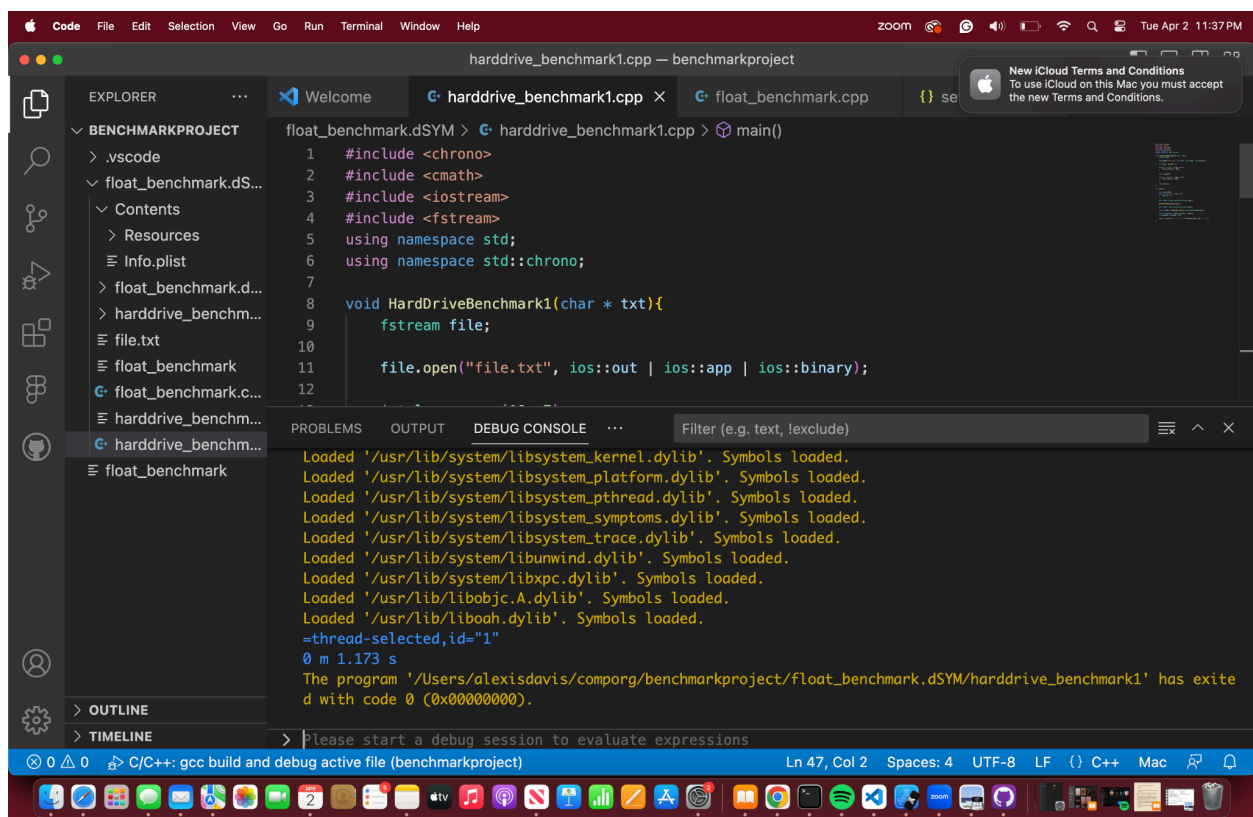


Computer Specifications

- CPU
 - Brand: Apple
 - Model: Apple Machbook Pro 14 M2 Pro
 - Cores: 10 cores
 - Base Clock: 3.49 GHz
- 32 GB unified memory
- 512 GB SSD
 - 5293 MBps Reads
 - 6168 MBps writes

