

Specifications of my computer	Apple Macbook Pro
The brand of CPU (Intel or AMD)	Apple Silicon
The model of CPU (e.g. Intel i7-9700K Coffee Lake)	Apple M1 Pro
The number of cores on CPU	8 (6 performance and 2 efficiency)
The clock rate of CPU in GHz	3.2 GHz to 3.8 GHz
The amount of memory in GB	16GB RAM
The speed of memory (for example: DDR4 3200)	3845 MHz
The type of hard drive: magnetic or SSD	SSD
The capacity of hard drive	512 GB
The RPM number	doesn't contain any Serial ATA devices
Cache size	6317 MB
Average latency	21 ms
Max sequential read speed	3230.3 MB/s
Max sequential write speed	2893.2 MB/s
Max random read speed	5048.8 MB/s
Max random write speed	3042.9 MB/s

Benchmarks	Execution Time (seconds)
a)32-bit Integer operation benchmark	1686.6233
b)64-bit Floating point operation benchmark	86.1979
c)Memory benchmark	18.6653
d)Hard drive benchmark 1	2.3488
e)Hard drive benchmark 2	1.78918

Now calculation execution time ration ,

Ratio = reference time/execution time

$$a = 100/1686.6233 = 0.08$$

$$b = 100/86.1979 = 1.16012$$

$$c = 100/18.6653 = 5.3575$$

$$d = 250/2.3488 = 106.4373$$

$$e = 10/1.78918 = 5.58915$$

N =5

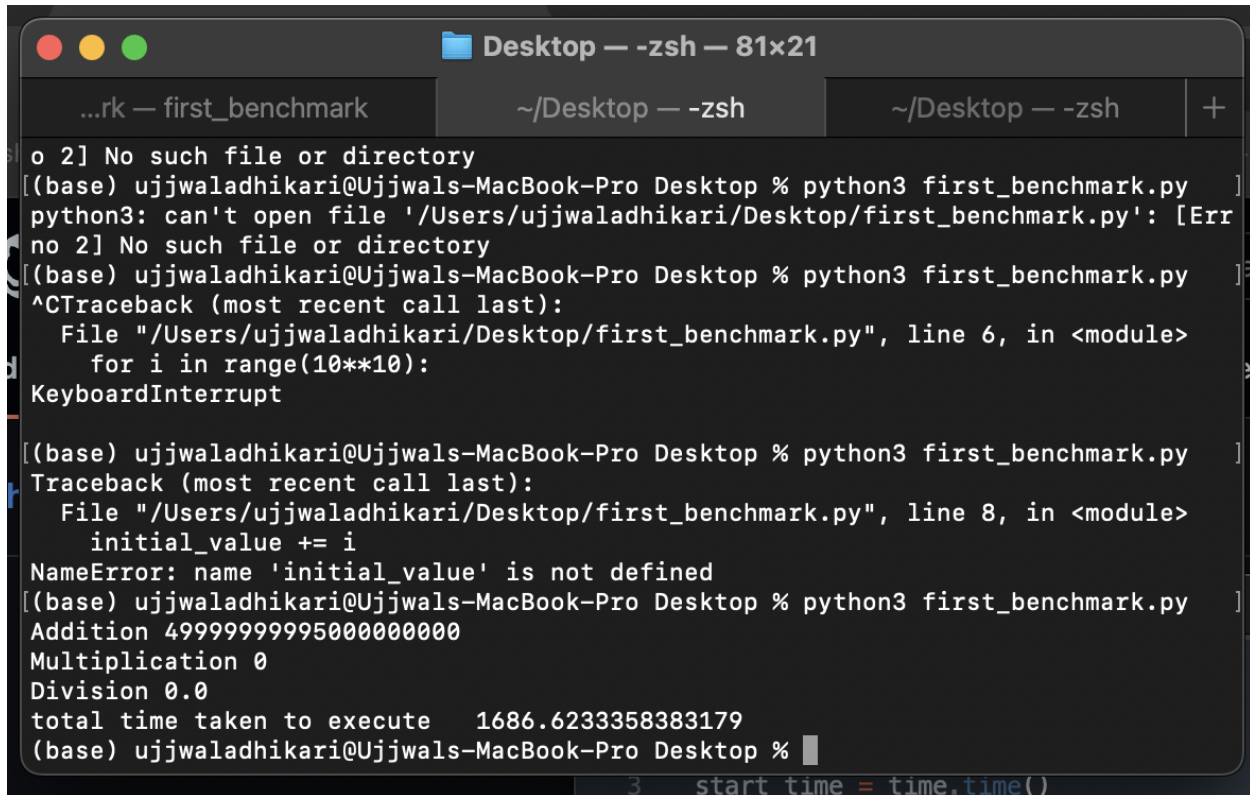
Geometric mean = $(a*b*c*d*e)^{1/N}$

$$= (0.059290 * 1.16012 * 5.3575 * 106.4373 * 5.58915)^{1/5}$$

$$= 2.9388$$

Screenshots:

32-bit Integer operation benchmark



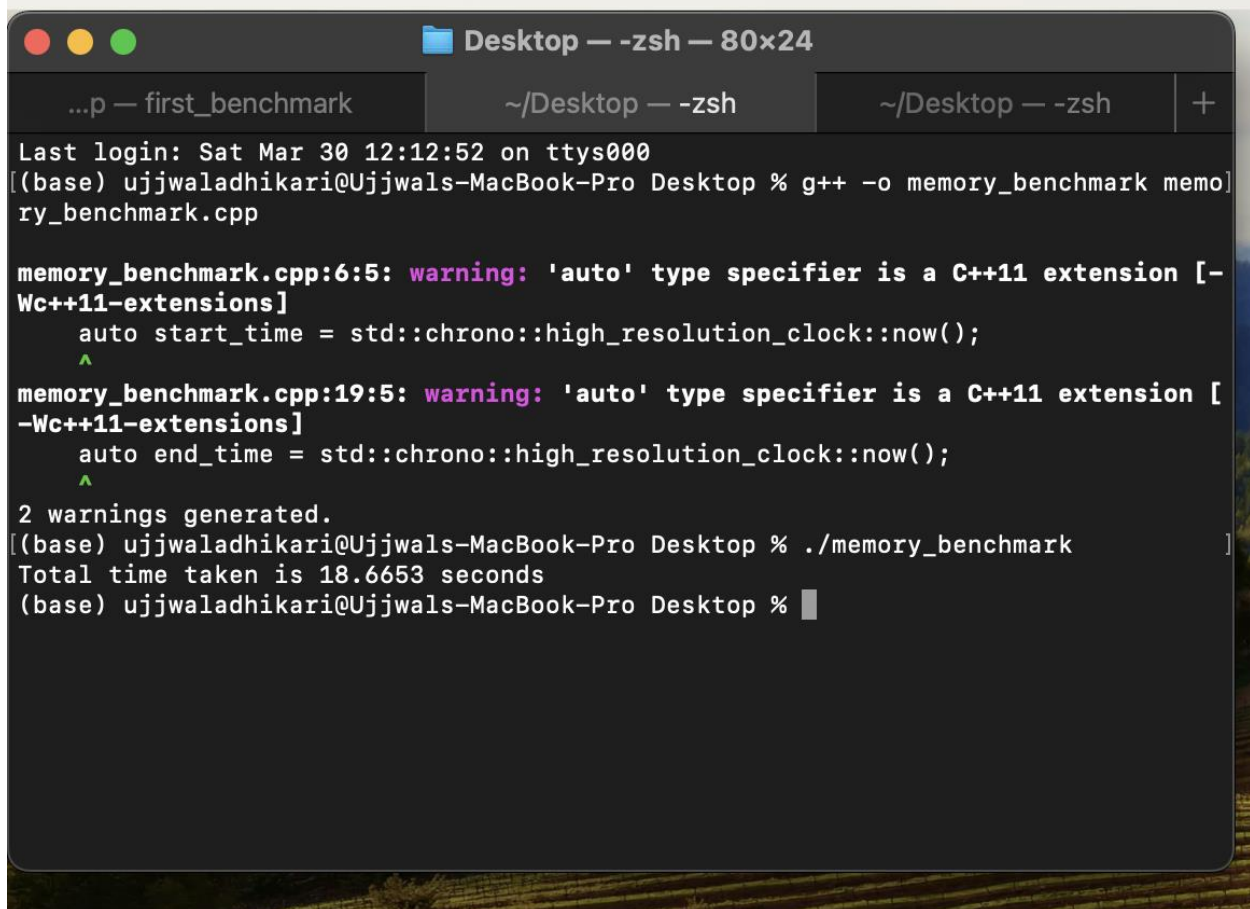
```
Desktop — zsh — 81x21
...rk — first_benchmark  ~/Desktop — zsh  ~/Desktop — zsh  +
o 2] No such file or directory
[(base) ujjwaladhikari@Ujjwals-MacBook-Pro Desktop % python3 first_benchmark.py ]
python3: can't open file '/Users/ujjwaladhikari/Desktop/first_benchmark.py': [Err
no 2] No such file or directory
[(base) ujjwaladhikari@Ujjwals-MacBook-Pro Desktop % python3 first_benchmark.py ]
^C
Traceback (most recent call last):
  File "/Users/ujjwaladhikari/Desktop/first_benchmark.py", line 6, in <module>
    for i in range(10**10):
KeyboardInterrupt

[(base) ujjwaladhikari@Ujjwals-MacBook-Pro Desktop % python3 first_benchmark.py ]
Traceback (most recent call last):
  File "/Users/ujjwaladhikari/Desktop/first_benchmark.py", line 8, in <module>
    initial_value += i
NameError: name 'initial_value' is not defined
[(base) ujjwaladhikari@Ujjwals-MacBook-Pro Desktop % python3 first_benchmark.py ]
Addition 49999999995000000000
Multiplication 0
Division 0.0
total time taken to execute 1686.6233358383179
(base) ujjwaladhikari@Ujjwals-MacBook-Pro Desktop % █
3 start_time = time.time()
```

