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Group : CS7

UCS654

Multithreading Assignment

Task :

Multiply 100 random matrices of size 1k*1k with a constant matrix of size 1k*1k and generate the result table, graph and CPU usage.

Code for the given task :

(to be modified according to number of threads required)

```
import os, sys, time, sysconfig, threading, multiprocessing
import numpy as np

def mat():
    return np.random.rand(1000, 1000)


def task(line):
    print(line)
    conMat = mat()
    results = []
    for _ in range(100):
        ranMat = mat()
        resMat = np.matmul(ranMat, conMat)
        results.append(resMat)

    print(line)
    return

# main
startTime = time.time()
activeThreads=threading.activeCount()
print('Active threads : ', activeThreads)
line = 'Program to multiply two matrix'
print('Program Started')
print('Thread1 Starts')
t1=threading.Thread(target=task, args=(line,))
t1.start()
print('Thread2 Starts')
```

```
t2=threading.Thread(target=task, args=(line,))
t2.start()
print('Thread3 Starts')
t3=threading.Thread(target=task, args=(line,))
t3.start()
print('Thread4 Starts')
t4=threading.Thread(target=task, args=(line,))
t4.start()
print('Thread5 Starts')
t5=threading.Thread(target=task, args=(line,))
t5.start()
print('Thread6 Starts')
t6=threading.Thread(target=task, args=(line,))
t6.start()
print('Thread7 Starts')
t7=threading.Thread(target=task, args=(line,))
t7.start()

while True:
    if threading.activeCount()==activeThreads:
        break
    else :
        print('Thread is still running (remaining %d)...' % (threading.activeC
ount()-activeThreads))
        time.sleep(1)

print('Thread Ends')
print('Program Finished')
print('Total time %f sec ' % (round(time.time()-startTime, 4)))
```

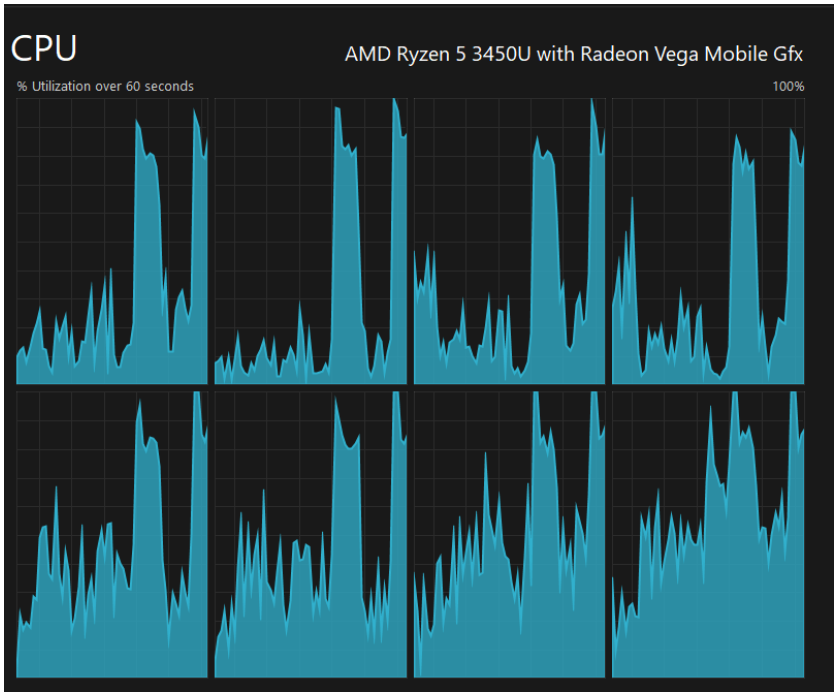
Result :

Run time and CPU Usage :

T=1

```
Active threads :  1
Program Started
Thread1 Starts
Program to multiply two matrixThread is still ru
nning (remaining 1)...

Thread is still running (remaining 1)...
Thread is still running (remaining 1)...
Thread is still running (remaining 1)...
Thread is still running (remaining 1)...
Thread is still running (remaining 1)...
Thread is still running (remaining 1)...
Thread is still running (remaining 1)...
Program to multiply two matrix
Thread Ends
Program Finished
Total time 8.059400 sec
```