Hard drive 1 benchmark

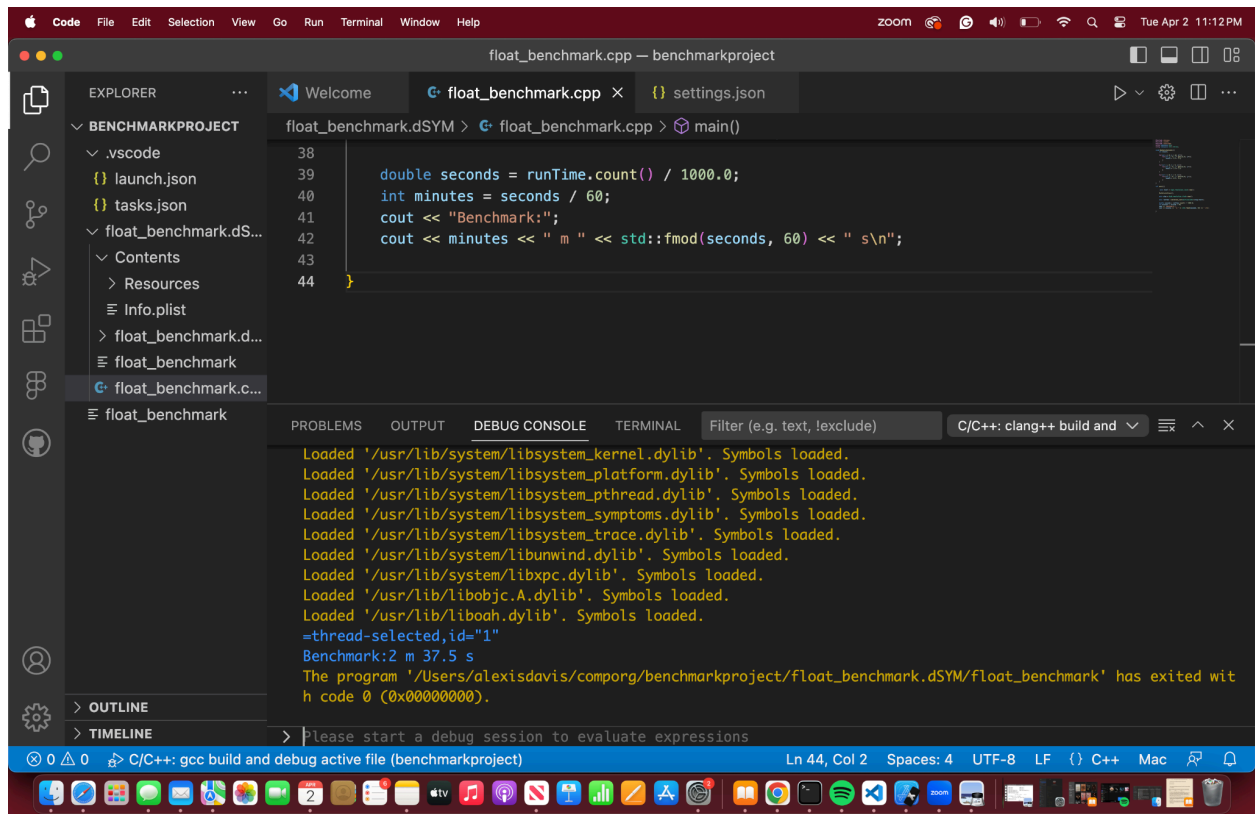


The screenshot shows the Visual Studio Code editor with a C++ benchmark project. The Explorer sidebar on the left shows the project structure, including a file named `harddrive_benchmark1.cpp`. The main editor window displays the source code of this file, which includes headers for `<chrono>`, `<cmath>`, `<iostream>`, and `<fstream>`, and uses the `std` namespace. The code defines a function `HardDriveBenchmark1` that takes a character pointer `txt` and opens a file named `file.txt` in append mode. The bottom panel shows the `DEBUG CONSOLE` with the following output:

```
Loaded '/usr/lib/system/libsystem_kernel.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_platform.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_pthread.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_symptoms.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_trace.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libunwind.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libxpc.dylib'. Symbols loaded.
Loaded '/usr/lib/libobjc.A.dylib'. Symbols loaded.
Loaded '/usr/lib/liboah.dylib'. Symbols loaded.
=thread-selected,id="1"
0 m 1.173 s
The program '/Users/alexisdavis/comporg/benchmarkproject/float_benchmark.dSYM/harddrive_benchmark1' has exited with code 0 (0x00000000).
```

The status bar at the bottom indicates the active file is `harddrive_benchmark1.cpp` in the `benchmarkproject` folder, with the compiler set to `g++` and the debug mode active.

