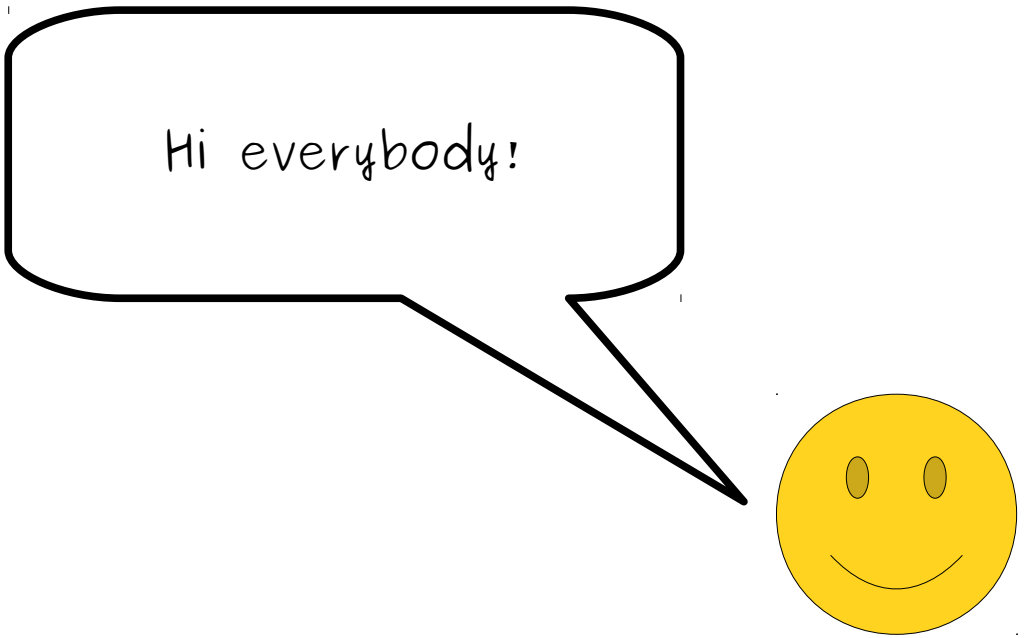
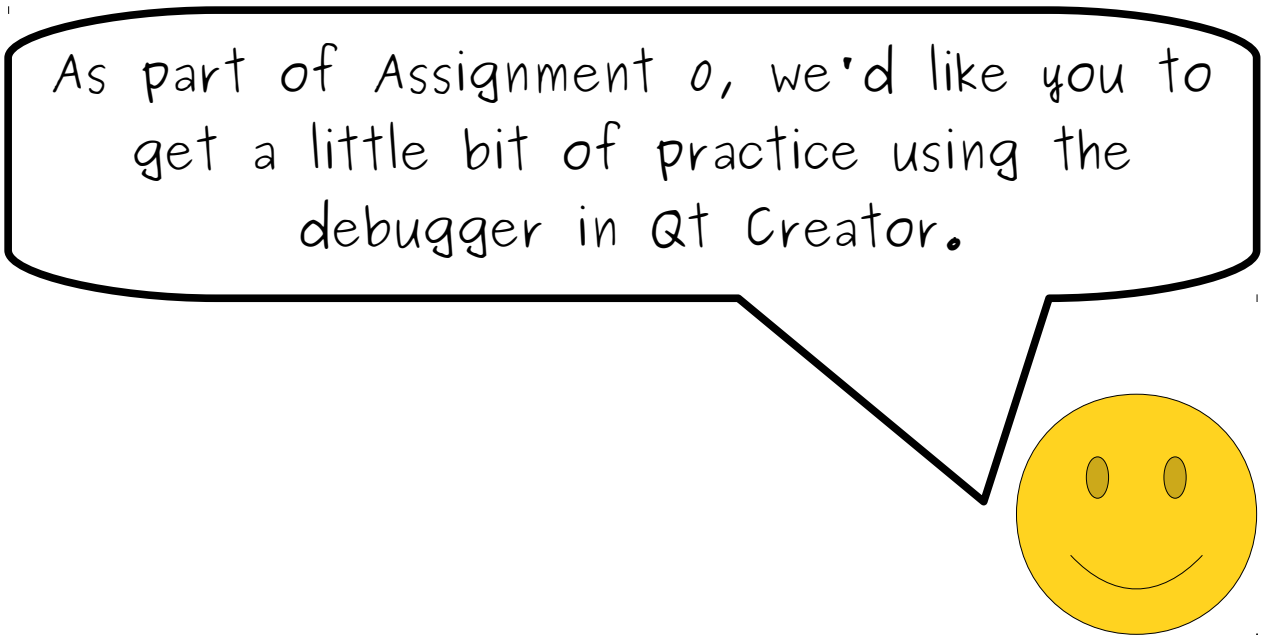
