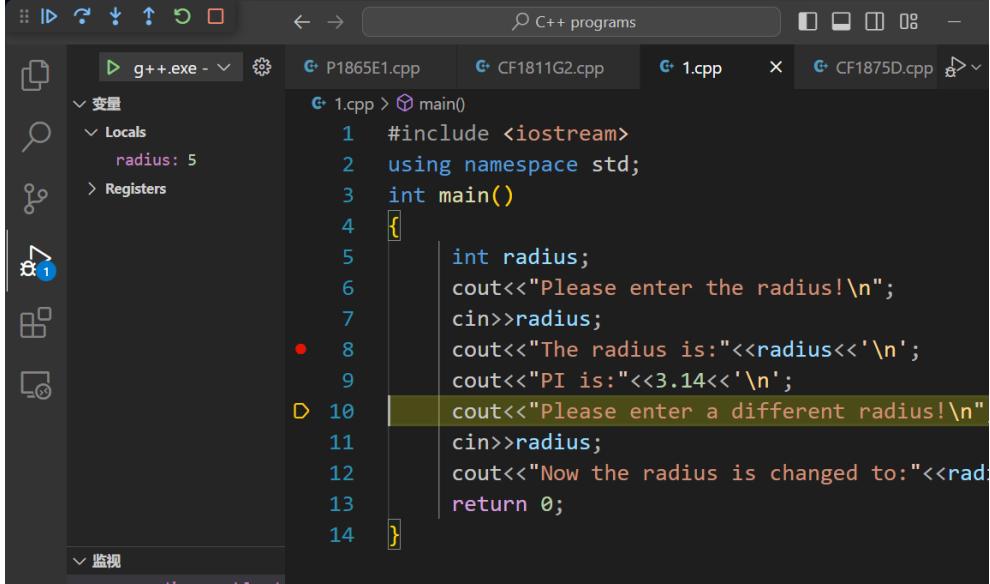


计算机学院 高级程序语言设计 课程实验报告

| | | |
|---|------------------|---------|
| 实验题目： C++简单程序设计 | 学号： 202300130150 | |
| 日期： 2024-3-12 | 班级： 4 | 姓名： 王成意 |
| 实验目的： 运行第二章 ppt 中给出的下列程序，发现问题、提出问题，解决问题。 | | |
| 实验步骤与内容： 2-1 | | |
|  | | |

The screenshot shows the VS Code interface with the following details:

- Top Bar:** Includes icons for file operations, a search bar labeled "C++ programs", and tabs for "P1865E1.cpp", "CF1811G2.cpp", "1.cpp", and "CF1875D.cpp".
- Left Sidebar:** Shows the current process "g++.exe -" and its memory state. It includes sections for "变量" (Variables), "Locals" (with a value "radius: 8"), and "Registers".
- Code Editor:** Displays the "1.cpp" file with the following code:

```
1 #include <iostream>
2 using namespace std;
3 int main()
4 {
5     int radius;
6     cout<<"Please enter the radius!\\n";
7     cin>>radius;
8     cout<<"The radius is:"<<radius<<'\\n';
9     cout<<"PI is:"<<3.14<<'\\n';
10    cout<<"Please enter a different radius!";
11    cin>>radius;
12    cout<<"Now the radius is changed to:"<<
13    return 0;
14 }
```
- Bottom Panel:** Shows the "Terminal" tab with the command "-exec disassemble /n" and its output:

```
-f: -var-create: un...
ans: -var-create: ...
```
- Bottom Left:** Shows the "Breakpoints" and "Variables" sections of the debugger sidebar.
- Bottom Right:** Shows the "Output" tab with the command "-vscode.cppTools-1.19.7-win32-x64\debugAdapters\bin\WindowsDebugLaur...". Below it is the terminal output:

```
-vscode.cppTools-1.19.7-win32-x64\debugAdapters\bin\WindowsDebugLaur...
e' '--stdin=Microsoft-MIEngine-In-tjjv5110.2ru' '--stdout=Microsoft-
e-Out-asbv0uuk.4da' '--stderr=Microsoft-MIEngine-Error-xgljns2y.r5o'
=Microsoft-MIEngine-Pid-40yzl0qa.fu0' '--dbgExe=D:\mingw64\bin\gdb.e
interpreter=mi'
Please enter the radius!
5
The radius is:5
PI is:3.14
Please enter a different radius!
8
```