64-bit Floating point operation benchmark

```
Desktop — -zsh — 80x24
~/Desktop — first_benchmark  ~/Desktop — -zsh  +
Last login: Fri Mar 29 18:28:45 on ttys001
(base) ujjwaladhikari@Ujjwals-MacBook-Pro Desktop % g++ -o second_benchmark seco
nd_benchmark.cpp
second_benchmark.cpp:5:5: warning: 'auto' type specifier is a C++11 extension [-
Wc++11-extensions]
    auto start = std::chrono::high_resolution_clock::now();
    ^
second_benchmark.cpp:27:5: warning: 'auto' type specifier is a C++11 extension [
-Wc++11-extensions]
    auto end = std::chrono::high_resolution_clock::now();
    ^
2 warnings generated.
(base) ujjwaladhikari@Ujjwals-MacBook-Pro Desktop % ./second_benchmark
Execution time: 86197.9 ms
(base) ujjwaladhikari@Ujjwals-MacBook-Pro Desktop %
```

Memory benchmark

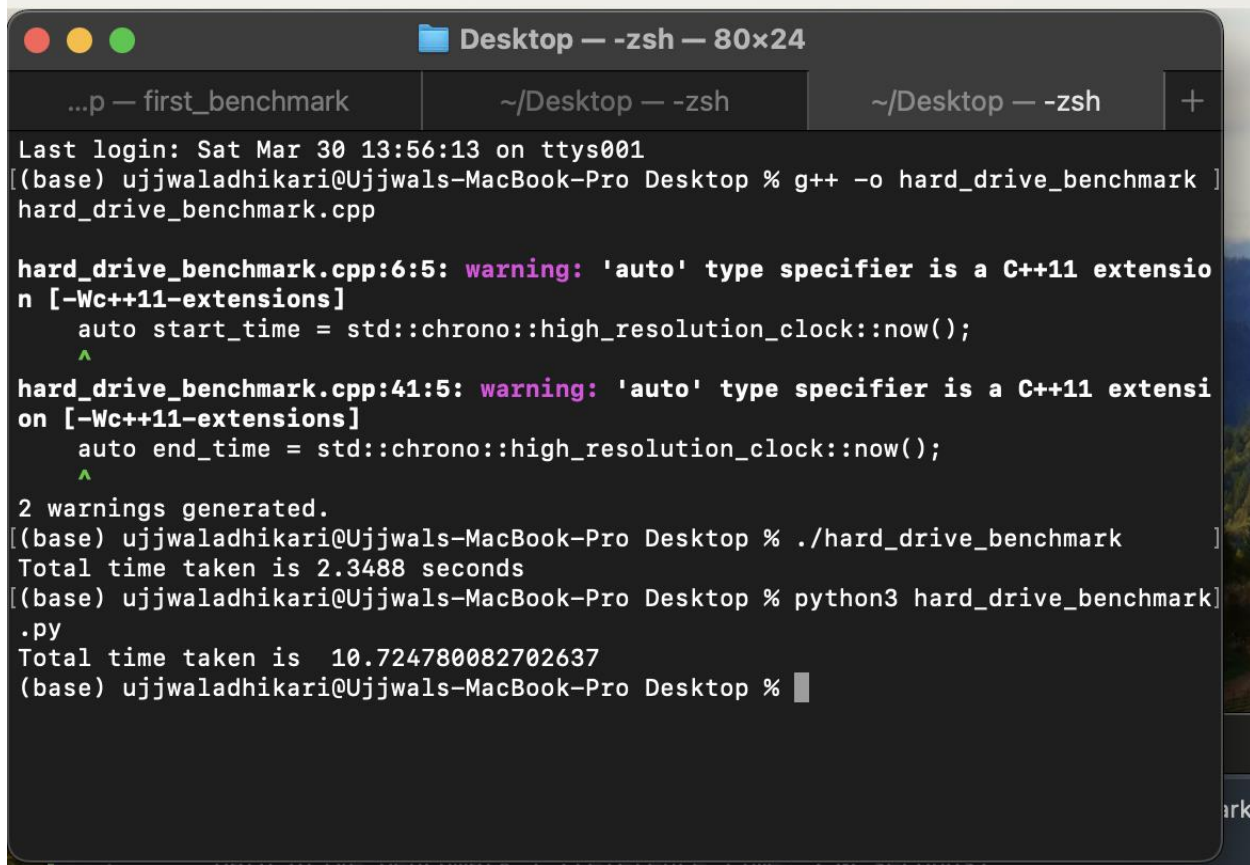


A terminal window titled "Desktop — -zsh — 80x24" with three tabs: "...p — first_benchmark", "~/Desktop — -zsh", and "~/Desktop — -zsh" with a plus icon. The terminal shows the following output:

```
Last login: Sat Mar 30 12:12:52 on ttys000
[(base) ujjwaladhikari@Ujjwals-MacBook-Pro Desktop % g++ -o memory_benchmark memo-
ry_benchmark.cpp

memory_benchmark.cpp:6:5: warning: 'auto' type specifier is a C++11 extension [-
Wc++11-extensions]
    auto start_time = std::chrono::high_resolution_clock::now();
    ^
memory_benchmark.cpp:19:5: warning: 'auto' type specifier is a C++11 extension [
-Wc++11-extensions]
    auto end_time = std::chrono::high_resolution_clock::now();
    ^
2 warnings generated.
[(base) ujjwaladhikari@Ujjwals-MacBook-Pro Desktop % ./memory_benchmark
Total time taken is 18.6653 seconds
(base) ujjwaladhikari@Ujjwals-MacBook-Pro Desktop %
```