floating point benchmark



The screenshot shows the Visual Studio Code editor with a project named 'benchmarkproject'. The file 'float_benchmark.cpp' is open, showing a C++ program that benchmarks a simple floating-point calculation. The program calculates the time taken to compute $\text{seconds} / 60$ and prints the result in minutes and seconds. The output window shows the program's execution, including the loading of system libraries and the final benchmark result: 'Benchmark: 2 m 37.5 s'.

```
float_benchmark.cpp — benchmarkproject
Welcome
float_benchmark.cpp x {} settings.json
float_benchmark.dSYM > float_benchmark.cpp > main()
38
39 double seconds = runTime.count() / 1000.0;
40 int minutes = seconds / 60;
41 cout << "Benchmark:";
42 cout << minutes << " m " << std::fmod(seconds, 60) << " s\n";
43
44 }
```

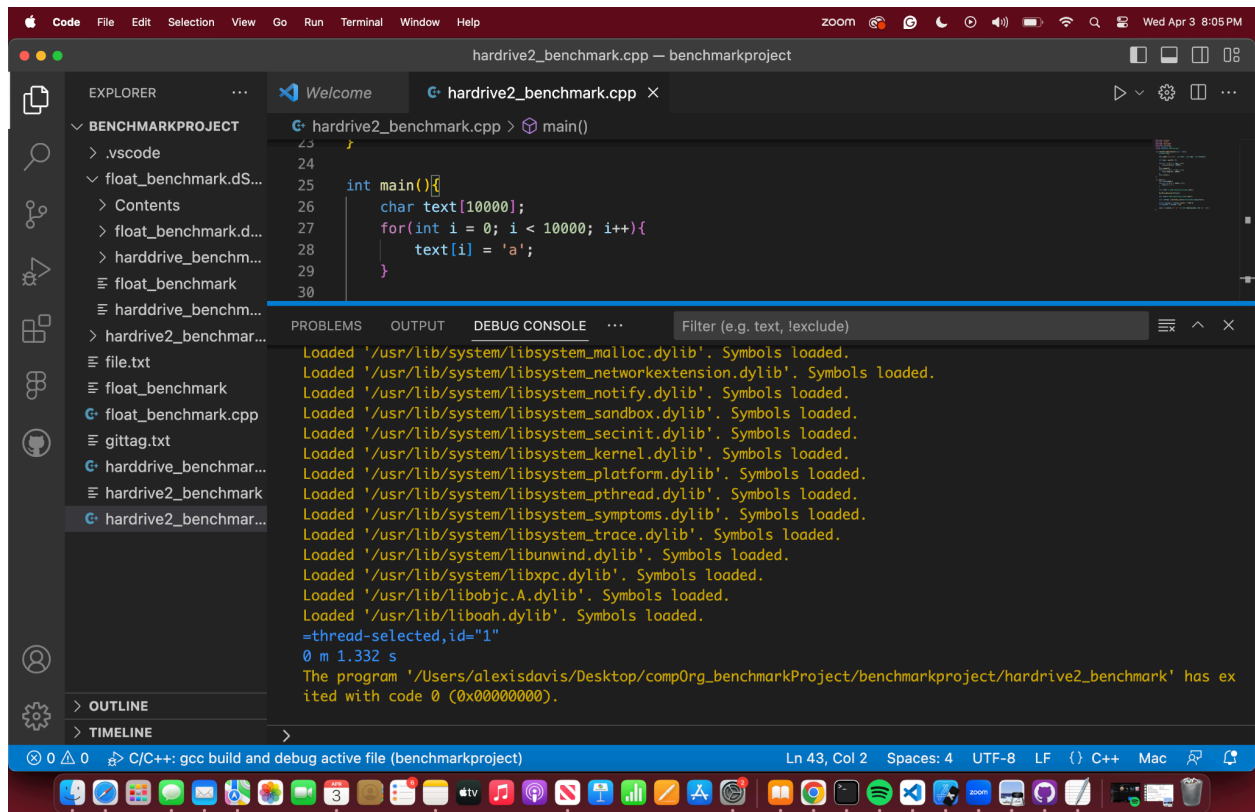
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL Filter (e.g. text, lexclude) C/C++: clang++ build and

Loaded '/usr/lib/system/libsystem_kernel.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_platform.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_pthread.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_symptoms.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_trace.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libunwind.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libxpc.dylib'. Symbols loaded.
Loaded '/usr/lib/libobjc.A.dylib'. Symbols loaded.
Loaded '/usr/lib/liboah.dylib'. Symbols loaded.
=thread-selected,id="1"
Benchmark: 2 m 37.5 s
The program '/Users/alexisdavis/comporg/benchmarkproject/float_benchmark.dSYM/float_benchmark' has exited with code 0 (0x00000000).