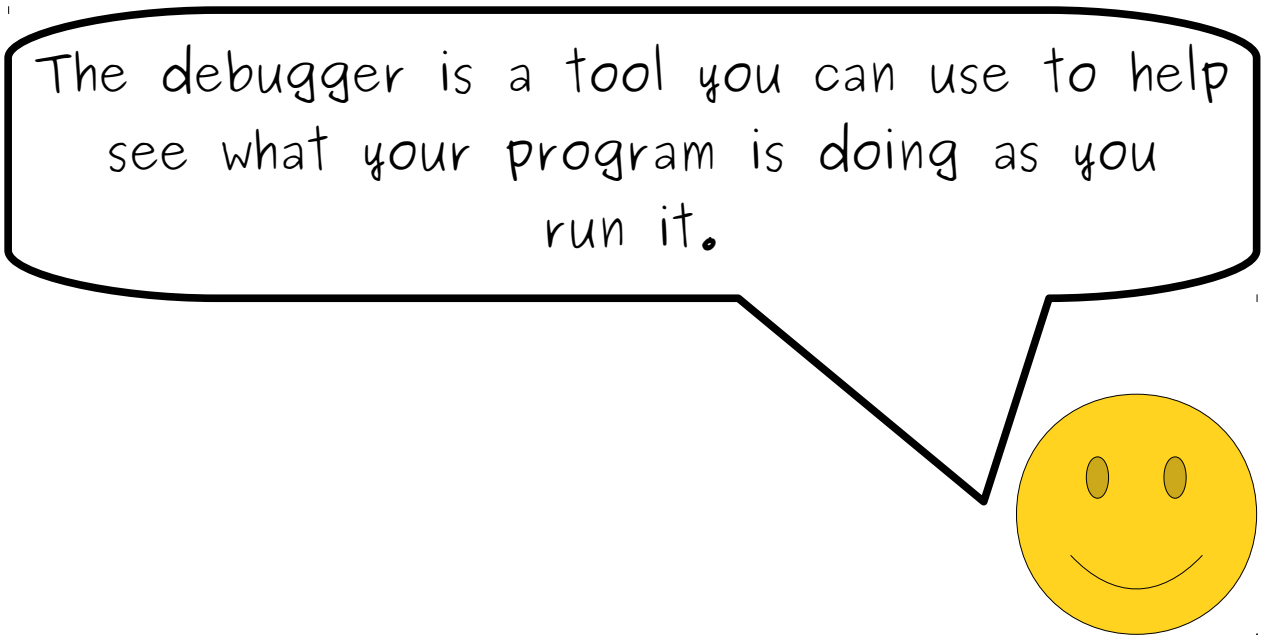
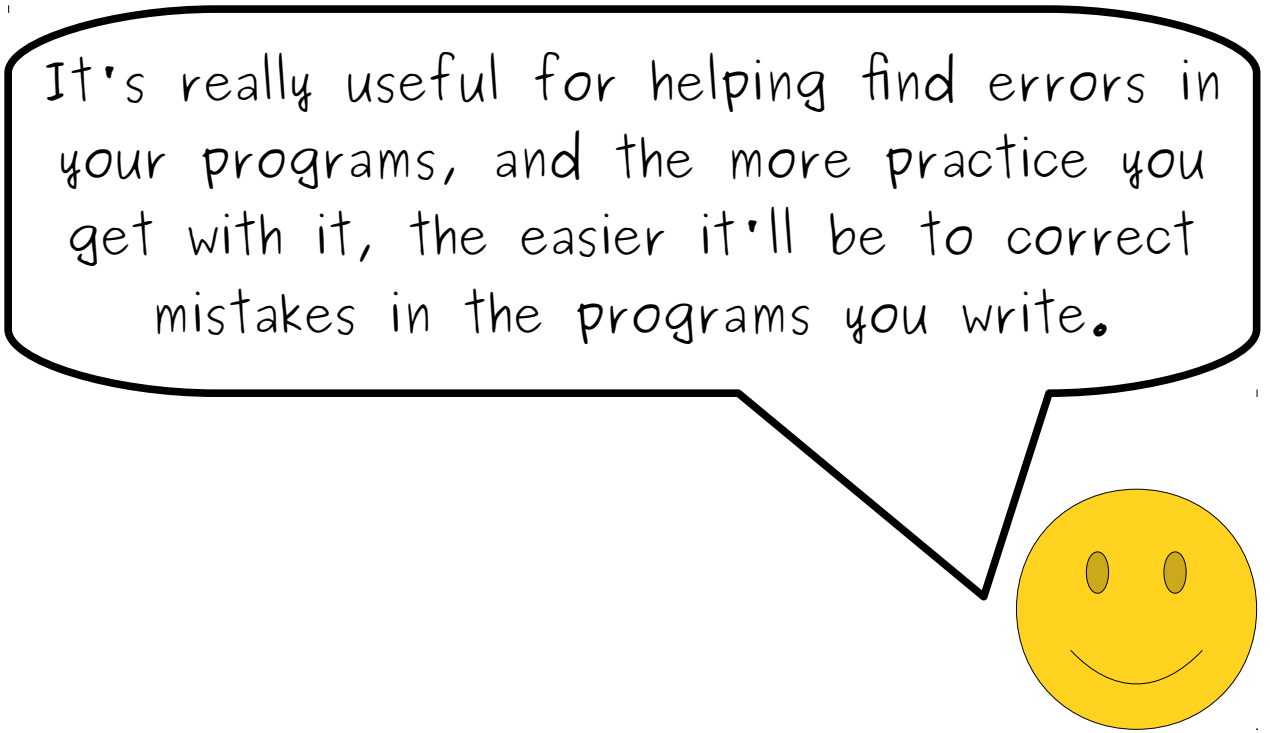
