

ECGR 6118
Computer Project: Image Enhancement
Student Name: _____

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For this project, you may use mathcad or NetBeans

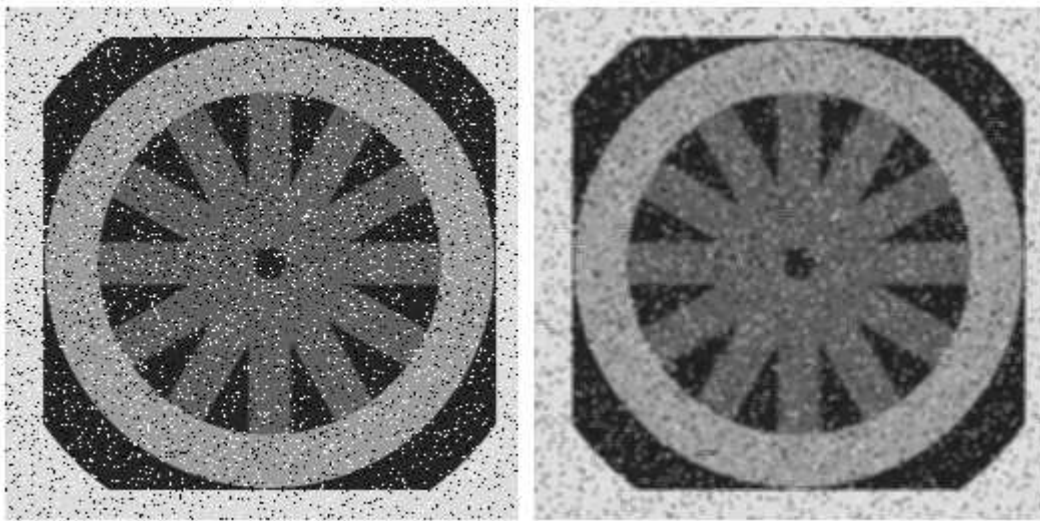
Project tasks:

Complete the tasks below and turn in a project report.

Turn in a 6-page report,
with page-1 cover sheet,
page 2 explaining the methods you used,
pages 3 - 7 being 6x6 inch printouts of your images for each of the tasks below.
Make sure that you caption each image, clearly stating what the image is.
Include your Mathcad or Java as an appendix.

1. For the salt-and-pepper noisy wheel image, spwheel.gif, write a program to form the 3x3 mean filtered image (3x3 average), and plot the filtered image.

Below, the input image is illustrated on the left, and a 3x3 median is illustrated on the right. Do not use the image below, download the original image from the website.



2. For the salt-and-pepper noisy wheel image, spwheel.gif, write a program to form the 3x3 median filtered image, and plot the filtered image.

3. For the trail1d.gif image, illustrated below, write a program to histogram equalize the image, and plot the enhanced image. Do not use the image below, download the original image from the website.



4. For the brain scan image, mri.gif, write a program to sharpen the image using the following mask. You will likely need to rescale the image after filtering with the mask.

$$\begin{pmatrix} -1 & -1 & -1 \\ -1 & 9 & -1 \\ -1 & -1 & -1 \end{pmatrix}$$

Small Kernel Convolution, 3x3 mask example

define a mask

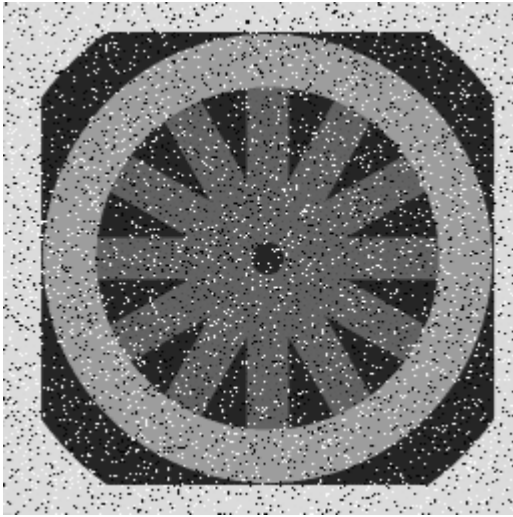
$$\text{mask} := \begin{pmatrix} 0.11 & -0.011 & 0.11 \\ 0.11 & -0.011 & 0.11 \\ 0.11 & -0.011 & 0.11 \end{pmatrix}$$

```
filter2d3x3(f, mask) :=
  nc ← cols(f)
  nr ← rows(f)
  for rr ∈ 0..rows(f) - 1
    for cc ∈ 0..cols(f) - 1
      yrr, cc ← 0
      for j ∈ -1..1
        for k ∈ -1..1
          yrr, cc ← yrr, cc + maskj+1, k+1 fmod(rr+j+nr, nr), mod(cc+k+nc, nc)
      y ← floor(y)
  return y
```