Please start a debug session to evaluate expressions

C/C++: gcc build and debug active file (benchmarkproject) Ln 44, Col 2 Spaces: 4 UTF-8 LF () C++ Mac

Hard drive 2 benchmark



The screenshot shows the Visual Studio Code editor with a project named 'benchmarkproject'. The file 'harddrive2_benchmark.cpp' is open, showing a C++ program that benchmarks a hard drive write operation. The program writes a string of 10000 'a' characters to a file. The output window shows the program's execution, including the loading of system libraries and the final benchmark result: '0 m 1.332 s'.

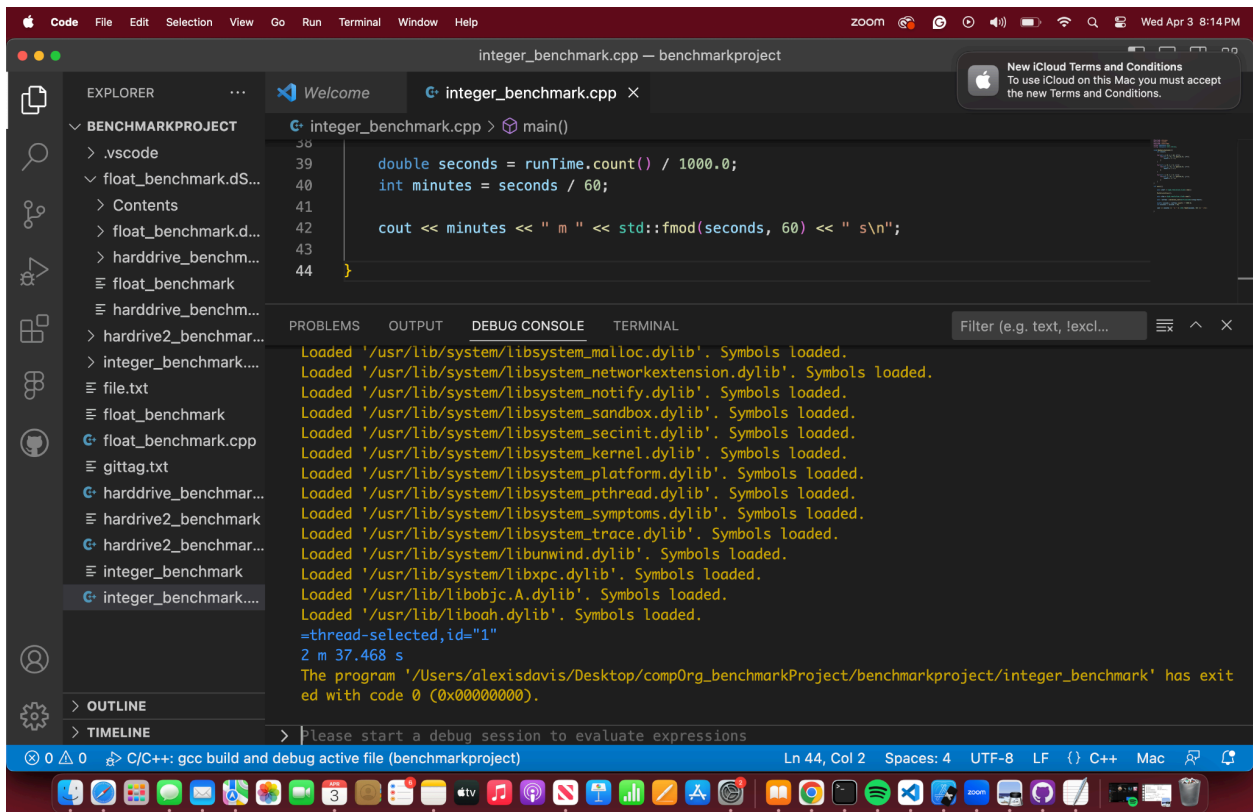
```
harddrive2_benchmark.cpp — benchmarkproject
Welcome
harddrive2_benchmark.cpp x
23
24
25 int main() {
26 char text[10000];
27 for(int i = 0; i < 10000; i++){
28 text[i] = 'a';
29 }
30 }
```