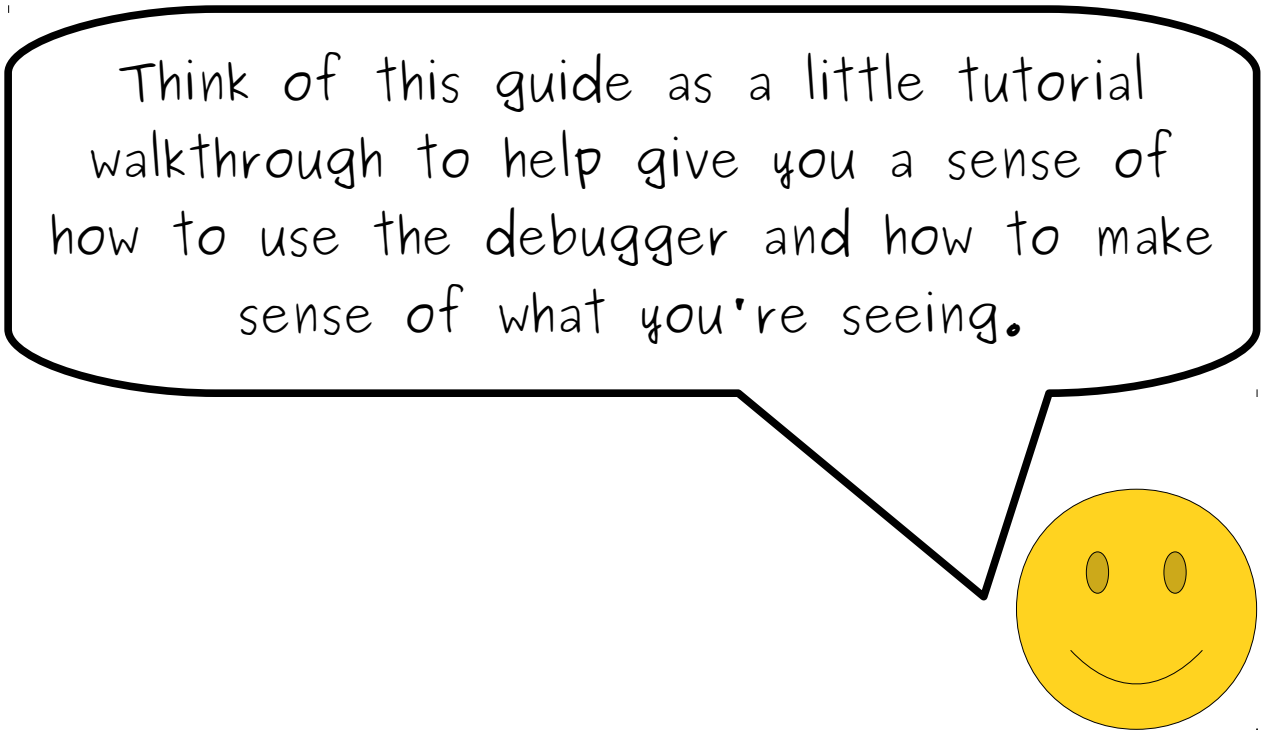
Assignment 0: Using the Debugger


