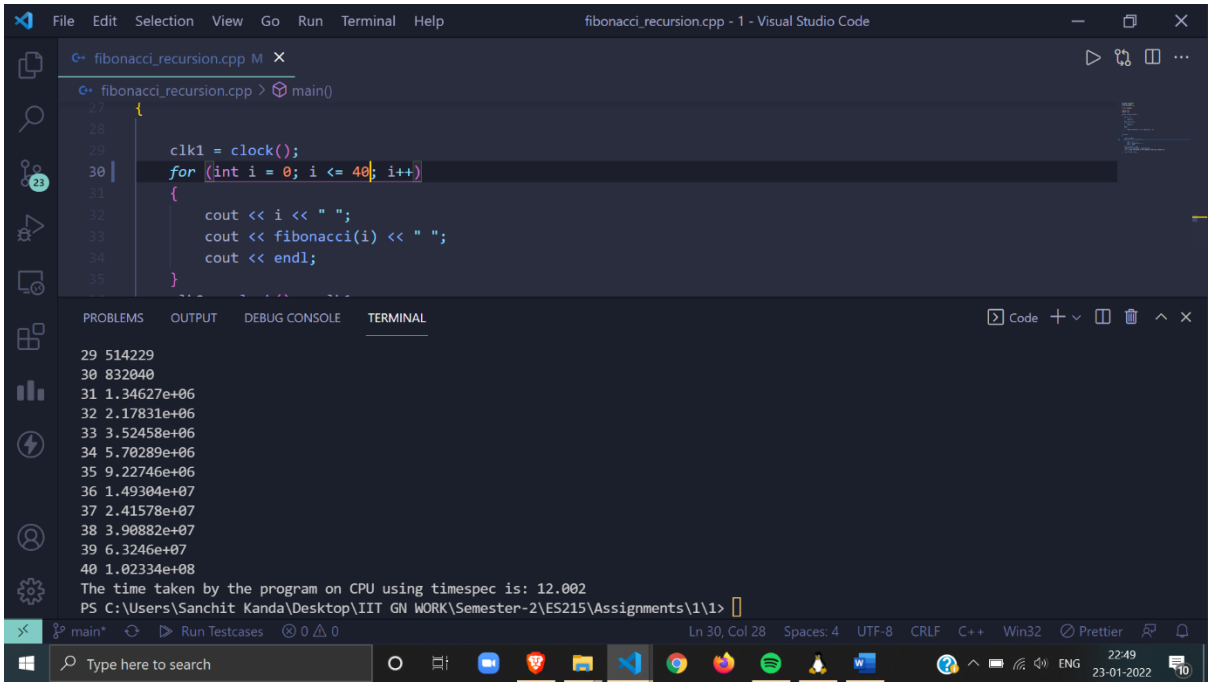
ES215: Computer Organisation and Architecture