PROBLEMS OUTPUT DEBUG CONSOLE ... Filter (e.g. text, lexclude)

Loaded '/usr/lib/system/libsystem_malloc.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_networkextension.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_notify.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_sandbox.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_secinit.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_kernel.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_platform.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_pthread.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_symptoms.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_trace.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libunwind.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libxpc.dylib'. Symbols loaded.
Loaded '/usr/lib/libobjc.A.dylib'. Symbols loaded.
Loaded '/usr/lib/liboah.dylib'. Symbols loaded.
=thread-selected,id="1"
0 m 1.332 s
The program '/Users/alexisdavis/Desktop/compOrg_benchmarkProject/benchmarkproject/harddrive2_benchmark' has exited with code 0 (0x00000000).

C/C++: gcc build and debug active file (benchmarkproject) Ln 43, Col 2 Spaces: 4 UTF-8 LF () C++ Mac

Integer Benchmark



```
integer_benchmark.cpp — benchmarkproject

EXPLORER
  BENCHMARKPROJECT
    .vscode
    float_benchmark.dS...
    Contents
    float_benchmark.d...
    harddrive_benchm...
    float_benchmark
    harddrive_benchm...
    hardrive2_benchmar...
    integer_benchmark...
    file.txt
    float_benchmark
    float_benchmark.cpp
    gittag.txt
    harddrive_benchmar...
    hardrive2_benchmark
    hardrive2_benchmar...
    integer_benchmark
    integer_benchmark...

  OUTLINE
  TIMELINE

integer_benchmark.cpp — main()
38
39 double seconds = runTime.count() / 1000.0;
40 int minutes = seconds / 60;
41
42 cout << minutes << " m " << std::fmod(seconds, 60) << " s\n";
43
44 }
```

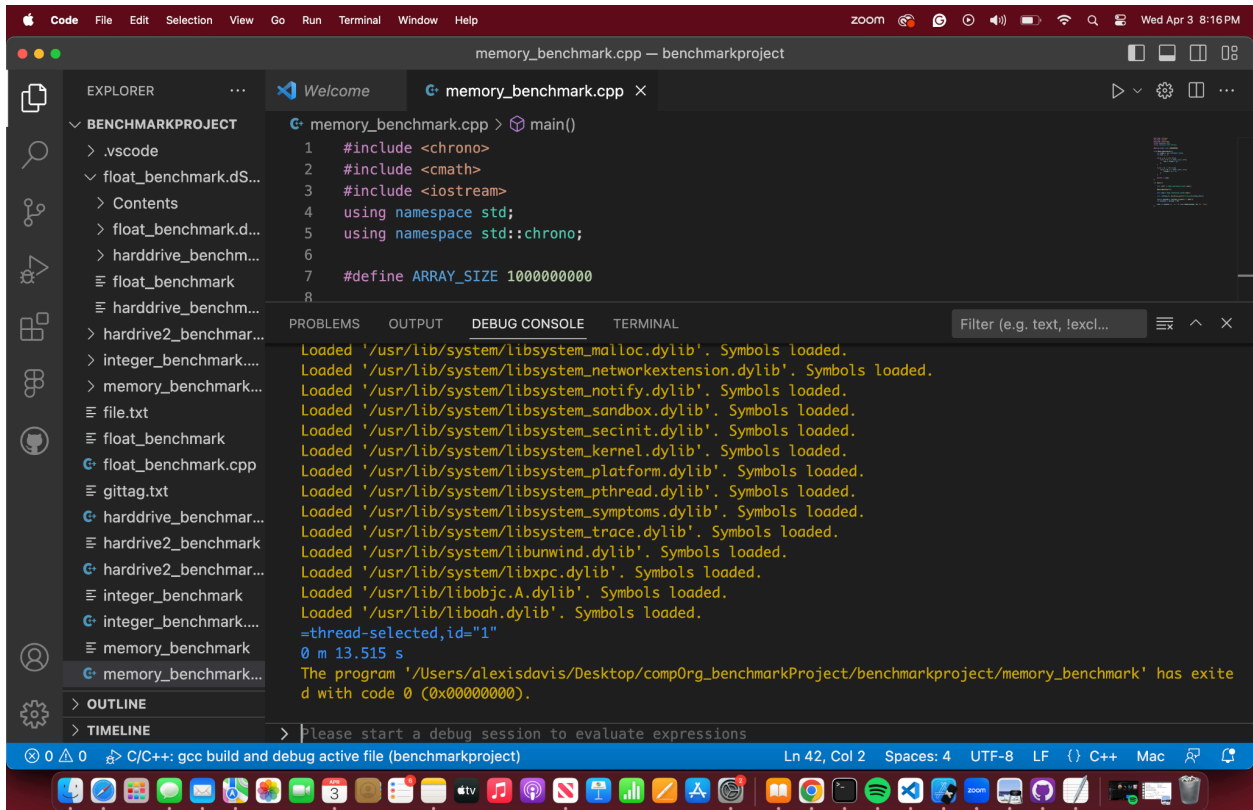
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL

