Windows PowerShell
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安装最新的 PowerShell，了解新功能和改进！https://aka.ms/PSWindows

PS D:\whk\work> docker ps
CONTAINER ID   IMAGE   COMMAND   CREATED   STATUS   PORTS   NAMES
e648f7392d84   scucpphw_test_img:latest   "/bin/bash"   10 minutes ago   Up 6 minutes   22/tcp   boring_ptolemy
PS D:\whk\work> docker run hello-world

Hello from Docker!
This message shows that your installation appears to be working correctly.

To generate this message, Docker took the following steps:
 1. The Docker client contacted the Docker daemon.
 2. The Docker daemon pulled the "hello-world" image from the Docker Hub.
    (amd64)
 3. The Docker daemon created a new container from that image which runs the
    executable that produces the output you are currently reading.
 4. The Docker daemon streamed that output to the Docker client, which sent it
    to your terminal.

To try something more ambitious, you can run an Ubuntu container with:
 $ docker run -it ubuntu bash

Share images, automate workflows, and more with a free Docker ID:
 https://hub.docker.com/

For more examples and ideas, visit:
 https://docs.docker.com/get-started/

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 3. The Docker daemon created a new container from that image which runs the
    executable that produces the output you are currently reading.
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    to your terminal.

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 $ docker run -it ubuntu bash