T=2

```
Active threads :  1
Program Started
Thread1 Starts
Program to multiply two matrix
Thread2 Starts
Program to multiply two matrix
Thread is still running (remaining 2)...
Thread is still running (remaining 2)...
Thread is still running (remaining 2)...
Thread is still running (remaining 2)...
Thread is still running (remaining 2)...
Thread is still running (remaining 2)...
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Thread is still running (remaining 2)...
Thread is still running (remaining 2)...
Thread is still running (remaining 2)...
Thread is still running (remaining 2)...
Thread is still running (remaining 2)...
Thread is still running (remaining 2)...
Program to multiply two matrixProgram to multiply two matrix
```
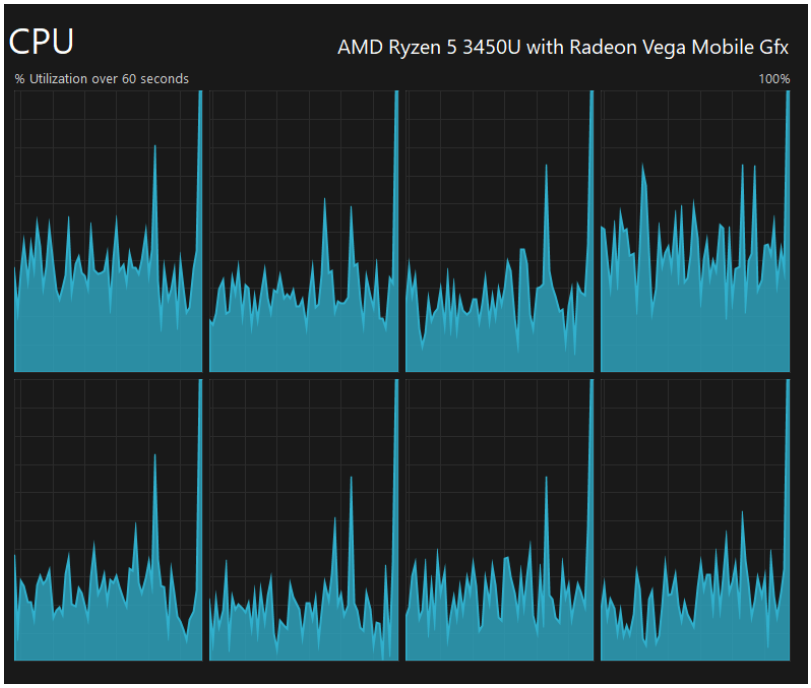

```
Thread is still running (remaining 2)...
Thread Ends
Program Finished
Total time 17.689400 sec
PS C:\Users\Shweta\Desktop\UCS654_Clustering> _
```



T=3

```
Active threads :  1
Program Started
Thread1 Starts
Program to multiply two matrix
Thread2 Starts
Program to multiply two matrixThread3 Starts

Program to multiply two matrixThread is still running (remaining 3)...

Thread is still running (remaining 3)...
Thread is still running (remaining 3)...
Thread is still running (remaining 3)...
Thread is still running (remaining 3)...
Thread is still running (remaining 3)...
Thread is still running (remaining 3)...
Thread is still running (remaining 3)...
Thread is still running (remaining 3)...
Thread is still running (remaining 3)...
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Thread is still running (remaining 3)...
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Thread is still running (remaining 3)...
Thread is still running (remaining 3)...
Thread is still running (remaining 3)...
Thread is still running (remaining 3)...
Thread is still running (remaining 3)...
Thread is still running (remaining 3)...
Program to multiply two matrixProgram to multiply two matrix

Thread is still running (remaining 3)...Program to multiply two matrix

Thread Ends
Program Finished
Total time 25.461100 sec
PS C:\Users\Shweta\Desktop\UCS654_Clustering> _
```