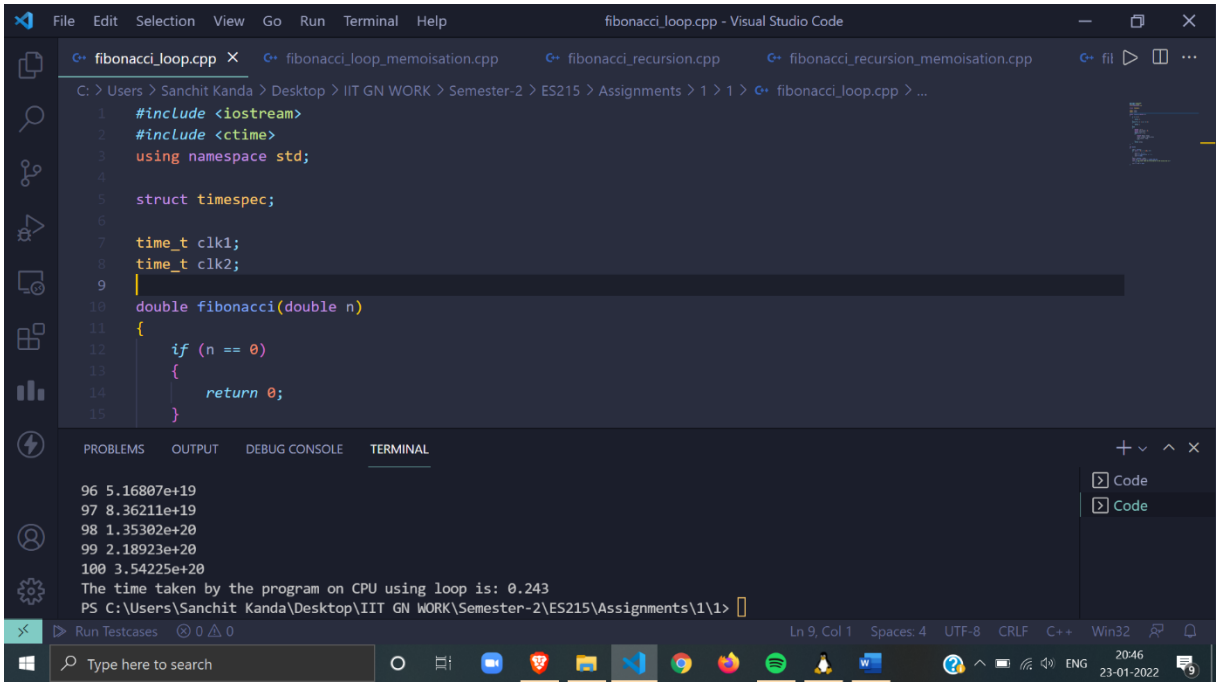
(https://github.com/Madhav-Kanda/ES215_Assignment_1)

Q1.

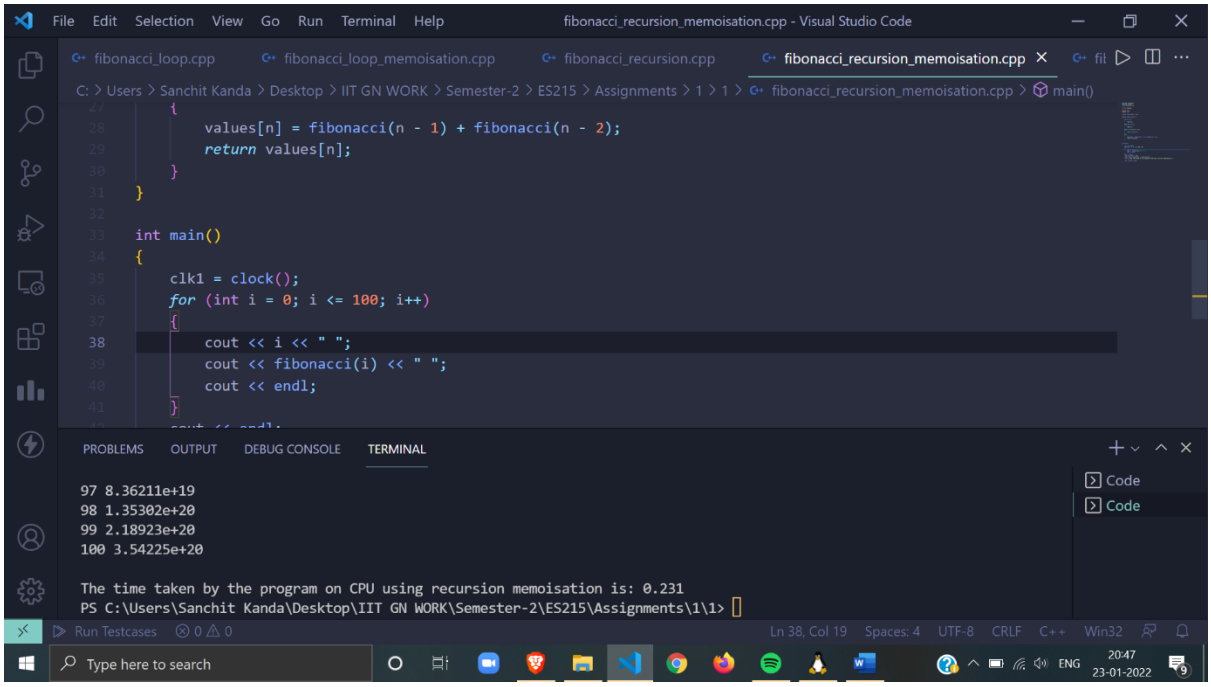
a) Time taken using recursion: **133,605.45 sec**
Time taken for first 40 fibonacci =**12.002 sec**
Formula to calculate time taken for 100 fibonacci = ((1.168)^(60)))*(12.002) sec



