# matrix - Matrix Multiplication

import random

import numpy as np

import time

N = 100

A = np.random.randint(0, N, size=(N, N))

B = np.random.randint(0, N, size=(N, N))

C = np.zeros((N, N), dtype=int)

start = time.time()

for i in range(N):

for j in range(N):

C[i][j] = 0

for k in range(N):

C[i][j] += A[i][k] \* B[k][j]

duration = time.time() - start

print("Serial Multiply Matrix and matrix:", duration)

start = time.time()

C = np.dot(A, B)

duration = time.time() - start

print("Parallel Multiply Matrix and matrix:", duration)

# Matrix -Vector Multiplication

import random

import numpy as np

import time

M = 700

# Multiply Vector and matrix

A = np.random.randint(0, M, size=(M, M))

a = np.random.randint(0, M, size=M)

d = np.zeros(M, dtype=int)

# serial

start = time.time()

for i in range(M):

sum = 0

for j in range(M):

sum += A[i][j] \* a[j]

d[i] = sum

duration = time.time() - start

print("Serial Multiply Vector and matrix:", duration)

# parallel

start = time.time()

d = np.dot(A, a)

duration = time.time() - start

print("Parallel Multiply Vector and matrix:", duration)

# Vector Addition

N = 10000000

# Addition of two vectors

a = [random.randint(0, N) for \_ in range(N)]

b = [random.randint(0, N) for \_ in range(N)]

c = np.zeros(N, dtype=int)

start = time.time()

for i in range(N):

c[i] = b[i] + a[i]

duration = time.time() - start

print("Serial vector addition:", duration)

start = time.time()

c = np.add(a, b)

duration = time.time() - start

print("Parallel vector addition:", duration)

print("\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*")