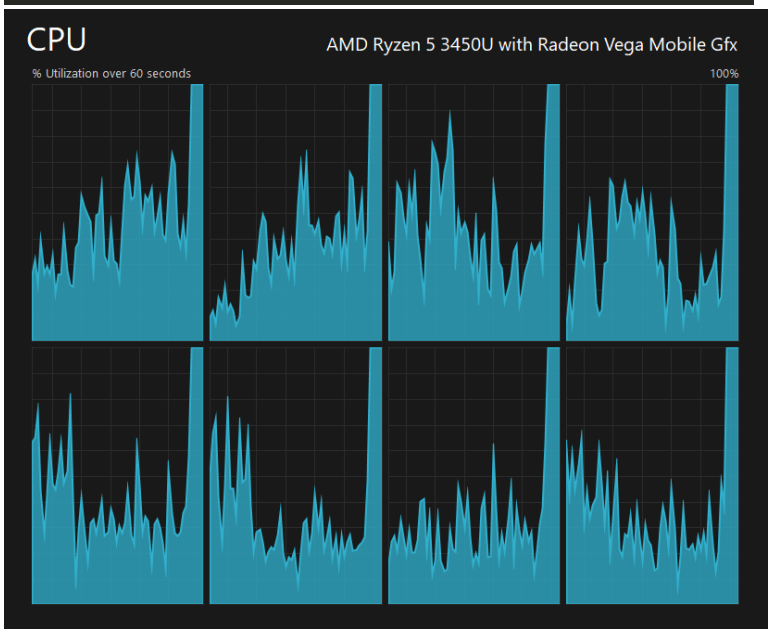

T=4

```
Active threads :  1
Program Started
Thread1 Starts
Program to multiply two matrix
Thread2 Starts
Program to multiply two matrixThread3 Starts

Program to multiply two matrixThread4 Starts

Program to multiply two matrix
Thread is still running (remaining 4)...
Thread is still running (remaining 4)...
Thread is still running (remaining 4)...
Thread is still running (remaining 4)...
Thread is still running (remaining 4)...
Thread is still running (remaining 4)...
Thread is still running (remaining 4)...
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Thread is still running (remaining 4)...
Thread is still running (remaining 4)...
Program to multiply two matrix
Program to multiply two matrixThread is still running (remaining 4)...

Program to multiply two matrixProgram to multiply two matrix

Thread Ends
Program Finished
Total time 32.874200 sec
PS C:\Users\Shweta\Desktop\UCS654_Clustering> _
```