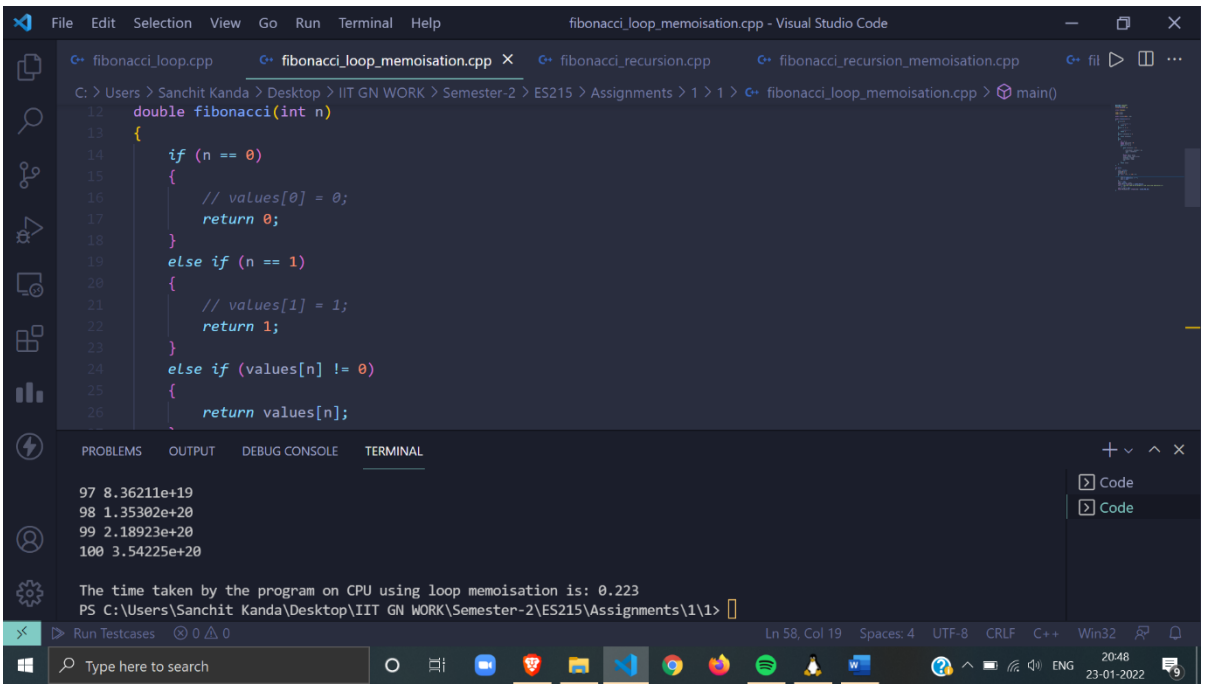
b) Time taken using loop: **0.243s**



c) Time taken using recursion and memoization: **0.231s**

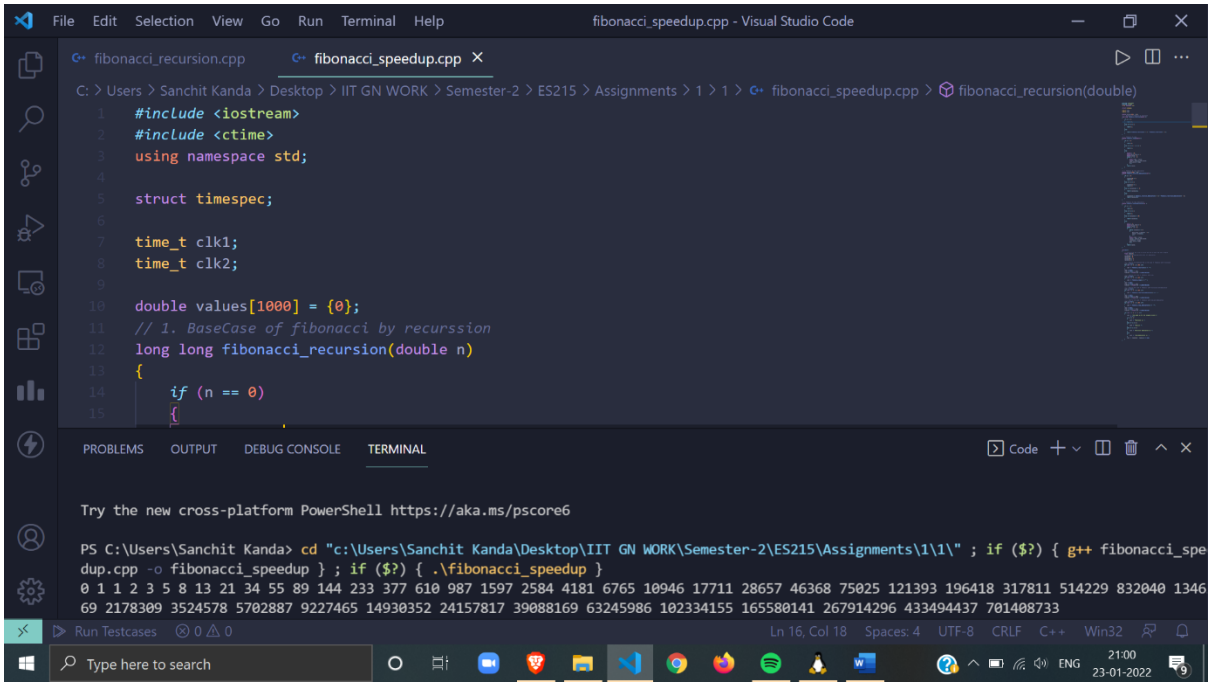


d) Time taken using loop memoization: **0.223s**



Speedup of all the program:

a. Speedup for recursion is: (Time taken using recursion/Time taken using recursion)= 1
b. Speedup for loop is: (Time taken using recursion/ Time taken using loop) =
c. Speedup for recursion and memoisation is:
d. Speedup for loop memoisation is:



Q2.

