

Serial vs parallel

python

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```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from mpi4py import MPI
import time
```

```
def f(x):
    return(x**2 + x**4+ np.sin(x) + np.cos(x) +x**25)
```

```
analytical = 613/390 + np.sin(1) - np.cos(1)
```

```
def mc(n):
    pyunif = np.random.uniform(0,1,n)
    EX = np.mean(f(pyunif))
    error = np.abs(EX-analytical)
    return(EX,error)
```

```
N = np.arange(1000000,10000001,2500000)
N = [10,100,1000]
EX = []
error = []
type = []
walltime = []
for n in N:
    start = time.time()
    ex,err = mc(n)
    end = time.time()
    EX.append(ex);error.append(err);type.append("MCser");walltime.append(end-start)

    # start = time.time()
    # ex,err = mcPar(n)
    # end = time.time()
    # EX.append(ex);error.append(err);type.append("MCser");walltime.append(end-start)
```

```
## (None, None)
## (None, None)
## (None, None)
```

```
dict = {"n": np.repeat(N,1),"EX": EX,"error":error,"type":type,"walltime":walltime}
print(dict)
```

```
## {'n': array([ 10, 100, 1000]), 'EX': [1.651900497885936, 1.8977417155326706, 1.8980953831457072],
```

```
df = pd.DataFrame(dict)
print(df)
```

```
##      n      EX      error  type  walltime
## 0    10  1.651900  0.221063  MCser  0.000202
## 1   100  1.897742  0.024778  MCser  0.000076
## 2  1000  1.898095  0.025132  MCser  0.000183
```

```
df.plot(kind='line',x='n',y='walltime',style='.-',rot=0)
plt.show()
```