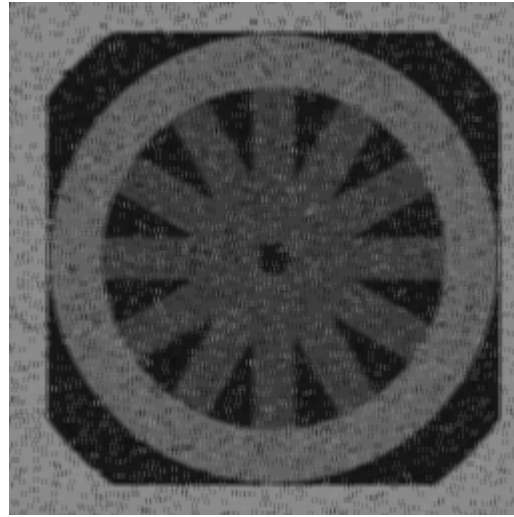
```
infile := READBMP("spwheel.gif")
```

```
out2 := filter2d3x3(infile, mask)
```

```
max(out2) = 147    min(out2) = 12
```



infile



out2

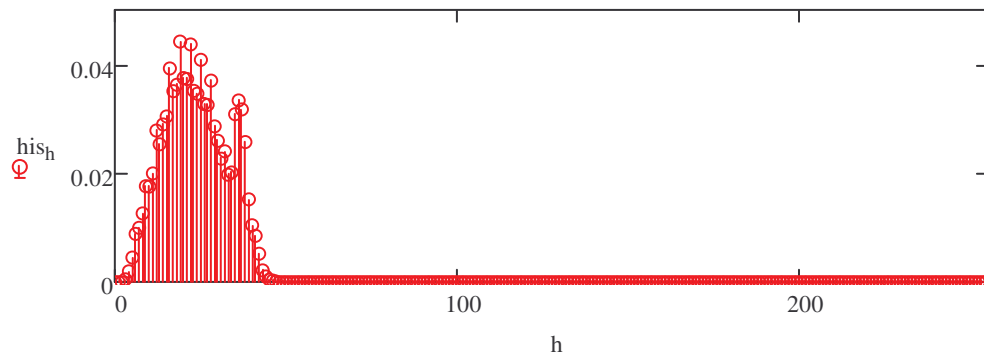
Histogram Example

```
histo_img(f) := | nc ← rows(f)
                 | y ← submatrix(f,0,rows(f) - 1,0,0)
                 | for cc ∈ 1..cols(f) - 1
                 |   | tempa ← submatrix(f,0,rows(f) - 1,cc,cc)
                 |   | y ← stack(y,tempa)
                 | for lev ∈ 0..255
                 |   bins_lev ← lev
                 |   z ← hist(bins,y)
                 |   z ←  $\frac{z}{rows(f) \cdot cols(f)}$ 
                 |   z
```

```
infile := READBMP("trail1d.gif")
```

```
his := histo_img(infile)
```

```
h := 0..255
```



CDF Example

```

cdf_img(f) := | nc ← rows(f)
               | y ← submatrix(f,0,rows(f) - 1,0,0)
               | for cc ∈ 1..cols(f) - 1
               |   | tempa ← submatrix(f,0,rows(f) - 1,cc,cc)
               |   | y ← stack(y,tempa)
               | for lev ∈ 0..255
               |   bins_lev ← lev
               |   z ← hist(bins,y)
               |   for rr ∈ 1..rows(z) - 1
               |     z_rr ← z_rr + z_rr-1
               |   z ←  $\frac{z}{\text{rows}(f) \cdot \text{cols}(f)}$ 
               | z

```

`cdf := cdf_img(infile)`

`h := 0..255`