Hi everybody!

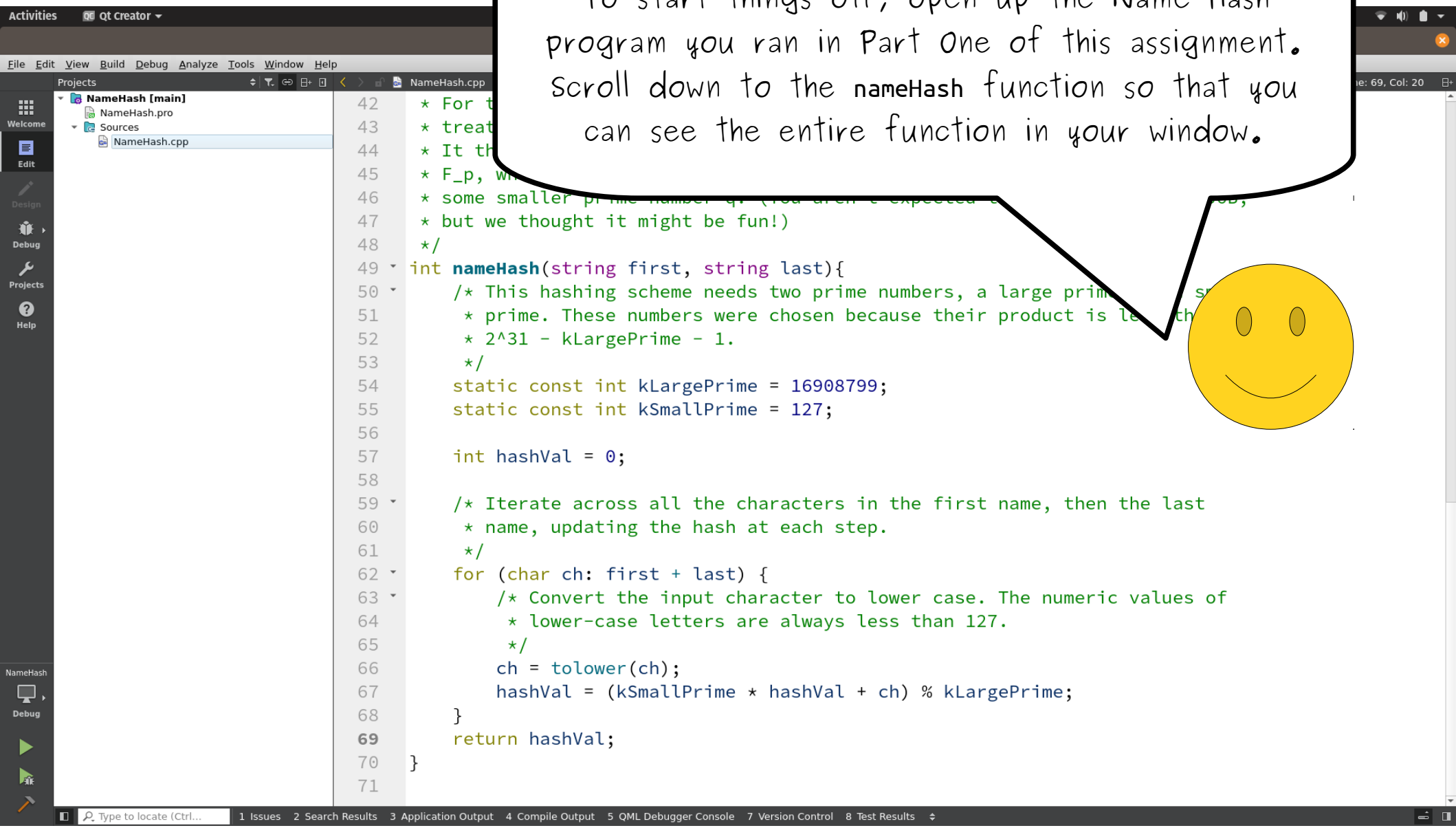

As part of Assignment 0, we'd like you to get a little bit of practice using the debugger in Qt Creator.


The debugger is a tool you can use to help see what your program is doing as you run it.


It's really useful for helping find errors in your programs, and the more practice you get with it, the easier it'll be to correct mistakes in the programs you write.