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PS D:\whk\work> docker images
REPOSITORY   TAG   IMAGE ID   CREATED   SIZE
scucpphw_test_img   latest   a698770a4c1f   29 hours ago   1.3GB
hello-world   latest   feb5d9fea6a5   17 months ago   13.3kB
PS D:\whk\work> docker ps
CONTAINER ID   IMAGE   COMMAND   CREATED   STATUS   PORTS   NAMES
e648f7392d84   scucpphw_test_img:latest   "/bin/bash"   11 minutes ago   Up 7 minutes   22/tcp   boring_ptolemy
PS D:\whk\work> docker exec -it e648f7392d84 /bin/bash
root@e648f7392d84:/# ls
bin boot code dev etc home lib lib64 media mnt opt proc root run sbin srv sys tmp usr var ws
root@e648f7392d84:/# cd ws
root@e648f7392d84:/ws# mkdir code
root@e648f7392d84:/ws# ls
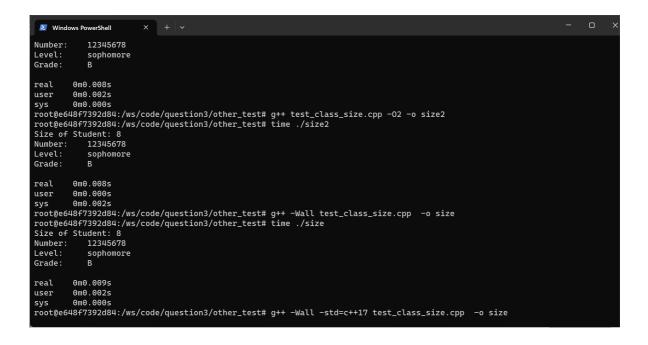Dockerfile code
root@e648f7392d84:/ws# cd code
root@e648f7392d84:/ws/code#

```
root@e648f7392d84:/ws/code/question3# ls
a.out  inefficency.cpp  other_test  test  test.cpp  test.i  test.o  test.s  with_o.out  without_o.out
root@e648f7392d84:/ws/code/question3# a.out
bash: a.out: command not found
root@e648f7392d84:/ws/code/question3# test.i
bash: test.i: command not found
root@e648f7392d84:/ws/code/question3# test.o
bash: test.o: command not found
root@e648f7392d84:/ws/code/question3# test.s
bash: test.s: command not found
root@e648f7392d84:/ws/code/question3# test
root@e648f7392d84:/ws/code/question3# time ./with_o.out
result = 100904034

real    0m0.008s
user    0m0.001s
sys     0m0.000s
root@e648f7392d84:/ws/code/question3# time ./without_o.out
result = 100904034

real    0m1.779s
user    0m1.762s
sys     0m0.010s
root@e648f7392d84:/ws/code/question3# cd other_test/
root@e648f7392d84:/ws/code/question3/other_test# ls
a.out            test_class_size.cpp        test_move.cpp        test_ptr.cpp
test_class.cpp   test_default_parameter.cpp  test_noexcept.cpp   test_raii.cpp
root@e648f7392d84:/ws/code/question3/other_test# g++ test_class.cpp
```

```
root@e648f7392d84:/ws/code/question3/other_test# ls
a.out            test_class_size.cpp        test_move.cpp        test_ptr.cpp
test_class.cpp   test_default_parameter.cpp  test_noexcept.cpp   test_raii.cpp
root@e648f7392d84:/ws/code/question3/other_test# g++ test_class.cpp
root@e648f7392d84:/ws/code/question3/other_test# g++ -E test_class_size.cpp -o test
root@e648f7392d84:/ws/code/question3/other_test# ls
a.out  test_class.cpp        test_default_parameter.cpp  test_noexcept.cpp  test_raii.cpp
test   test_class_size.cpp   test_move.cpp               test_ptr.cpp
root@e648f7392d84:/ws/code/question3/other_test# rm test
root@e648f7392d84:/ws/code/question3/other_test# g++ -E test_class_size.cpp -o
g++: error: missing filename after '-o'
root@e648f7392d84:/ws/code/question3/other_test# g++ -E test_class_size.cpp -o test.i
root@e648f7392d84:/ws/code/question3/other_test# g++ test_class.cpp -O2 -o test1
root@e648f7392d84:/ws/code/question3/other_test# ls
a.out   test1            test_class_size.cpp        test_move.cpp       test_ptr.cpp
test.i  test_class.cpp   test_default_parameter.cpp  test_noexcept.cpp  test_raii.cpp
root@e648f7392d84:/ws/code/question3/other_test# time test1
bash: test1: command not found

real    0m0.002s
user    0m0.001s
sys     0m0.001s
root@e648f7392d84:/ws/code/question3/other_test# time ./test1
1       #21325302 is created
1       #58320212 is created
5       #21325302       5000    5000
25      #58320212       10000   10000
45      #21325302       5500    10500
```

```
1       #58320212 is created
5       #21325302       5000    5000
25      #58320212       10000   10000
45      #21325302       5500    10500
60      #58320212       -4000   6000
90      #21325302       27.64   10527.6
90      #58320212       21.78   6021.78
#21325302       Balance: 10527.6
#58320212       Balance: 6021.78

real    0m0.009s
user    0m0.002s
sys     0m0.000s
root@e648f7392d84:/ws/code/question3/other_test# g++ test_class.cpp -O1 -o test1
root@e648f7392d84:/ws/code/question3/other_test# time ./test1
1       #21325302 is created
1       #58320212 is created
5       #21325302       5000    5000
25      #58320212       10000   10000
45      #21325302       5500    10500
60      #58320212       -4000   6000
90      #21325302       27.64   10527.6
90      #58320212       21.78   6021.78