A) Output Time

CPU Time=user +sys

a) For C++ using Double

1. N=32

```
real    0m1.675s
user    0m0.016s
sys     0m0.000s
```

2. N=64

```
real    0m1.413s
user    0m0.000s
sys     0m0.000s
```

3. N=128

```
real    0m1.439s
user    0m0.031s
sys     0m0.047s
```

4. N=256

```
real    0m1.760s
user    0m0.078s
sys     0m0.047s
```

5. N=512

```
real    0m3.858s
user    0m0.781s
sys     0m0.016s
```

b) For C++ using Integer

1. N=32

```
real    0m0.719s
user    0m0.000s
sys     0m0.000s
```

2. N=64

```
real    0m1.026s
user    0m0.016s
sys     0m0.000s
```

3. N=128

```
real    0m1.267s
user    0m0.016s
sys     0m0.000s
```

4. N=256

```
real    0m2.311s
user    0m0.156s
sys     0m0.000s
```

5. N=512

```
real    0m3.572s
user    0m0.766s
sys     0m0.047s
```

a) For Python using integer

1. N=32

```
real    0m3.512s
user    0m0.031s
sys     0m0.031s
```

2. N=64

```
real    0m3.905s
user    0m0.078s
sys     0m0.031s
```

3. N=128

```
real    0m2.539s
user    0m0.484s
sys     0m0.000s
```

4. N=256

```
real    0m5.792s
user    0m3.406s
sys     0m0.047s
```

5. N=512

```
real    0m32.467s
user    0m30.344s
sys     0m0.078s
```

b) For Python using Double

1. N=32

```
real    0m1.257s
user    0m0.047s
sys     0m0.016s
```

2. N=64

```
real    0m1.555s
user    0m0.078s
sys     0m0.031s
```

3. N=128

```
real    0m2.119s
user    0m0.406s
sys     0m0.078s
```

4. N=256

```
real    0m4.258s
user    0m3.406s
sys     0m0.031s
```

5. N=512

```
real    0m32.619s
user    0m30.641s
sys     0m0.125s
```

B)

a) **C++ program for integer**

1. N=32

Execution Time: 3.757s

Meat Portion: 0.015625s

(Meat Portion/Execution Time): 0.00415

```
The time taken by the meat portion of the program is: 0.015625

real    0m3.757s
user    0m0.031s
sys     0m0.000s
madhav@LAPTOP-RUM7KR1E:/mnt/c/Users/Sanchit Kanda/Desktop/IIT GN WORK/Semester-2/ES215/Assignments/1/2$
```

2. N=64

Execution Time: 1.641s

Meat Portion: 0.015625s

(Meat Portion/Execution Time): 0.0.009521

```
The time taken by the meat portion of the program is: 0.015625

real    0m1.641s
user    0m0.016s
sys     0m0.000s
madhav@LAPTOP-RUM7KR1E:/mnt/c/Users/Sanchit Kanda/Desktop/IIT GN WORK/Semester-2/ES215/Assignments/1/2$ time ./a.out
```

3. N=128

Execution Time: 4.554s

Meat Portion: 0.046875s

(Meat Portion/Execution Time): 0.0102

```
The time taken by the meat portion of the program is: 0.046875

real    0m4.554s
user    0m0.031s
sys     0m0.031s
madhav@LAPTOP-RUM7KR1E:/mnt/c/Users/Sanchit Kanda/Desktop/IIT G
```

4. N=256

Execution Time: 2.150s

Meat Portion: 0.09375s

(Meat Portion/Execution Time): 0.043

```
The time taken by the meat portion of the program is: 0.09375

real    0m2.150s
user    0m0.063s
sys     0m0.031s
madhav@LAPTOP-RUM7KR1E:/mnt/c/Users/Sanchit Kanda/Desktop/IIT
```

5. N=512

Execution Time: 6.323s

Meat Portion: 0.84375s

(Meat Portion/Execution Time): 0.133

```
The time taken by the meat portion of the program is: 0.84375

real    0m6.323s
user    0m0.797s
sys     0m0.063s
madhav@LAPTOP-RUM7KR1E:/mnt/c/Users/Sanchit Kanda/Desktop/IIT
```

b) **C++ program for double**

1. N=32

Execution Time: 1.278s

Meat Portion: 0.015625s

(Meat Portion/Execution Time): 0.1222

```
The time taken by the meat portion of the program is: 0.015625

real    0m1.278s
user    0m0.000s
sys     0m0.016s
madhav@LAPTOP-RUM7KR1E:/mnt/c/Users/Sanchit Kanda/Desktop/IIT G
```

2. N=64

Execution Time: 0.932s

Meat Portion: 0.015625s

(Meat Portion/Execution Time): 0.0167

```
The time taken by the meat portion of the program is: 0.015625

real    0m0.932s
user    0m0.000s
sys     0m0.016s
madhav@LAPTOP-RUM7KR1E:/mnt/c/Users/Sanchit Kanda/Desktop/IIT G
```

3. N=128

Execution Time: 1.373s

Meat Portion: 0.015625s

(Meat Portion/Execution Time): 0.0113

```
The time taken by the meat portion of the program is: 0.015625

real    0m1.373s
user    0m0.000s
sys     0m0.016s
madhav@LAPTOP-RUM7KR1E:/mnt/c/Users/Sanchit Kanda/Desktop/IIT G
```