2-2

The screenshot shows a C++ development environment with multiple tabs at the top: 1.cpp, 2.cpp, 3.cpp, and 4.cpp. The 1.cpp tab is active, displaying the following code:

```
1 #include <iostream>
2 using namespace std;
3 int main()
4 { const double PI(3.14159);
5     int radius;
6     cout<<"Please enter the radius!\n";
7     cin>>radius;
8     cout<<"The radius is:"<<radius<<'\n';
9     cout<<"PI is:"<<PI<<'\n';
10    cout<<"Please enter a different radius!\n";
11    cin>>radius;
12    cout<<"Now the radius is changed to:"<<radius<<'\n';
13    cout<<"PI is still:"<<PI<<'\n';
14    //cin>>pi;
15    return 0;
16 }
17
```

The terminal window below shows the program's execution and its interaction with the user:

```
e- Out-blxqtwuy.k3o' '--stderr=Microsoft-MIEngine-Error-pnakoju2.geq' '--pid
=Microsoft-MIEngine-Pid-lydlrntd.hme' '--dbgExe=D:\mingw64\bin\gdb.exe' '--
interpreter=mi'
Please enter the radius!
4
The radius is:4
PI is:3.14159
Please enter a different radius!
4
Now the radius is changed to:4
PI is still:3.14159
PS D:\C++ programs>
```

At the bottom, there is a note in Chinese:

//思考：能给常量输入新值吗？如定义 PI 时不初始化会怎样？
不能。
会报错：

```
1.cpp > main()
1 #include <iostream>
2 using namespace std;
3 int main()
4 { const double PI;
5     int radius;
6     cout<<"Please enter the radius!\n";
7     cin>>radius;
8     cout<<"The radius is:"<<radius<<'\n';
9     cout<<"PI is:"<<PI<<'\n';
10    cout<<"Please enter a different radius!\n";
11    cin>>radius;
12    cout<<"Now the radius is changed to:"<<radius<
13    cout<<"PI is still:"<<PI<<'\n';
14 //cin>>pi;
15 return 0;
16 }
17
```

问题 1 转到输出 终端 ... + C/C++: g++.exe 生成活动文件 ⊗ ⌂ ⌂ ...

```
cmd /c chcp 65001>nul && D:\mingw64\bin\g++.exe -fdiagnostics-color=always
-g "D:\C++ programs\1.cpp" -o "D:\C++ programs\1.exe" -std=c++11
D:\C++ programs\1.cpp: In function 'int main()':
D:\C++ programs\1.cpp:4:18: error: uninitialized const 'PI' [-fpermissive]
{ const double PI;
^~
```

生成已完成，但出现错误。

* 终端进程已终止。退出代码：1

The screenshot shows the VS Code interface with the debugger extension active. The top half displays the code editor with a C++ file named 1.cpp. The code defines a global variable `pi` (3.1415899999...) and a local variable `radius` (7). It then prompts the user to enter a different radius. The bottom half shows the terminal output where the user has entered a new radius value of 7, and the program continues to run.

1.cpp > main()

```
1 #include <iostream>
2 using namespace std;
3 int main()
4 {
5     const double pi(3.14159);
6     int radius(0);
7     cout<<"The initial radius is:"<<radius<<'\n';
8     cout<<"PI is:"<<pi<<'\n';
9     cout<<"Please enter a different radius!\n";
10    cin>>radius;
11    cout<<"Now the radius is changed to:"<<radius<<'\n';
12    cout<<"PI is still:"<<pi<<'\n';
13    return 0;
14 }
```

-exec disassemble /m
f: -var-create: un...
ans: -var-create: ...