#21325302       Balance: 10527.6
#58320212       Balance: 6021.78

real    0m0.007s
user    0m0.002s
```

```
user     0m0.002s
sys      0m0.000s
root@e648f7392d84:/ws/code/question3/other_test# g++ test_class.cpp -O0 -o test0
root@e648f7392d84:/ws/code/question3/other_test# time ./test0
1       #21325302 is created
1       #58320212 is created
5       #21325302       5000    5000
25      #58320212       10000   10000
45      #21325302       5500    10500
60      #58320212       -4000   6000
90      #21325302       27.64   10527.6
90      #58320212       21.78   6021.78
#21325302       Balance: 10527.6
#58320212       Balance: 6021.78

real     0m0.008s
user     0m0.001s
sys      0m0.000s
root@e648f7392d84:/ws/code/question3/other_test# g++ test_class_size.cpp -O0 -o size0
root@e648f7392d84:/ws/code/question3/other_test# time ./size0
Size of Student: 8
Number:     12345678
Level:      sophomore
Grade:      B

real     0m0.008s
user     0m0.002s
sys      0m0.000s
```

```
Number:     12345678
Level:      sophomore
Grade:      B

real     0m0.008s
user     0m0.002s
sys      0m0.000s
root@e648f7392d84:/ws/code/question3/other_test# g++ test_class_size.cpp -O2 -o size2
root@e648f7392d84:/ws/code/question3/other_test# time ./size2
Size of Student: 8
Number:     12345678
Level:      sophomore
Grade:      B

real     0m0.008s
user     0m0.000s
sys      0m0.002s
root@e648f7392d84:/ws/code/question3/other_test# g++ -Wall test_class_size.cpp  -o size
root@e648f7392d84:/ws/code/question3/other_test# time ./size
Size of Student: 8
Number:     12345678
Level:      sophomore
Grade:      B

real     0m0.009s
user     0m0.002s
sys      0m0.000s
root@e648f7392d84:/ws/code/question3/other_test# g++ -Wall -std=c++17 test_class_size.cpp  -o size
```

```
Number:    12345678
Level:     sophomore
Grade:     B

real    0m0.008s
user    0m0.000s
sys     0m0.002s
root@e648f7392d84:/ws/code/question3/other_test# g++ -Wall test_class_size.cpp  -o size
root@e648f7392d84:/ws/code/question3/other_test# time ./size
Size of Student: 8
Number:    12345678
Level:     sophomore
Grade:     B

real    0m0.009s
user    0m0.002s
sys     0m0.000s
root@e648f7392d84:/ws/code/question3/other_test# g++ -Wall -std=c++17 test_class_size.cpp  -o size
root@e648f7392d84:/ws/code/question3/other_test# time ./size
Size of Student: 8
Number:    12345678
Level:     sophomore
Grade:     B

real    0m0.009s
user    0m0.001s
sys     0m0.000s
root@e648f7392d84:/ws/code/question3/other_test#
```

```
Breakpoint 4 at 0x40121e: file test_function_overload.cpp, line 15.
(gdb) bt
#0  main () at test_function_overload.cpp:15
(gdb) n
Enter two integer: 2 3
16              cout << "Their sum of square: " << sumOfSquare(m, n) << endl;
(gdb) n

Breakpoint 1, sumOfSquare (a=2, b=3) at test_function_overload.cpp:5
5               return a * a + b * b;
(gdb) bt
#0  sumOfSquare (a=2, b=3) at test_function_overload.cpp:5
#1  0x0000000000401262 in main () at test_function_overload.cpp:16
(gdb) n
6       }
(gdb) n
Their sum of square: 13
main () at test_function_overload.cpp:19
19              cout << "Enter two real number: ";
(gdb) n
20              cin >> x >> y;
(gdb) n
Enter two real number: 2.2 1.1
21              cout << "Their sum of square: " << sumOfSquare(x, y) << endl;
(gdb) n

Breakpoint 2, sumOfSquare (a=2.2000000000000002, b=1.1000000000000001) at test_function_overload.cpp:9
9               return a * a + b * b;
(gdb) bt
#0  sumOfSquare (a=2.2000000000000002, b=1.1000000000000001) at test_function_overload.cpp:9
#1  0x00000000004012d4 in main () at test_function_overload.cpp:21
```

```
┌─test_range_based.cpp────────────────────────────────────────────────────────┐
│    8           {                                                             │
│B+  9               int x[10] = { 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 };            │
│    10                                                                        │
│>   11              for( int y : x ) { // Access by value using a copy declared as a specific type.│
│    12                      // Not preferred.                                 │
│    13                  cout << y << " ";                                     │