4. N=256

Execution Time: 3.026s

Meat Portion: 0.171875s

(Meat Portion/Execution Time): 0.056799

```
The time taken by the meat portion of the program is: 0.171875

real    0m3.026s
user    0m0.141s
sys     0m0.031s
madhav@LAPTOP-RUM7KR1E:/mnt/c/Users/Sanchit Kanda/Desktop/IIT G
```

5. N=512

Execution Time: 3.894s

Meat Portion: 1.0156s

(Meat Portion/Execution Time): 0.2608

```
The time taken by the meat portion of the program is: 1.01562

real    0m3.894s
user    0m0.969s
sys     0m0.078s
madhav@LAPTOP-RUM7KR1E:/mnt/c/Users/Sanchit Kanda/Desktop/IIT
```

a) Python program for Double

1. N=32

Execution Time: 1.126s

Meat Portion: 0.0110s

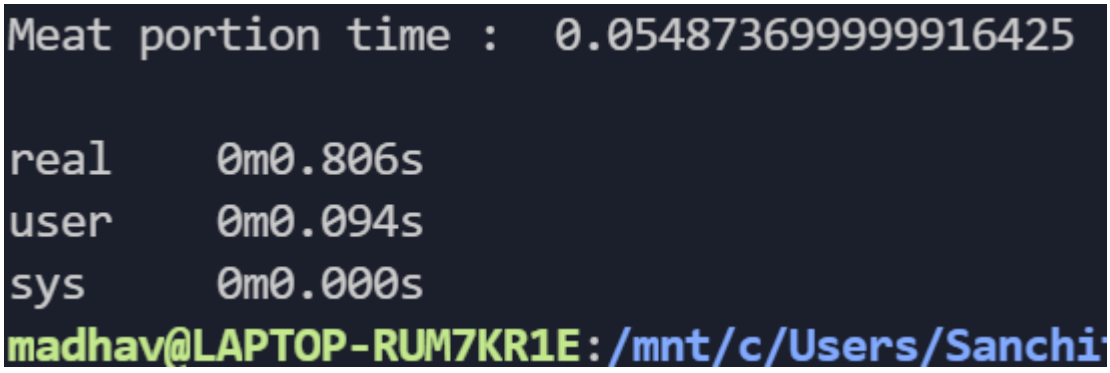
(Meat Portion/Execution Time): 0.00976

2. N=64

Execution Time: 0.806s

Meat Portion: 0.05487s

(Meat Portion/Execution Time): 0.067



3. N=128

Execution Time: 1.769s

Meat Portion: 0.403s

(Meat Portion/Execution Time): 0.2278

```
Meat portion time :  0.4038940000000366

real    0m1.769s
user    0m0.438s
sys     0m0.000s
madhav@LAPTOP-RUM7KR1E:/mnt/c/Users/Sanch
```

4. N=256

Execution Time: 4.882s

Meat Portion: 3.392s

(Meat Portion/Execution Time): 0.69

```
Meat portion time :  3.3926918999995905

real    0m4.882s
user    0m3.438s
sys     0m0.031s
madhav@LAPTOP-RUM7KR1E:/mnt/c/Users/Sanch
```

5. N=512

Execution Time: 32.378s

Meat Portion: 31.07s

(Meat Portion/Execution Time): 0.95

```
Meat portion time :  31.07839149999927

real    0m32.378s
user    0m30.859s
sys     0m0.141s
madhav@LAPTOP-RUM7KR1E:/mnt/c/Users/San
```

b)Python program for Integer

1. N=32

Execution Time: 1.216s

Meat Portion: 0.0107s

(Meat Portion/Execution Time): 0.087

```
Time :  0.010749000000032538

real    0m1.216s
user    0m0.031s
sys     0m0.016s
madhav@LAPTOP-RUM7KR1E:/mnt/c
```