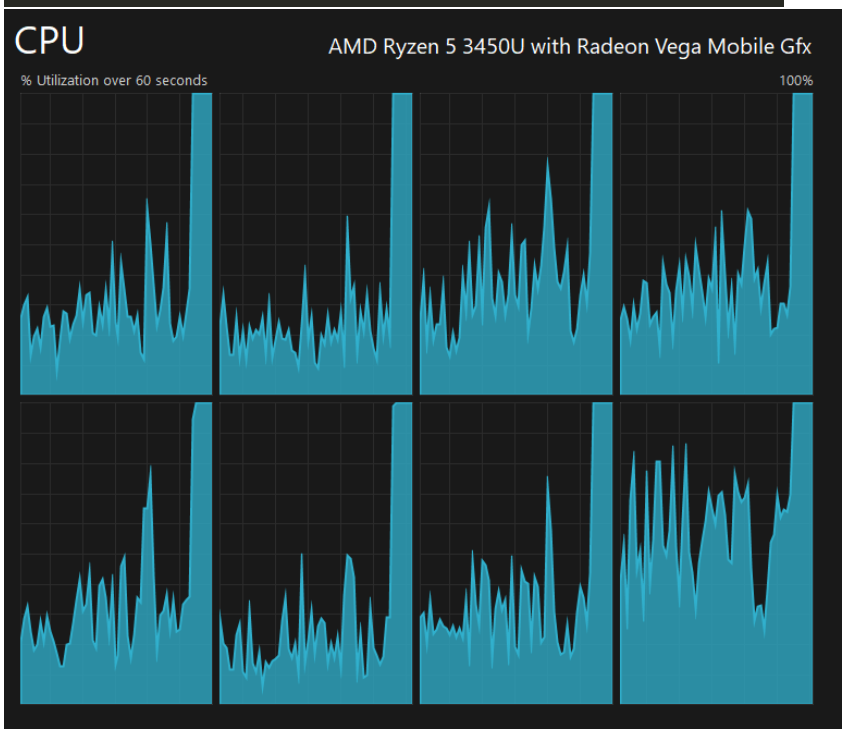

T=5

```
Active threads :  1
Program Started
Thread1 Starts
Program to multiply two matrixThread2 Starts

Program to multiply two matrixThread3 Starts

Program to multiply two matrixThread4 Starts

Program to multiply two matrix
Thread5 Starts
Program to multiply two matrix
Thread is still running (remaining 5)...
Thread is still running (remaining 5)...
```

```
Thread is still running (remaining 5)...
Thread is still running (remaining 5)...
Thread is still running (remaining 5)...
Thread is still running (remaining 5)...
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Thread is still running (remaining 5)...
Thread is still running (remaining 5)...
Thread is still running (remaining 5)...
```
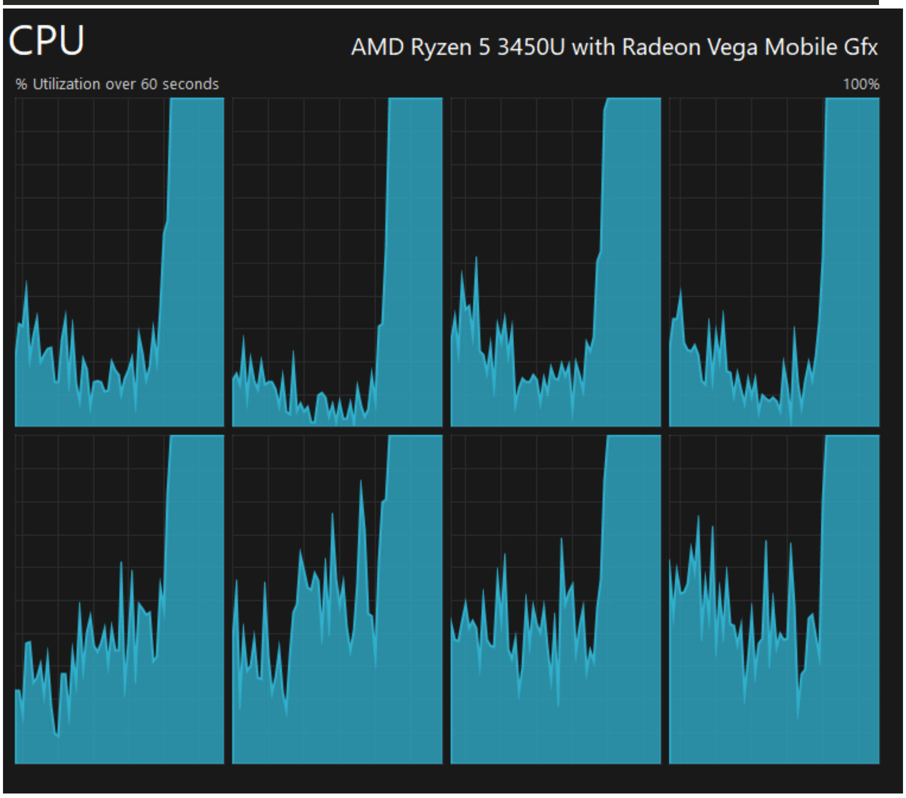

```
Thread is still running (remaining 5)...
Thread is still running (remaining 5)...
Program to multiply two matrixProgram to multiply two matrix
Program to multiply two matrix
Program to multiply two matrixThread is still running (remaining 5)...

Program to multiply two matrix

Thread Ends
Program Finished
Total time 64.405800 sec
PS C:\Users\Shweta\Desktop\UCS654_Clustering> conda activate base
```



