Program Assignment 1, EE5352

1. Using the histogram pseudocode given on the last 3 pages, construct a histogram function which inputs an array x of dimension Nx and a parameter Ny, which is the number of desired histogram bins. The outputs are a histogram array y of dimension Ny and a second array z of dimension Ny. After calculating a histogram, you can plot y versus z.

2. Using a random number generator, generate 1000 pseudorandom numbers uniformly distributed between -.5 and .5, and store them in an array x. Nx is therefore 1000. Plot the histogram produced if Ny = 20.

3. Generate and plot the histogram of array \( x_1 \) if \( x_1 \) is generated as follows.

   For \( i = 1 \) to 999
   \[
   x_1(i) = x(i) + x(i+1)
   \]
   end

4. Generate and plot the histogram of array \( x_2 \) if \( x_2 \) is generated as follows.

   For \( i = 1 \) to 998
   \[
   x_2(i) = x(i) + x(i+1) + x(i+2)
   \]
   end
Pseudocode for the histogram function is given below.

Given:
Nx data samples in an array x
Ny, which is the desired number of bins in the histogram, and
Nsmt, which is related to the amount of histogram smoothing to use.

Create arrays x, y, z with dimensions Nx, Ny, and Ny respectively.

GET MAX AND MIN OF x

Xm=x(1)
Xn=Xm

For i = 2 to Nx
IF(x(i) > Xm) Xm=x(i)
IF(x(i) < Xn) Xn=x(i)
End

B=(Ny-.02)/(Xm-Xn)
A=1.01-B*Xn

For i = 1 to Ny
y(i)=0.
End

CALCULATE BIN ARRAY y

For i = 1 to Nx
II=A+B*x(i)
II=floor(II)
y(II)=y(II)+1.
End

SMOOTH y AND PUT IT IN z

Xv=1./(2.*Nsmt+1.)
I1=Nsmt+1
I2=Ny-Nsmt
Np=2*Nsmt+1
For i= I1 to I2
S=0.
J1=i-Nsmt-1
For j = 1 to Np
J1 = J1 + 1
S = S + y(J1)
End

z(i) = XV * S
End

IF(Nsmt = 0) GO TO 9

Np = 1.5 * NSMT + .5
XV = 1. / Np

For i = 1 to I1 - 1
S = 0.
For j = 1 to Np
S = S + y(i + j - 1)
End
z(i) = XV * S
End

For i = I2 + 1 to Ny
S = 0.
For j = 1 to Np
S = S + Y(I - J + 1)
End
z(i) = XV * S
End

PUT SMOOTHED Z BACK INTO Y

9
For i = 1 to Ny
y(i) = z(i)
End

PUT X-AXIS INTO Z

For i = 1 to Ny
z(i) = (i - A) / B
End

NORMALIZE Y SO THAT ITS INTEGRAL IS 1.

G = 0.
For i = 1 to Ny
G = G + y(i)
End

V = B / G
For i = 1 to Ny
\[ y(i) = V \cdot y(i) \]
End

The final histogram is \( y(i) \) versus \( z(i) \) for \( i = 1 \) to \( Ny \)