2. N=64

Execution Time: 1.736s

Meat Portion: 0.0566s

(Meat Portion/Execution Time): 0.032

```
Time :  0.05667099999936909

real    0m1.736s
user    0m0.063s
sys     0m0.031s
```

3. N=128

Execution Time: 1.306s

Meat Portion: 0.489s

(Meat Portion/Execution Time): 0.37

```
Time :   0.48954700000012963

real     0m1.306s
user     0m0.547s
sys      0m0.016s
madhav@LAPTOP-RUM7KR1E:/mnt/c/
```

4. N=256

Execution Time: 5.590s

Meat Portion: 4.251s

(Meat Portion/Execution Time): 0.76

```
Time :   4.251851899999565

real     0m5.590s
user     0m4.281s
sys      0m0.078s
madhav@LAPTOP-RUM7KR1E:/mnt/c/
```

5. N=512

Execution Time: 39.384s

Meat Portion: 38.05s

(Meat Portion/Execution Time): 0.96

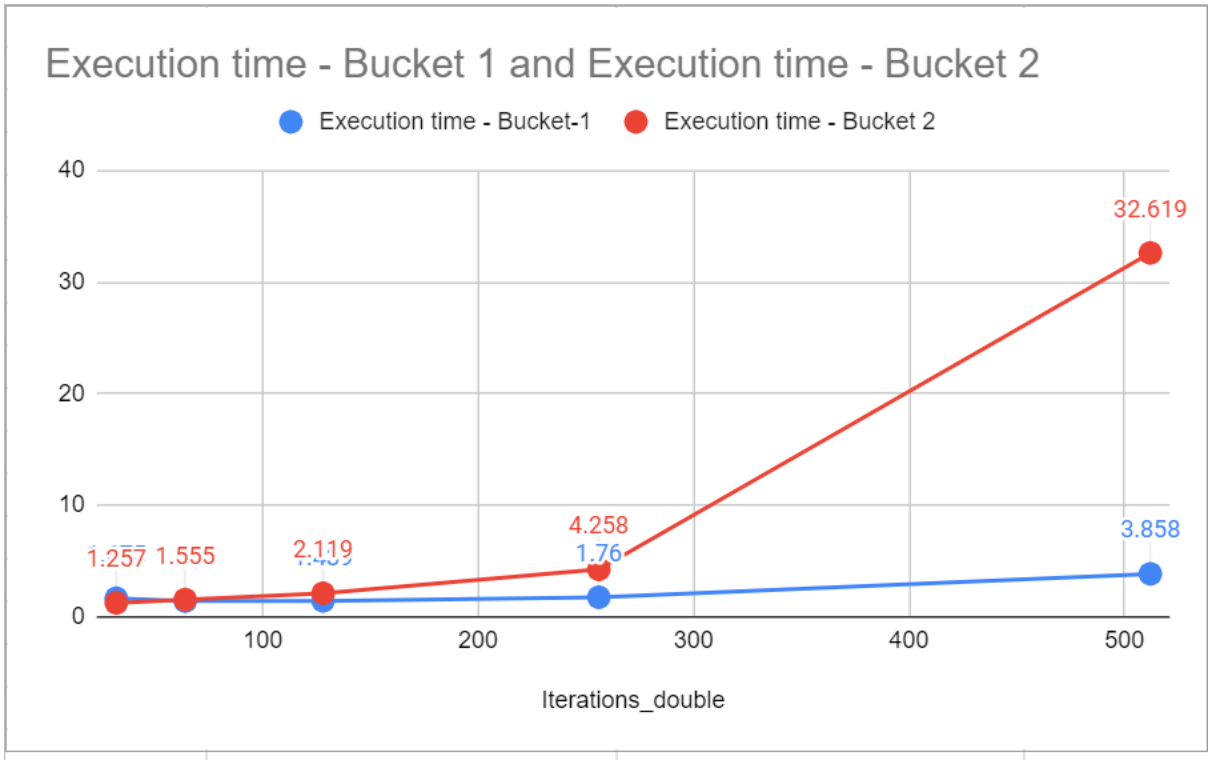
```
Time :   38.051534600000195

real     0m39.384s
user     0m37.813s
sys      0m0.125s
madhav@LAPTOP-RUM7KR1E:/mnt/c/
```

c)