Think of this guide as a little tutorial walkthrough to help give you a sense of how to use the debugger and how to make sense of what you're seeing.

To start things off, open up the Name Hash program you ran in Part One of this assignment. Scroll down to the **nameHash** function so that you can see the entire function in your window.



Activities Qt Creator Jan 4 3:09 PM

NameHash.cpp @ NameHash [main] - Qt Creator

File Edit View Build Debug Analyze Tools Window Help

Projects

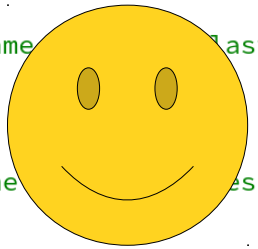
NameHash [main]
NameHash.pro
Sources
NameHash.cpp

NameHash.cpp | nameHash(std::string, std::string) -> int | Unix (LF) | Line: 69, Col: 20

```
42  * For those of you who are more mathematically inclined, this function
43  * treats each character in the input name as a number between 0 and 128.
44  * It then uses them as coefficients in a polynomial over the finite field
45  * F_p, where p is a large prime number, and evaluates that polynomial at
                                                    is for CS106B,
                                                    and a small
                                                    ess than
56
57      int hashVal = 0;
58
59      /* Iterate across all the characters in the fi    name      ast
60       * name, updating the hash at each step.
61       */
62      for (char ch: first + last) {
63          /* Convert the input character to lower case. The      es of
64           * lower-case letters are always less than 127.
65           */
66          ch = tolower(ch);
67          hashVal = (kSmallPrime * hashVal + ch) % kLargePrime;
68      }
69      return hashVal;
70  }
71
```

Move your mouse cursor so that it's in the space right before the line number for line 66.

Now, click the mouse!



Welcome Edit Design Debug Projects Help

NameHash Debug

Type to locate (Ctrl... 1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results

Activities Qt Creator Jan 4 3:11 PM

NameHash.cpp @ NameHash [main] - Qt Creator

File Edit View Build Debug Analyze Tools Window Help

Projects

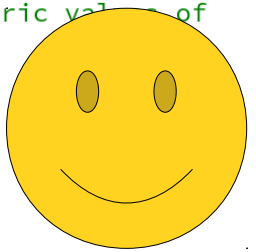
- NameHash [main]
  - NameHash.pro
  - Sources
    - NameHash.cpp

NameHash.cpp | nameHash(std::string, std::string) -> int | Unix (LF) | Line: 69, Col: 20

```
42  * For those of you who are more mathematically inclined, this function
43  * treats each character in the input name as a number between 0 and 128.
44  * It then uses them as coefficients in a polynomial over the finite field
45  *                                                          omial at
                                                             CS106B,
                                                          small
                                                          an
                                                          ast
60
61      */
62      for (char ch: first + last) {
63          /* Convert the input character to lower cas        umeric va    of
64           * lower-case letters are always less than 127.
65           */
66          ch = tolower(ch);
67          hashVal = (kSmallPrime * hashVal + ch) % kLargePrime;
68      }
69      return hashVal;
70  }
71
```

When you do, you should see a red circle with a little hourglass pop up.

This is called a **breakpoint**. If we run the program in debug mode, whenever the program gets to this line, it will pause and open up the debugger so we can see what's going on.



Welcome Edit Design Debug Projects Help

NameHash Debug

Type to locate (Ctrl... 1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results

Activities Qt Creator Jan 4 3:11 PM

NameHash.cpp @ NameHash [main] - Qt Creator

File Edit View Build Debug Analyze Tools Window Help

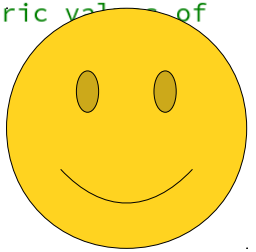
Projects

NameHash [main]
NameHash.pro
Sources
NameHash.cpp

NameHash.cpp | nameHash(std::string, std::string) -> int | Unix (LF) | Line: 69, Col: 20

```
42   * For those of you who are more mathematically inclined, this function
43   * treats each character in the input name as a number between 0 and 128.
44   * It then uses them as coefficients in a polynomial over the finite field
45   * F_p, where p is a large prime number, and evaluates that polynomial at
46   * some smaller prime number q. (You aren't expected to know this for CS106B,
47   * but we thought it might be fun!)
48   */
49  int nameHash(string first, string last){
50      /* This hashing scheme needs two prime numbers, a large prime and a small
                                                                        than
61       */
62      for (char ch: first + last) {
63          /* Convert the input character to lower cas        umeric va    of
64           * lower-case letters are always less than 127.
65           */
66          ch = tolower(ch);
67          hashVal = (kSmallPrime * hashVal + ch) % kLargePrime;
68      }
69      return hashVal;
70  }
71
```