T=6

```
Active threads :  1
Program Started
Thread1 Starts
Program to multiply two matrix
Thread2 Starts
Program to multiply two matrix
Thread3 Starts
Program to multiply two matrix
Thread4 Starts
Program to multiply two matrix
Thread5 Starts
Program to multiply two matrix
Thread6 Starts
Program to multiply two matrix
Thread is still running (remaining 6)...
Thread is still running (remaining 6)...
```

```
Thread is still running (remaining 6)...
Thread is still running (remaining 6)...
Thread is still running (remaining 6)...
Thread is still running (remaining 6)...
Thread is still running (remaining 6)...
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Thread is still running (remaining 6)...
Thread is still running (remaining 6)...
Thread is still running (remaining 6)...
Thread is still running (remaining 6)...
```
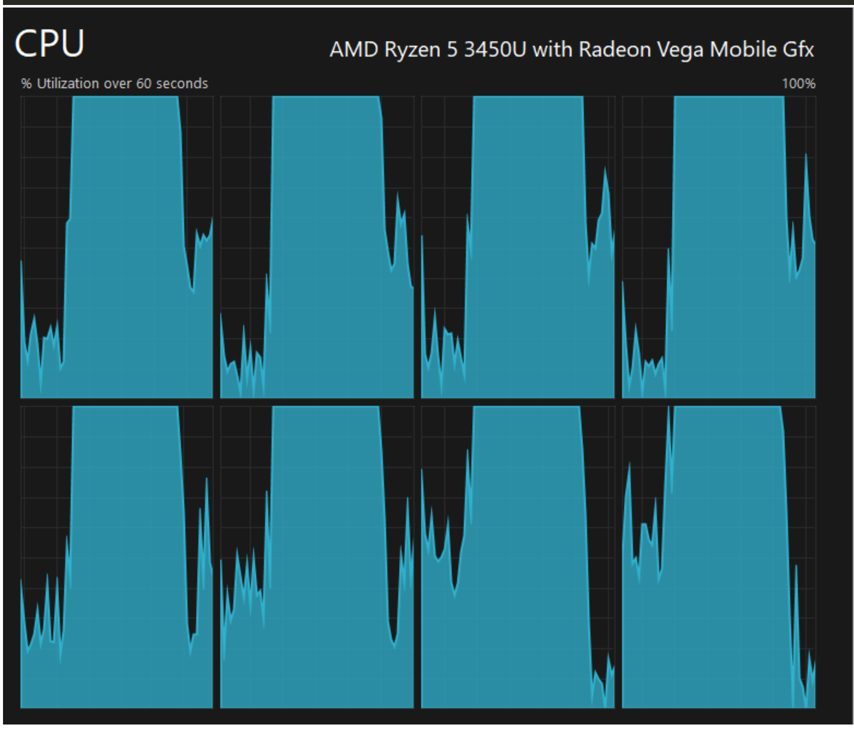
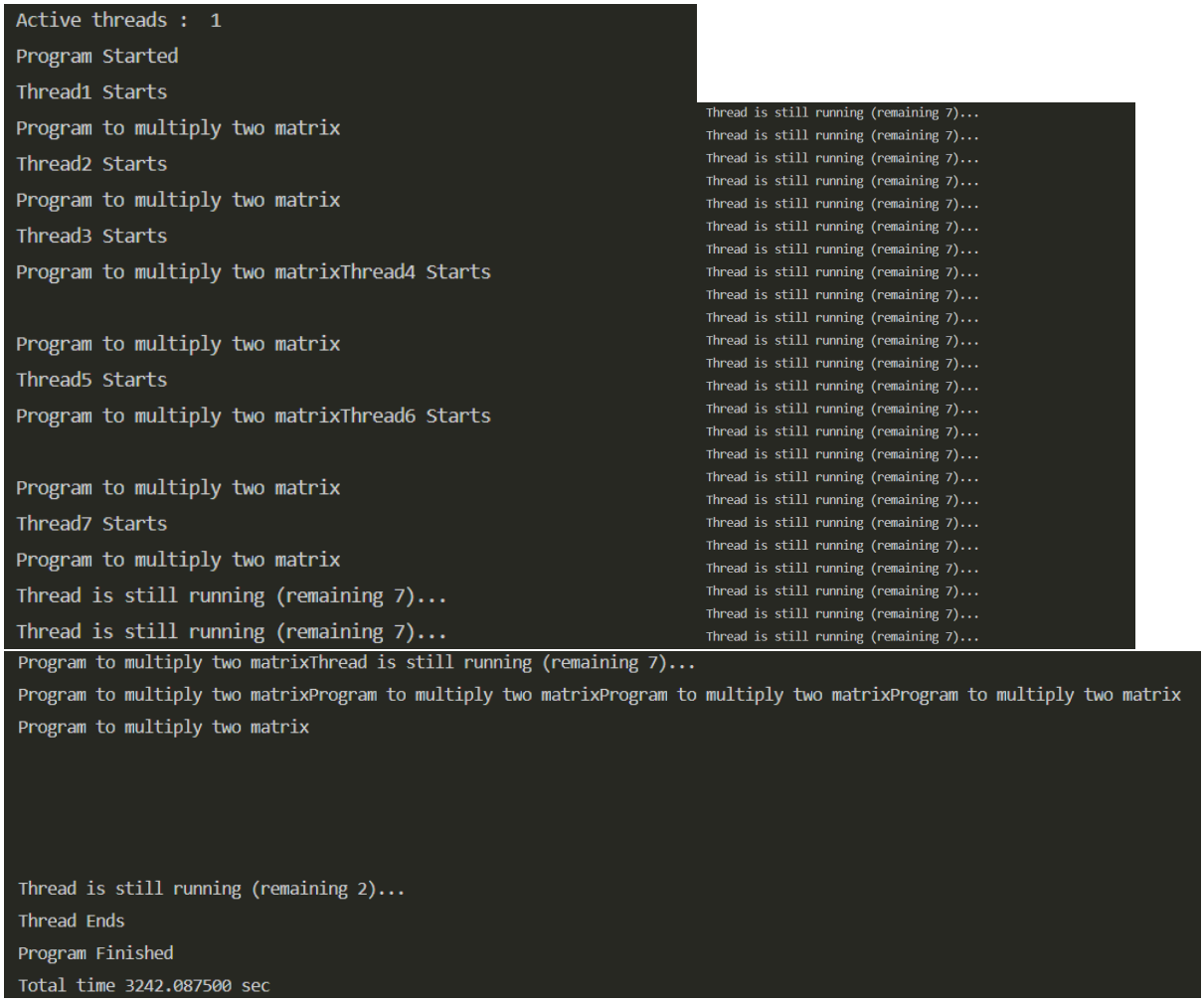

```
Thread is still running (remaining 6)...
Thread is still running (remaining 6)...
Program to multiply two matrixProgram to multiply two matrix

Program to multiply two matrixProgram to multiply two matrixProgram to multiply two matrixThread is still running (remaining 6)...Program to multiply two matrix




Thread Ends
Program Finished
Total time 157.602500 sec
PS C:\Users\Shweta\Desktop\UCS654_Clustering> conda activate base
```



