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"""
Registration : xxxx
Description  : Monte Carlo Integration (using Mean Value Theorem)
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"""

import numpy as np
from scipy.integrate import quad
import matplotlib.pyplot as plt

def f(x): return np.sin(x)

# Enter upper, lower limit of integration and total number of points
a, b, N = 0, np.pi, 100000000

# Compute the integral
x = np.random.uniform(a, b, N)
y = f(x)
I_mc = (b-a)*sum(y)/N

# Check with direct method
I_quad  = quad(f, a, b)[0]

print ('Integral_'+str(a)+'^'+str(b)+' sin(x) dx (Quad Method) = ', I_quad)
print ('Sample Points = '+str(N)+', Integral_'+str(a)+'^'+str(b)+' sin(x) dx (MC Method) =
', I_mc)

"""
Results
                    Integral_0^3.141592653589793 sin(x) dx (Quad Method)      = 2.0
Sample Points = 10, Integral_0^3.141592653589793 sin(x) dx (MC Method)        =
2.34920220593117
Sample Points = 100, Integral_0^3.141592653589793 sin(x) dx (MC Method)       =
1.8739854354580439
Sample Points = 1000, Integral_0^3.141592653589793 sin(x) dx (MC Method)      =
1.9829715929133231
Sample Points = 10000, Integral_0^3.141592653589793 sin(x) dx (MC Method)     =
1.9953162447092658
Sample Points = 100000, Integral_0^3.141592653589793 sin(x) dx (MC Method)    =
2.003114874189956
Sample Points = 1000000, Integral_0^3.141592653589793 sin(x) dx (MC Method)   =
2.0012093278663343
Sample Points = 10000000, Integral_0^3.141592653589793 sin(x) dx (MC Method)  =
2.000242813299424
Sample Points = 100000000, Integral_0^3.141592653589793 sin(x) dx (MC Method) =
2.000069158393095
"""
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