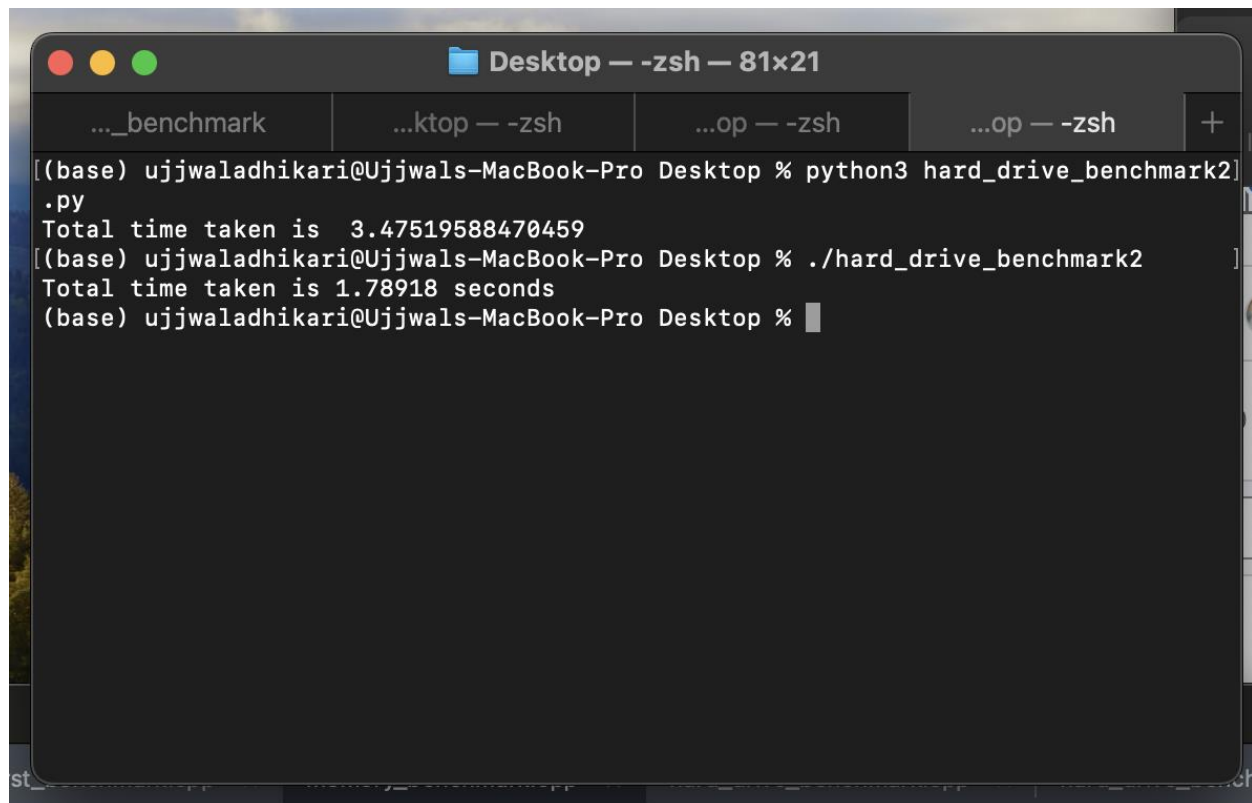
Hard drive benchmark



```
Desktop — -zsh — 80x24
...p — first_benchmark  ~/Desktop — -zsh  ~/Desktop — -zsh  +
Last login: Sat Mar 30 13:56:13 on ttys001
[(base) ujjwaladhikari@Ujjwals-MacBook-Pro Desktop % g++ -o hard_drive_benchmark ]
hard_drive_benchmark.cpp

hard_drive_benchmark.cpp:6:5: warning: 'auto' type specifier is a C++11 extensio
n [-Wc++11-extensions]
    auto start_time = std::chrono::high_resolution_clock::now();
    ^
hard_drive_benchmark.cpp:41:5: warning: 'auto' type specifier is a C++11 extensi
on [-Wc++11-extensions]
    auto end_time = std::chrono::high_resolution_clock::now();
    ^
2 warnings generated.
[(base) ujjwaladhikari@Ujjwals-MacBook-Pro Desktop % ./hard_drive_benchmark ]
Total time taken is 2.3488 seconds
[(base) ujjwaladhikari@Ujjwals-MacBook-Pro Desktop % python3 hard_drive_benchmark]
.py
Total time taken is 10.724780082702637
(base) ujjwaladhikari@Ujjwals-MacBook-Pro Desktop %
```

Hard Drive benchmark 2

A screenshot of a macOS terminal window titled "Desktop — -zsh — 81x21". The window has a dark background and a light gray title bar with standard macOS window controls (red, yellow, green buttons). The terminal shows the execution of a benchmark script. The first command is `python3 hard_drive_benchmark2.py`, which outputs "Total time taken is 3.47519588470459". The second command is `./hard_drive_benchmark2`, which outputs "Total time taken is 1.78918 seconds". The prompt is `(base) ujjwaladhikari@Ujjwals-MacBook-Pro Desktop %`.

```
Desktop — -zsh — 81x21
..._benchmark  ...ktop — -zsh  ...op — -zsh  ...op — -zsh  +
[(base) ujjwaladhikari@Ujjwals-MacBook-Pro Desktop % python3 hard_drive_benchmark2
.py
Total time taken is 3.47519588470459
[(base) ujjwaladhikari@Ujjwals-MacBook-Pro Desktop % ./hard_drive_benchmark2
]
Total time taken is 1.78918 seconds
(base) ujjwaladhikari@Ujjwals-MacBook-Pro Desktop %
```