调用堆栈

断点

All C++ Exceptions
1.cpp (10)
1.cpp (14)
B.cpp Contest... (22)
B.cpp Contest... (55)
C.cpp Contest... (9)
C.cpp Contest... (18)
C.cpp Contest... (15)
C.cpp Contest... (27)

PS D:\C++ programs>
PS D:\C++ programs> & 'd:\VsCode-extentions\.vscode-insiders\extensions\nodejs\vscode_cppTools-1.19.7-win32-x64\debugAdapters\bin\WindowsDebugLauncher.exe' '--stdin=Microsoft-MIEngine-In-vvsxsnrs.xdp' '--stdout=Microsoft-MIEngine-Out-thuudcjk.cu0' '--stderr=Microsoft-MIEngine-Error-b1nqiz5m.jw3' '--pid=Microsoft-MIEngine-Pid-3dxrcfz3.clm' '--dbgExe=D:\mingw64\bin\gdb.exe' '--interpreter=mi'
The initial radius is:0
PI is:3.14159
Please enter a different radius!
7

2-4

```
1.cpp > ...
1 #include <iostream>
2 using namespace std;
3 int main()
4 {
5     short int i;
6     unsigned short int j;
7     j = 50000;
8     i = j;
9     cout << "Short int is:" << i << endl;
10    cout << "Short unsigned int is: " << j << endl;
11    return 0;
12 }
● 13
```

问题 输出 调试控制台 终端 端口 + × 代码 cppdbg: 1.exe

```
7
PS D:\C++ programs> ^C
PS D:\C++ programs>
PS D:\C++ programs> & 'd:\VsCode-extentions\vscode-insiders\extensions\ms
-vscode.cptools-1.19.7-win32-x64\debugAdapters\bin\WindowsDebugLauncher.ex
e' '--stdin=Microsoft-MIEngine-In-os4gbihu.0zx' '--stdout=Microsoft-MIEngin
e-Out-hhwbyaeu.jxh' '--stderr=Microsoft-MIEngine-Error-inpu52t.col' '--pid
=Microsoft-MIEngine-Pid-hszanysp.bvm' '--dbgExe=D:\mingw64\bin\gdb.exe' '--
interpreter=mi'
Short int is: -15536
Short unsigned int is: 50000
PS D:\C++ programs> []
```