│    14              }                                                         │
│    15              cout << endl;                                             │
│    16                                                                        │
│    17              for( auto y : x ) { // Copy of 'x', almost always undesirable│
│    18                  cout << y << " ";                                     │
│    19              }                                                         │
│    20              cout << endl;                                             │
│    21                                                                        │
│    22              for( auto &y : x ) { // Type inference by reference.       │
│    23                  cout << y << " ";                                     │
│    24              }                                                         │
│    25              cout << endl;                                             │
└──────────────────────────────────────────────────────────────────────────────┘
native process 2578 In: main                              L11    PC: 0x4012d2
1: y = 4214944
(gdb) n
1: y = 1
(gdb) n
1: y = 1
(gdb) n
1: y = 2
(gdb) n
1: y = 2
(gdb)
```

```
    test_range_based.cpp
        8              {
B+ 9              int x[10] = { 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 };
        10
        11              for( int y : x ) { // Access by value using a copy declared as a specific type.
        12                          // Not preferred.
        13                  cout << y << " ";
        14              }
        15              cout << endl;
        16
  >     17              for( auto y : x ) { // Copy of 'x', almost always undesirable
        18                  cout << y << " ";
        19              }
        20              cout << endl;
        21
        22              for( auto &y : x ) { // Type inference by reference.
        23                  cout << y << " ";
        24              }
        25              cout << endl;
native process 2578 In: main                                              L17   PC: 0x40133c
2: y = 2
(gdb) n
2: y = 2
(gdb) n
2: y = 3
(gdb) n
2: y = 3
2: y = 4
2: y = 4
(gdb)
```

```
    test_range_based.cpp
        12                          // Not preferred.
        13                  cout << y << " ";
        14              }
        15              cout << endl;
        16
        17              for( auto y : x ) { // Copy of 'x', almost always undesirable
        18                  cout << y << " ";
        19              }
        20              cout << endl;
        21
  >     22              for( auto &y : x ) { // Type inference by reference.
        23                  cout << y << " ";
        24              }
        25              cout << endl;
        26
        27              for( const auto &y : x ) { // Type inference by const reference.
        28                  cout << y << " ";
        29              }
native process 2578 In: main                                              L22   PC: 0x4013a8
No symbol "yy" in current context.
(gdb) display y
3: y = (int &) @0x7fff733070e0: 1
(gdb) n
3: y = (int &) @0x7fff733070e0: 1
(gdb) n
3: y = (int &) @0x7fff733070e4: 2
(gdb) n
3: y = (int &) @0x7fff733070e4: 2
(gdb)
```

```
        12                          // Not preferred.
        14              }
        15              cout << endl;
        16
        17              for( auto y : x ) { // Copy of 'x', almost always undesirable
        18                  cout << y << " ";
        19              }
        19              }
        20              cout << endl;
        21
        22              for( auto &y : x ) { // Type inference by reference.
        23                  cout << y << " ";
        24              }
        25              cout << endl;
        26
        27              for( const auto &y : x ) { // Type inference by const reference.
  >     28                  cout << y << " ";
        29              }
        30              cout << endl;
native process 2578 In: main                                              L25   PC: 0x4013b7
3: y = (int &) @0x7fff733070f4: 6                                         8        3f2
(gdb) display y
