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In [5]: import numpy
import random
import matplotlib.pyplot as plt
import scipy.stats as sps
%matplotlib inline

k = 5
N = 10**4
Arr = sps.cauchy.rvs(size = N)
h = []
for i in range (N):
    h += [0]

def plot(n):
    x = range(n)
    Y = []
    for i in range(n):
        Y += [sps.cauchy.pdf(i)]
    plt.plot(x, Y, color = 'm', label = "density graph N = " + str(n))

    plt.plot(Arr, h, color = 'b', label = "sample")

    legend = plt.legend(loc='upper center', shadow=True, fontsize='x-large')
    legend.get_frame().set_facecolor('#00FFCC')
    plt.ylim(0, 0.01)
    plt.show()

def countS1(n,s1, arr):
    s1 += arr[n]
    return s1

def countS2(n, s2, arr):
    s2 += arr[n]**2
    return s2

def countRealDispersion(n, s1, s2, arr):
    return (s2 / (n+1) - s1**2 / (n+1)**2)

def plotDispersion(n, arr):
    x = range(n)
    S1 = 0
    S2 = 0
    Y = []

    for i in range(n):
        S1 = countS1(i, S1, arr)
        S2 = countS2(i, S2, arr )
        Y += [countRealDispersion(i, S1, S2, arr)]

    plt.plot(x, Y, color = 'm', label = "dispersion")# Dispersion cauchy not exist
    plt.show()

plot(N)
plotDispersion(N, Arr)

```