//观察思考：将正数 50000 赋值给变量 i 以后，输出 i 的结果是什么？为什么？输出 j 的结果是什么？为什么？

输出结果如上图。

原因：i 因为 short 数据范围溢出所以输出-15536，j: 50000<65535，没有溢出，输出结果为 50000.

```
1 #include <iostream>
2 #include <iostream>
3 #include <climits>
4 using namespace std;
5 int main()
6 { cout <<"Min of short is: "<<SHRT_MIN<<endl;
7   cout <<"Max of short is: "<<SHRT_MAX<<endl;
8   cout <<"Min of int is: "<<INT_MIN<<endl;
9   cout <<"Max of int is: "<<INT_MAX<<endl;
10  cout <<"Min of long is: "<<LONG_MIN<<endl;
11  cout <<"Max of long is: "<<LONG_MAX<<endl;
12  cout <<"Max of unsigned short is: "<<USHRT_MAX<<endl;
13  cout <<"Max of unsigned int is: "<<UINT_MAX<<endl;
14  cout <<"Max of unsigned long is: "<<ULONG_MAX<<endl;
15  return 0;
16 }
17 |
```

```
=Microsoft-MIEngine-Pid-gzitsjz2.wkx' '--dbgExe=D:\mingw64\bin\gdb.exe' '--  
interpreter=mi'  
Min of short is: -32768  
Max of short is: 32767  
Min of int is: -2147483648  
Max of int is: 2147483647  
Min of long is: -2147483648  
Max of long is: 2147483647  
Max of unsigned short is: 65535  
Max of unsigned int is: 4294967295  
Max of unsigned long is: 4294967295
```

```
1.cpp > main()
1 #include <iostream>
2 #include <limits>
3 using namespace std;
4 int main()
5 {
6     int isample, osample, hsample;
7     unsigned long ulsample;
8     cin>>isample>>oct>>osample>>hex>>hsample;
9     cout<<isample<<'(';<<oct<<osample<<'(';<<hex<<hsam
10    isample=123;
11    osample=0173;
12    hsample=0x7B;
13    ulsample=4294967295UL;
14    cout<<dec<<isample<<'(';<<oct<< isample
15        <<'(';<<hex<< isample <<endl;
16    cout<<dec<< osample<<'(';<<oct<<osample
17        <<'(';<<hex<< osample <<endl;
18    cout<< dec<<hsample <<'(';<<oct<< hsample<<';'
19        <<hex<<hsample<<endl;
20    cout<<dec<< ulsample <<'(';<<oct<<ulsample<<''
21        <<hex<<ulsample<<endl;
22    return 0;
23 }
```

```
问题 输出 调试控制台 终端 端口 + -> cppdbg: 1.exe ... 
-vscode.cppTools-1.19.7-win32-x64\debugAdapters\bin\WindowsDebugLauncher.exe' '--stdin=Microsoft-MIEngine-In-we3o1waj.kyl' '--stdout=Microsoft-MIEngine-Out-zkr2j0g3.rr4' '--stderr=Microsoft-MIEngine-Error-vb1ljvtv.vqu' '--pid=Microsoft-MIEngine-Pid-vuipv3tx.cpm' '--dbgExe=D:\mingw64\bin\gdb.exe' '--interpreter=mi'
666 666 666
666;666;666
123;173;7b
123;173;7b
123;173;7b
4294967295;377777777777;ffffffff
PS D:\C++\Programme>
```

```
1.cpp > ...
1 #include <iostream>
2 using namespace std;
3 const float PI_FLOAT = 3.1415926f;
4 const double PI_DOUBLE = 3.1415926;
5 const long double PI_LDOUBLE = 3.1415926;
6 int main()
7 {
8     float nRadiusFloat = 5.5f, nAreaFloat;
9     double nRadiusDouble = 5.5, nAreaDouble;
10    long double nRadiusLDouble = 5.5, nAreaLDouble;
11    nAreaFloat = PI_FLOAT* nRadiusFloat* nRadiusFloat;
12    nAreaDouble = PI_DOUBLE* nRadiusDouble* nRadiusDouble;
13    nAreaLDouble = PI_DOUBLE* nRadiusLDouble* nRadiusLDouble;
14    cout << "nAreaFloat = "<< nAreaFloat <<, sizeof(nAreaFloat);
15
16    cout << "nAreaDouble = "<< nAreaDouble
17        <<, sizeof(nAreaDouble) = "
18        << sizeof(nAreaDouble)<< endl;
19    cout << "nAreaLDouble = "<< nAreaLDouble
20        <<, sizeof(nAreaLDouble) = "
21        << sizeof(nAreaLDouble)<< endl;
22
23    return 0;
24 }
25
```

```
问题    输出    调试控制台    终端    端口    +  ×  cpptools: 1.exe  □  垃圾
PS D:\C++ programs> ^C
PS D:\C++ programs>
PS D:\C++ programs> & 'd:\VsCode-extentions\.vscode-insiders\extensions\vscode.cpptools-1.19.7-win32-x64\debugAdapters\bin\WindowsDebugLauncher.exe' '--stdin=Microsoft-MIEngine-In-lpyww00r.2e1' '--stdout=Microsoft-MIEngine-Out-pnr2h33j.44y' '--stderr=Microsoft-MIEngine-Error-co5soogr.3ml' '--pid=Microsoft-MIEngine-Pid-wrbjnrfy.sob' '--dbgExe=D:\mingw64\bin\gdb.exe' 'interpreter=mi'
nAreaFloat = 95.0332, sizeof(nAreaFloat) = 4
nAreaDouble = 95.0332 , sizeof(nAreaDouble) = 8
nAreaLDouble = 95.0332 , sizeof(nAreaLDouble) = 16
PS D:\C++ programs>
```

```
1.cpp > ...
1 #include <iostream>
2 using namespace std;
3 int main()
4 {
5     cout << 'A' << ' ' << 'a' << endl;      //输出普通字符
6     cout << "one\ttwo\tthree\n";           //使用水平制表符
7     cout << "123\b\b45\n";                 //使用退格符
8     cout << "Alert\a\n";                  //使用响铃
9     return 0;
10}
11
```