4: y = (const int &) @0x7fff733070e0: 1
(gdb) n
4: y = (const int &) @0x7fff733070e0: 1
4: y = (const int &) @0x7fff733070e4: 2
4: y = (const int &) @0x7fff733070e4: 2
4: y = (const int &) @0x7fff733070e8: 3
4: y = (const int &) @0x7fff733070e8: 3
4: y = (const int &) @0x7fff733070ec: 4
(gdb)
```

```
    25              cout << endl;
    31              cout << "end of integer array test" << endl;
    32              cout << endl;
    33
    34              vector<double> v;
    35              for (int i = 0; i < 10; ++i) {
    36                  v.push_back(i + 0.14159);
    37              }
    38
    39              for( const auto &j : v ) {
>   40                  cout << j << " ";
    41              }
    42              cout << endl;
    43              cout << "end of vector test" << endl;
    44          }
    45
```

```
4: y = (const int &) @0x7fff733070f8: 7
4: y = (const int &) @0x7fff733070f8: 7
(gdb) d display 5
(gdb) n
6: j = (const double &) @0x11cf388: 1.1415899999999999
(gdb) n
6: j = (const double &) @0x11cf390: 2.1415899999999999
(gdb) n
6: j = (const double &) @0x11cf390: 2.1415899999999999
(gdb) n
6: j = (const double &) @0x11cf398: 3.1415899999999999
(gdb)
```

```
    21              }
    19              inline int Max(const T& a, const T& b){
    20                  return (a>b ? a:b);
    21              }
    22          const int C::NUM;
    23          int main() {
B+  24              cout << p << endl;
    25              C c;
    26              cout << &c.NUM << endl;
    27
    28              cout << C::NUM1 << endl;
    29
>   30              int a=5, b=0;
    31              cout<<MAX(++a, b)<<endl;
    32              cout<<MAX(++a, b+10)<<endl;
    33              a=5,b=0;
    34              cout<<Max(++a,b)<<endl;
    35          }
```

```
For more information about this security protection see the
--Type <RET> for more, q to quit, c to continue without paging--
        info "(gdb)Auto-loading safe path"

Breakpoint 1, main () at test_const.cpp:24
(gdb) n
hello
(gdb) n
0x402004
(gdb) n
3
(gdb)
```

```
    21              }
    19              inline int Max(const T& a, const T& b){
    20                  return (a>b ? a:b);
    21              }
    22          const int C::NUM;
    23          int main() {
B+  24              cout << p << endl;
    25              C c;
    26              cout << &c.NUM << endl;
    27
    28              cout << C::NUM1 << endl;
    29
   >30              int a=5, b=0;
    31              cout<<MAX(++a, b)<<endl;
    32              cout<<MAX(++a, b+10)<<endl;
    33              a=5,b=0;
    34              cout<<Max(++a,b)<<endl;
    35          }
For more information about this security protection see the                  8            d
--Type <RET> for more, q to quit, c to continue without paging--            30            f
No symbol "p" in current context.
(gdb) display &c.NUM
1: &c.NUM = <error: Attempt to take address of value not located in memory.>
(gdb) display C::NUM1
2: C::NUM1 = C::NUM1
(gdb) display c.NUM
3: c.NUM = 3
(gdb) dispaly &C::NUM1
Undefined command: "dispaly".  Try "help".
(gdb)
```

```
    21              }
     9          public:
    10
    11              static const int NUM = 3;
    12              enum con {
    13                  NUM1 = 3
    14              };
    15          };
    16
    17          #define MAX(a,b) ((a) > (b) ? (a) : (b))
    18          template<typename T>
    19          inline int Max(const T& a, const T& b){
    20                  return (a>b ? a:b);
    21          }
    22          const int C::NUM;
    23          int main() {
B+  24              cout << p << endl;
    25              C c;
For more information about this security protection see the                  8            d
--Type <RET> for more, q to quit, c to continue without paging--            31           20
(gdb) dispaly &C::NUM1
Undefined command: "dispaly".  Try "help".
(gdb) display &C::NUM1
4: &C::NUM1 = <error: Can't take address of "C::NUM1" which isn't an lvalue.>
(gdb) n
1: &c.NUM = <error: Attempt to take address of value not located in memory.>
2: C::NUM1 = C::NUM1
3: c.NUM = 3
4: &C::NUM1 = <error: Can't take address of "C::NUM1" which isn't an lvalue.>
(gdb)
```