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In [3]: import random
import matplotlib.pyplot as plt
from matplotlib import mlab

%matplotlib inline

Q = 1
N = 10**4
Arr = []

def rand(q):
    a = []
    for i in range(N):
        a += [random.uniform(0, q)]
    return a

def countFirst(a, n, q):
    sample = a[:n]
    return abs(2 * sum(sample)/n - q)

def countSecond(a, n, q):
    sample = a[:n]
    return abs(sum(sample)/n + max(sample)/2 - q)

def countThird(a, n, q):
    sample = a[:n]
    return abs((n+1)*min(sample) - q)

def countFourth(a, n, q):
    sample = a[:n]
    return abs(max(sample) + min(sample) - q)

def countFifth(a, n, q):
    sample = a[:n]
    return abs((n+1)/n*max(sample) - q)

def plot(countFunc, arr, n, q, col, name):
    x = range(n)
    Y = []
    for i in range(n):
        Y += [countFunc(arr, i + 1, q)]
    plt.plot(x, Y, color = col, label = name)

def research(q, yMin, yMax):
    Arr = rand(q)
    plot(countFirst, Arr, N, q, 'r', "2X")
    plot(countSecond, Arr, N, q, 'g', "X + Xmax / 2")
    plot(countThird, Arr, N, q, 'b', "(n+1)*Xmin")
    plot(countFourth, Arr, N, q, 'y', "Xmin+Xmax")
    plot(countFirst, Arr, N, q, 'm', "(n+1)/n * Xmax")
    Arr = []

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

    plt.ylim(yMin, yMax)

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