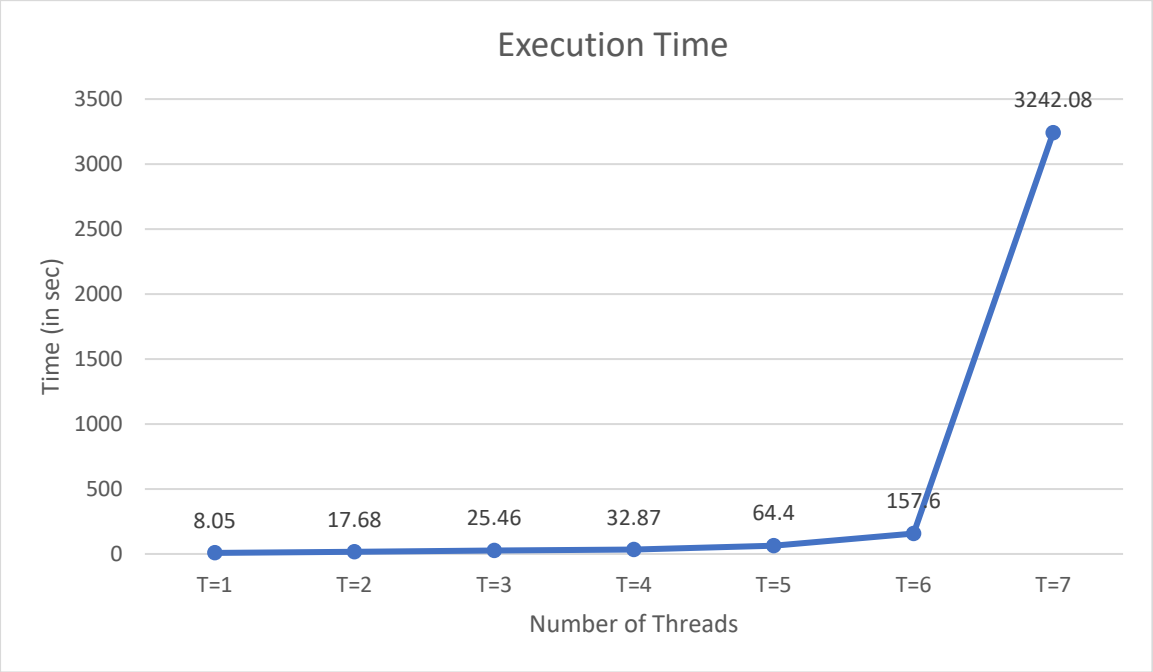
T=7



Result table :

Threads	T=1	T=2	T=3	T=4	T=5	T=6	T=7
Time taken (in sec)	8.0594	17.6894	25.4611	32.8742	64.4058	157.6025	3242.0875

Result Graph :



Result table using colab :

Threads	T=1	T=2	T=3	T=4	T=5	T=6	T=7
Time taken (in sec)	9.0157	17.0252	27.0615	33.1443	44.0760	53.0982	64.0964

Result Graph :