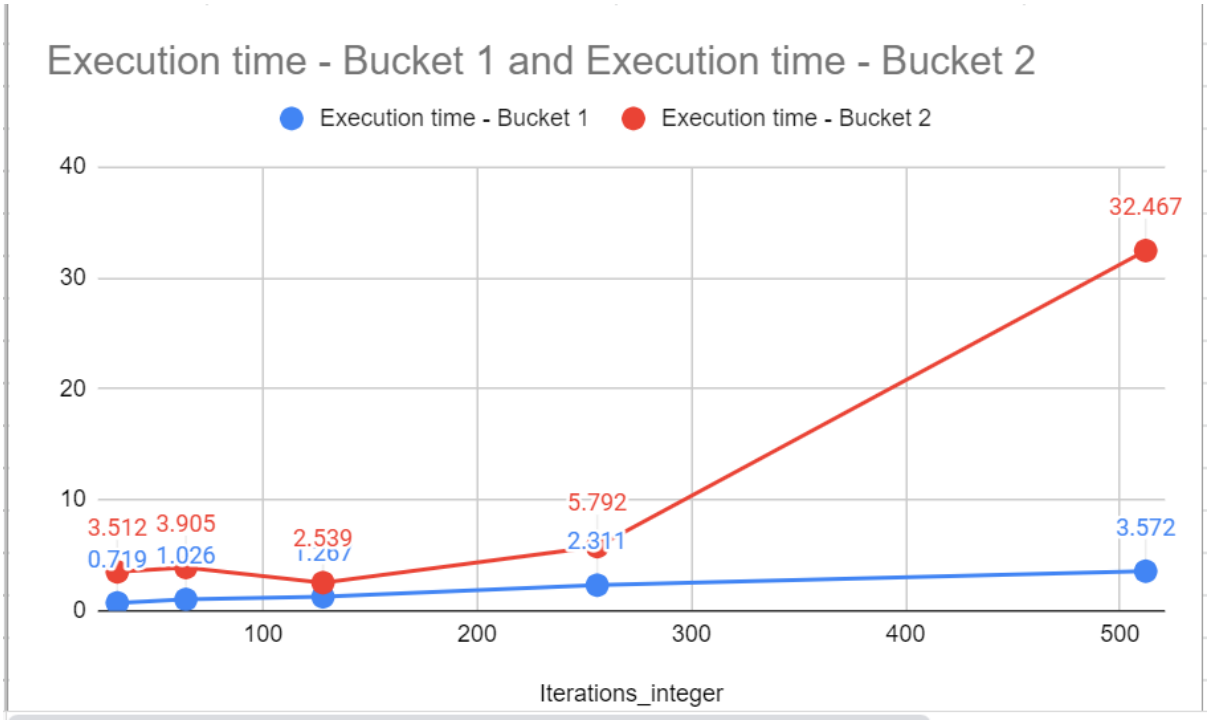
Execution Time for Double of the Two programming languages

Iterations_double	Execution time - Bucket-1	Execution time - Bucket 2
32	1.675	1.257
64	1.413	1.555
128	1.439	2.119
256	1.76	4.258
512	3.858	32.619



Execution Time for Integer of the two program languages

Iterations_intege	Execution time - Bucket 1	Execution time - Bucket 2
32	0.719	3.512
64	1.026	3.905
128	1.267	2.539
256	2.311	5.792
512	3.572	32.467



Meat Portion Time for Integer of the two program languages

Iterations_intege	Meat Portion - Bucket-1	Meat Portion - Bucket 2
32	0.015625	0.107
64	0.015625	0.056
128	0.048675	2.48
256	0.09375	4.25
512	0.84375	38.05