问题 输出 调试控制台 终端 端口 + × cppdbg: 1.exe □ ■ ... ^

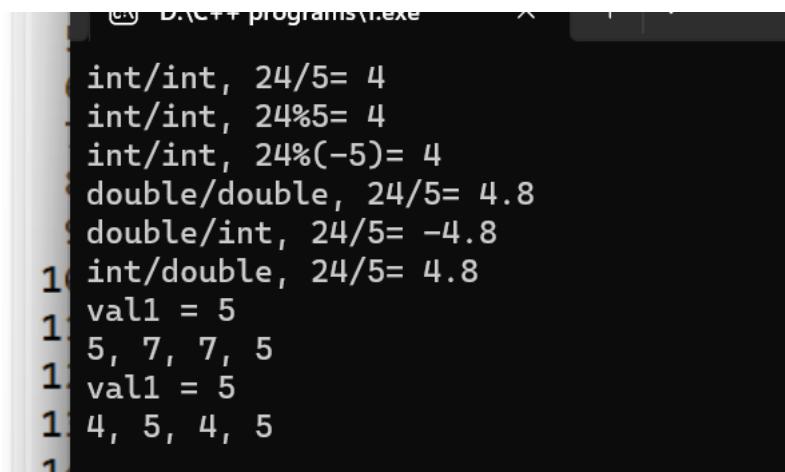
```
PS D:\C++ programs>
PS D:\C++ programs> & 'd:\VsCode-extentions\.vscode-insiders\extensions\ms-vscode.cpptools-1.19.7-win32-x64\debugAdapters\bin\WindowsDebugLauncher.exe' '--stdin=Microsoft-MIEngine-In-bjgzi44a.2dx' '--stdout=Microsoft-MIEngine-Out-tlmesjz4.b34' '--stderr=Microsoft-MIEngine-Error-oieoszrh.ckr' '--pid=Microsoft-MIEngine-Pid-ge1oleam.wrc' '--dbgExe=D:\mingw64\bin\gdb.exe' '--interpreter=mi'
A a
one    two    three
145
Alert
PS D:\C++ programs>
```

```
1.cpp > main()
1 #include <iostream>
2 using namespace std;
3 int main()
4 {
5     bool bV1= true, bV2= false;
6     cout <<" value bV1 = "<<bV1<<endl;
7     cout <<"bool value bV2 = "<<bV2<<endl;
8     int nV1=bV1, nV2 = 0;
9     bV1 = nV2;
10    cout <<"int value nV1 = "<< nV1<<endl;
11    cout <<"bool value bV1 = "<<bV1<<endl;
12    return 0;
13 }
```

