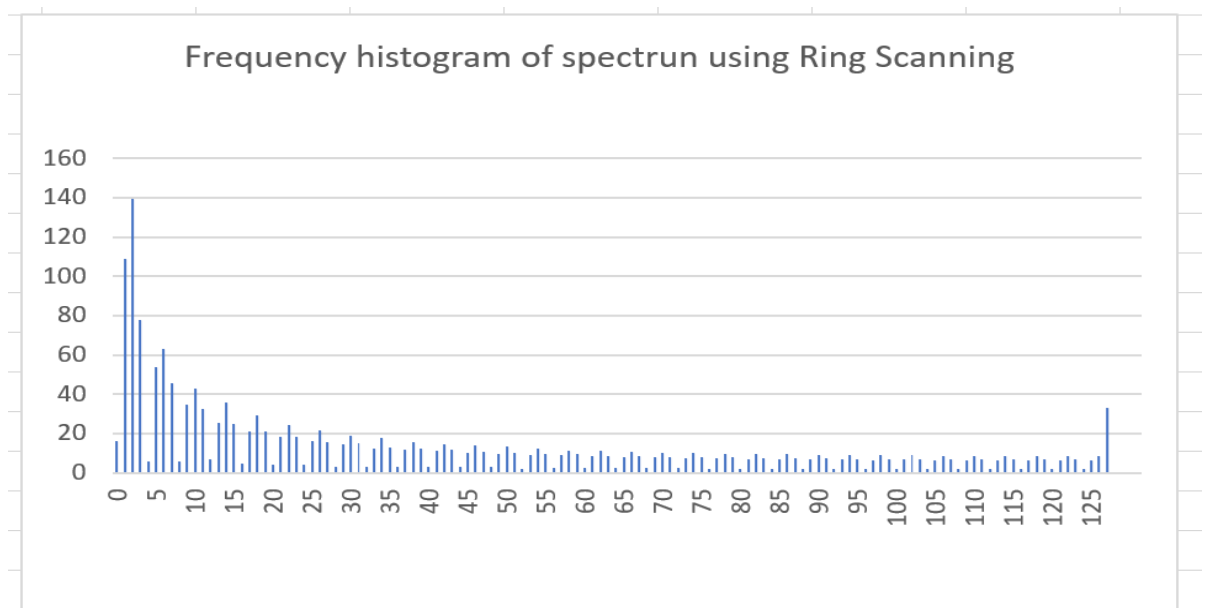
b) Another one is to divide the spectrum into angular sectors:

Figure: Computation performed for car image using angular sector method

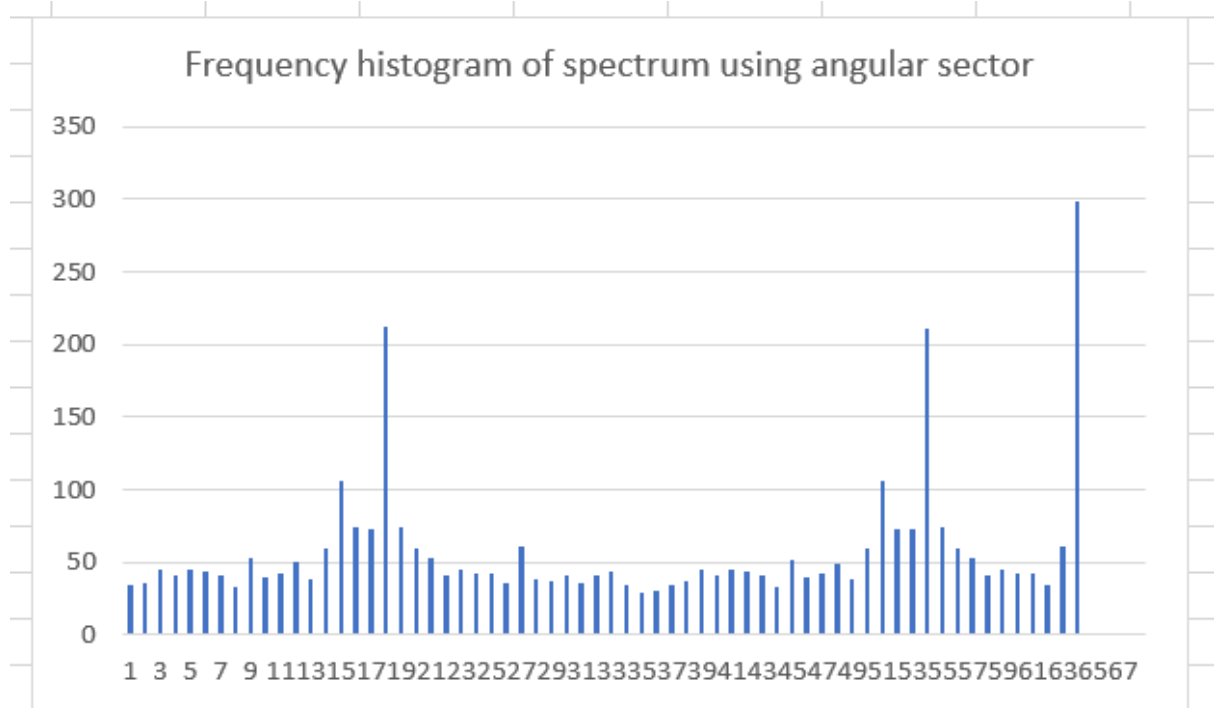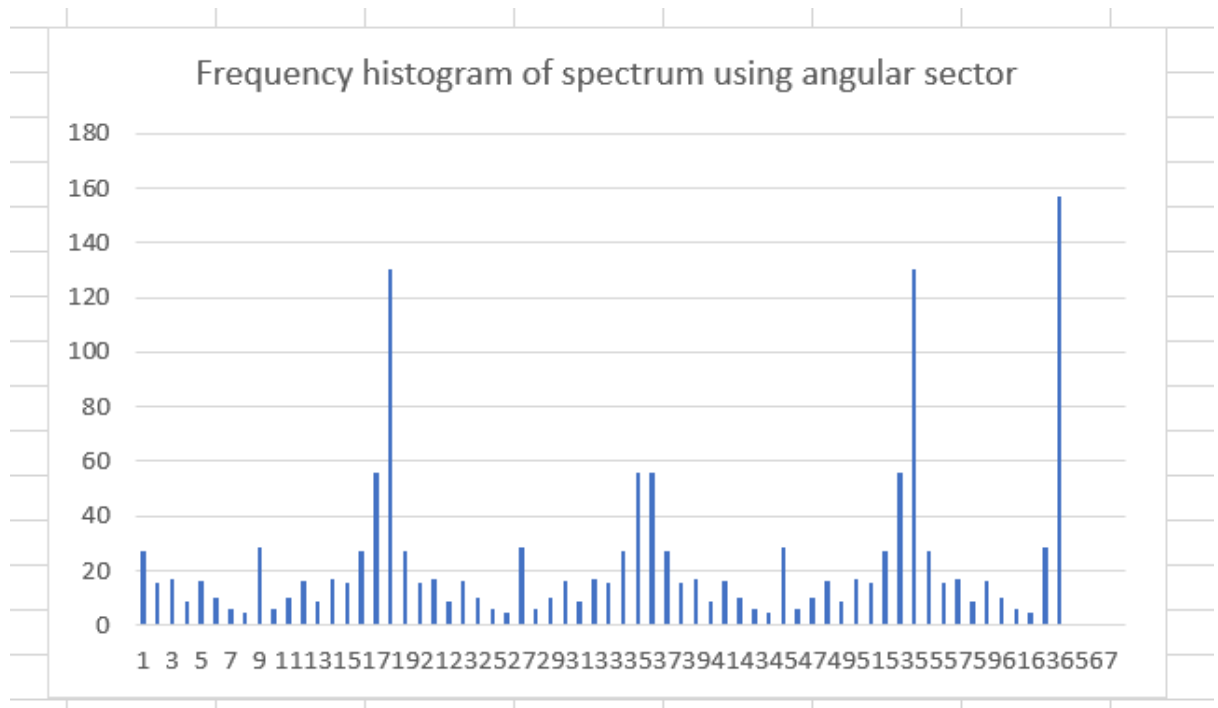Frequency histogram of spectrum using angular sector

Figure: Computation performed for square256 image using angular sector method

Frequency histogram of spectrum using angular sector

Question3:

Write complete programs to implement ideal low-pass and high-pass filtering algorithms respectively. Test your programs with at least two cut-off frequencies.
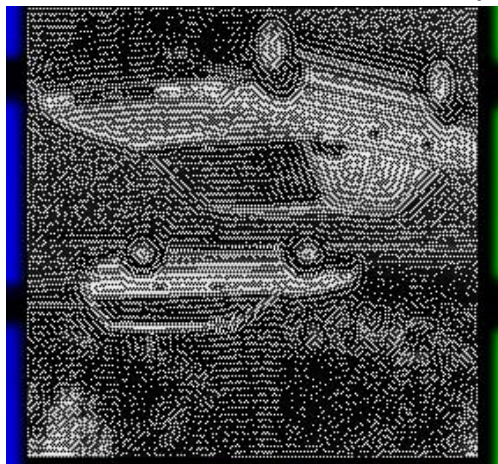
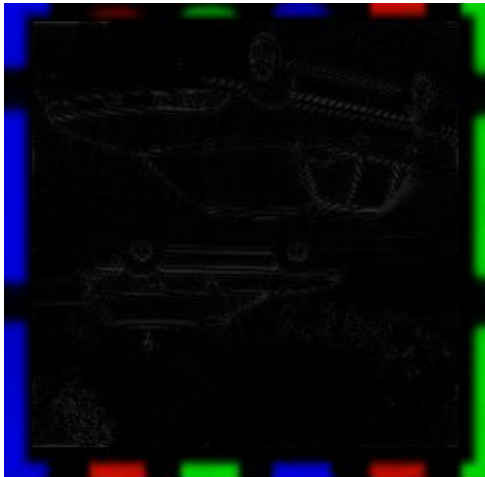**Low pass filter for the car with the cut off frequency 40**
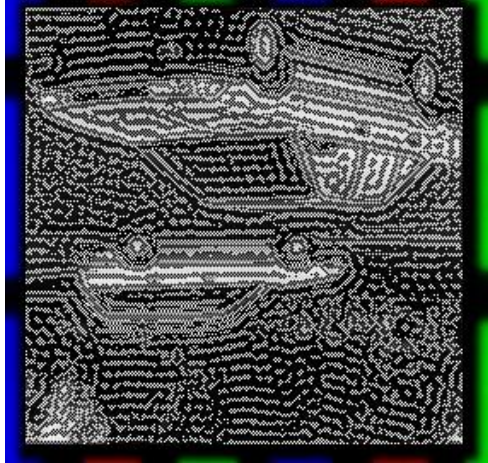
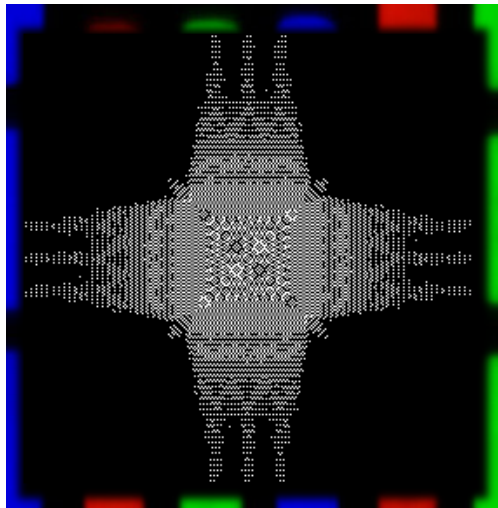**High pass filter for the car with the cut off frequency 40**
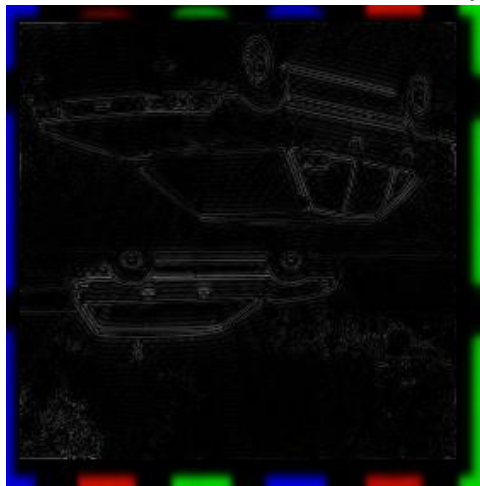
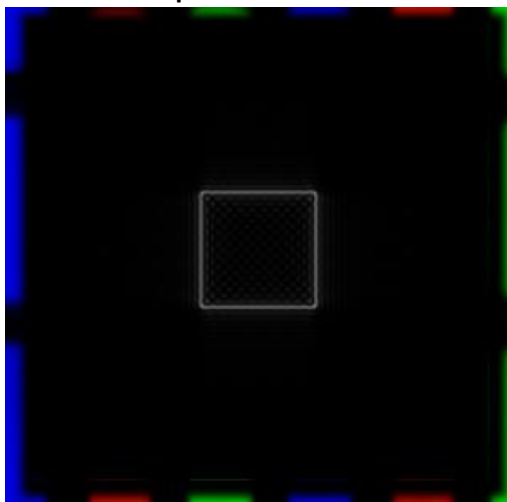**Low pass filter for the car with the cut off frequency 70**

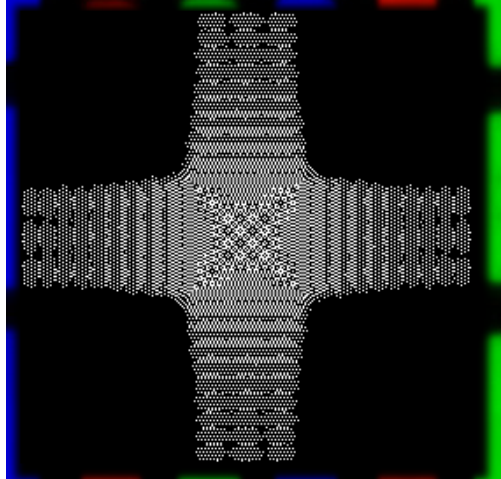**High pass filter for the car with the cut off frequency 70**

Low pass filter for the square256 with the cut off frequency 40

High pass filter for the square256 with the cut off frequency 40

Low pass filter for the square256 with the cut off frequency 70

High pass filter for the square256 with the cut off frequency 70