Loaded '/usr/lib/system/libsystem_malloc.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_networkextension.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_notify.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_sandbox.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_secinit.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_kernel.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_platform.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_pthread.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_symptoms.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_trace.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libunwind.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libxpc.dylib'. Symbols loaded.
Loaded '/usr/lib/libobjc.A.dylib'. Symbols loaded.
Loaded '/usr/lib/liboah.dylib'. Symbols loaded.
-thread-selected,id="1"
2 m 37.468 s
The program '/Users/alexisdavis/Desktop/compOrg_benchmarkProject/benchmarkproject/integer_benchmark' has exit ed with code 0 (0x00000000).

Please start a debug session to evaluate expressions

C/C++: gcc build and debug active file (benchmarkproject) Ln 44, Col 2 Spaces: 4 UTF-8 LF {} C++ Mac

Memory Benchmark



```
memory_benchmark.cpp — benchmarkproject

EXPLORER
  BENCHMARKPROJECT
    .vscode
    float_benchmark.dS...
    Contents
    float_benchmark.d...
    harddrive_benchm...
    float_benchmark
    harddrive_benchm...
    hardrive2_benchmar...
    integer_benchmark...
    memory_benchmark...
    file.txt
    float_benchmark
    float_benchmark.cpp
    gittag.txt
    harddrive_benchmar...
    hardrive2_benchmark
    hardrive2_benchmar...
    integer_benchmark
    integer_benchmark...
    memory_benchmark
    memory_benchmark...

  OUTLINE
  TIMELINE

memory_benchmark.cpp — main()
1 #include <chrono>
2 #include <cmath>
3 #include <iostream>
4 using namespace std;
5 using namespace std::chrono;
6
7 #define ARRAY_SIZE 1000000000
8

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
```

Loaded '/usr/lib/system/libsystem_malloc.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_networkextension.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_notify.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_sandbox.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_secinit.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_kernel.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_platform.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_pthread.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_symptoms.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libsystem_trace.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libunwind.dylib'. Symbols loaded.
Loaded '/usr/lib/system/libxpc.dylib'. Symbols loaded.
Loaded '/usr/lib/libobjc.A.dylib'. Symbols loaded.
Loaded '/usr/lib/liboah.dylib'. Symbols loaded.
-thread-selected,id="1"
0 m 13.515 s
The program '/Users/alexisdavis/Desktop/compOrg_benchmarkProject/benchmarkproject/memory_benchmark' has exite d with code 0 (0x00000000).

Please start a debug session to evaluate expressions

C/C++: gcc build and debug active file (benchmarkproject) Ln 42, Col 2 Spaces: 4 UTF-8 LF {} C++ Mac

Floating point	HardDrive 1	Hard Drive 2	Memory	Integer	Geometric Mean
2m 37.5 s	1.173 s	1.332 s	13.515 s	2 m 37.468 s	13.925738361331 s