问题 输出 调试控制台 终端 端口 + × cppdbg: 1.exe

```
PS D:\C++ programs>
PS D:\C++ programs> & 'd:\VsCode-extentions\.vscode-insiders\extensions\r-vscode.cppTools-1.19.7-win32-x64\debugAdapters\bin\WindowsDebugLauncher.e
e' '--stdin=Microsoft-MIEngine-In-vw1toedr.pbr' '--stdout=Microsoft-MIEng
e-Out-ygplpws0.z0n' '--stderr=Microsoft-MIEngine-Error-k4aw00jp.4bf' '--p
=Microsoft-MIEngine-Pid-1i3s53w0.rwz' '--dbgExe=D:\mingw64\bin\gdb.exe' '
interpreter=mi'
 value bV1 = 1
bool value bV2 = 0
int value nV1 = 1
bool value bV1 = 0
```

```
interpreter=mi'
int/int, 24/5= 4
int/int, 24%5= 4
int/int, 24%(-5)= 4
double,double, 24/5= 4.8
double/int, 24/5= -4.8
int/double, 24/5= 4.8
val1 = 5
5, 7, 7, 5
val1 = 5
5, 7, 7, 5
```



```
1 int/int, 24/5= 4
1 int/int, 24%5= 4
1 int/int, 24%(-5)= 4
1 double,double, 24/5= 4.8
1 double/int, 24/5= -4.8
1 int/double, 24/5= 4.8
1 val1 = 5
1 5, 7, 7, 5
1 val1 = 5
1 4, 5, 4, 5
1
```

确实不同

2-13

```
1 // 第一章 - 类型和常量
2 #include <iostream>
3 using namespace std;
4 int main()
5 {
6     cout << "sizeof(short) = " << sizeof(short) << endl;
7     cout << "sizeof(unsigned short) = " << sizeof(unsigned short) << endl;
8     cout << "sizeof(int) = " << sizeof(int) << endl;
9     cout << "sizeof(unsigned int) = " << sizeof(unsigned int) << endl;
10    cout << "sizeof(long) = " << sizeof(long) << endl;
11    cout << "sizeof(unsigned long) = " << sizeof(unsigned long) << endl;
12    cout << "sizeof(float) = " << sizeof(float) << endl;
13    cout << "sizeof(double) = " << sizeof(double) << endl;
14    cout << "sizeof(long double) = " << sizeof(long double) << endl;
15    cout << "sizeof(char) = " << sizeof(char) << endl;
16    return 0;
17 }
```

题 输出 调试控制台 终端 端口 + × cppdbg: 1.exe ⌂ ⌂ ...
interpreter=mi'
sizeof(short)=2
sizeof(unsigned short)=2
sizeof(int)= 4
sizeof(unsigned int)= 4
sizeof(long)= 4
sizeof(unsigned long)=4
sizeof(float)= 4
sizeof(double)= 8
sizeof(long double)= 16
sizeof(char)= 1

有。Long double 课本上长度是 8.

```
1.cpp > main()
1 #include <iostream>
2 #include <bitset>
3 using namespace std;
4 int main()
5 {
6     cout << "~15 = "<<(~15)<<endl;
7     cout << "15 & 21 = "<<(15&21)<<endl;
8     cout << "15 ^ 21 = "<<(15^21)<<endl;
9     cout << "15 | 21 = "<<(15|21)<<endl;
● 10     unsigned int nTest = 9;
11     cout <<"nTest = "<<nTest<<endl;
12     nTest |= 1<<4; //将第4位置为1
13     cout <<"After set the position 4 to 1, nTest
14         <<endl;
15     nTest &= ~(1<<4); //将第4位置0
16     cout <<"After set the position 4 to 0, nTest =
17     bool nFlag;
18         for (int i=0; i<16; i++){ //实现翻转
19             nFlag = nTest & (1<<i);
20             if (nFlag) {
21                 nTest &= ~(1<<i);
22             }
23             else{
24                 nTest |= 1<<i;
25             }
26         }
27     cout <<"After flip, nTest = "<<nTest<<endl;
28
```

```
问题 输出 调试控制台 终端 端口 + 退出 cppdbg: 1.exe ...  
e-Out-bhlz5ptb.2do' '--stderr=Microsoft-MIEngine-Error-sczf44xk.0aj' '--pid=Microsoft-MIEngine-Pid-orugtfhq.ker' '--dbgExe=D:\mingw64\bin\gdb.exe' '--interpreter=mi'  
~15 = -16  
15 & 21 = 5  
15 ^ 21 = 26  
15 | 21 = 31  
nTest = 9  
After set the position 4 to 1, nTest = 25  
After set the position 4 to 0, nTest = 9  
After flip, nTest = 65526
```

// 程序 15:
// 执行如下程序，解释每一行打印结果

```
1.cpp > main()
1 #include <iostream>
2 using namespace std;
3
4 int main(){
5     auto a = 0;
6     auto b = 0.0;
7     auto c = 0.0f;
8     auto d = b+c;
9     decltype(c) e = a+b;
10    cout<<sizeof(a)<<endl;
11    cout<<sizeof(b)<<endl;
12    cout<<sizeof(c)<<endl;
13    cout<<sizeof(d)<<endl;
14    cout<<sizeof(e)<<endl;
15    cout<<sizeof(sizeof(e))<<endl;
16 }
17
```

问题 输出 调试控制台 终端 端口 + cppdbg: 1.exe

```
-vscode.cppTools-1.19.7-win32-x64\debugAdapters\bin\WindowsDebugLaunch' '--stdin=Microsoft-MIEngine-In-3cwesoz.jpj' '--stdout=Microsoft-MIEngine-Out-siavipb3.vbj' '--stderr=Microsoft-MIEngine-Error-eax0p0xc.stv' '=Microsoft-MIEngine-Pid-gliwwuxif.sli' '--dbgExe=D:\mingw64\bin\gdb.exe' --interpreter=mi'
4
8
4
8
4
8
PS D:\C++ programs>
```

a 是 int 型 4 字节, b 是 double 型 8 字节, c 是 float 型 4 字节, d 是 double 型 8 字节, e 是 float 型 4 字节, sizeof (e) 是 unsigned long long 型 8 字节。

// 程序 16:

// 执行如下程序, 解释为什么最后 a 的值是这个。

The screenshot shows the Visual Studio Code interface. The top half displays a C++ file named '1.cpp' with the following code:

```
#include <iostream>
using namespace std;
int main(){
    int a = 2;
    a=(a=(a=2*a+1)+2)*3+a;
    cout<<a<<endl;
}
```

The bottom half shows the terminal window with the following output:

```
PS D:\C++ programs> ^C
PS D:\C++ programs>
PS D:\C++ programs> & 'd:\VsCode-extentions\vscode-insiders\extens
-vscodc.cppptools-1.19.7-win32-x64\debugAdapters\bin\WindowsDebugLau
e' '--stdin=Microsoft-MIEngine-In-oljmhly.x45' '--stdout=Microsoft-
e-Out-zqzy1j0t.ehn' '--stderr=Microsoft-MIEngine-Error-eg5ybd51.ptr
=Microsoft-MIEngine-Pid-klm1c2px.jrz' '--dbgExe=D:\mingw64\bin\gdb.e
interpreter=mi'
28
```

```
6           a=(a=2*a+1)+2)*3+a;
=> 0x0000000000401564 <+20>:    mov    -0x4(%rbp),%eax
    0x0000000000401567 <+23>:    add    %eax,%eax
    0x0000000000401569 <+25>:    add    $0x1,%eax
    0x000000000040156c <+28>:    mov    %eax,-0x4(%rbp)
    0x000000000040156f <+31>:    addl   $0x2,-0x4(%rbp)
    0x0000000000401573 <+35>:    mov    -0x4(%rbp),%edx
    0x0000000000401576 <+38>:    mov    %edx,%eax
    0x0000000000401578 <+40>:    add    %eax,%eax
    0x000000000040157a <+42>:    add    %edx,%eax
    0x000000000040157c <+44>:    add    %eax,-0x4(%rbp)
```

结论分析与体会：

这一次的实验十分有价值，让我对于 c++ 这门语言有了全新的认知。比如说不同的编译器编译顺序也可能不一样（2-10）。除此之外，我在 c 语言的基础上对于 c++ 的理解也有了提高，认识到了 c 语言和 c++ 的许多极为相似的性质和一些不同的属性。这让我在接下来的 c++ 学习中充满了动力。