Now, we're going to run this program in debug mode. To do so, click on the "run in debug mode" button in the bottom-right corner of the screen. It's the one just below the regular green "run" button. When you do…

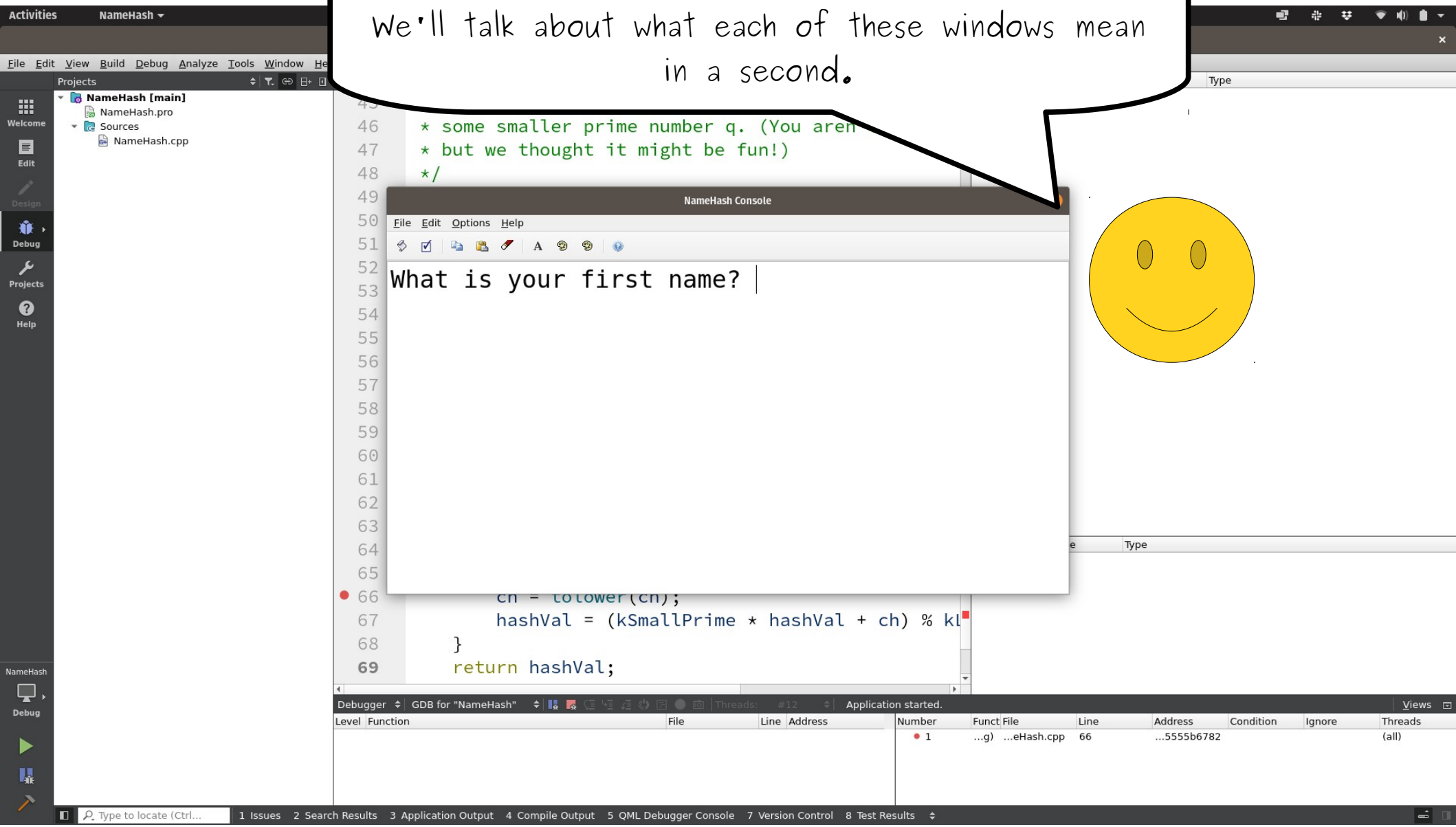


Welcome Edit Design Debug Projects Help

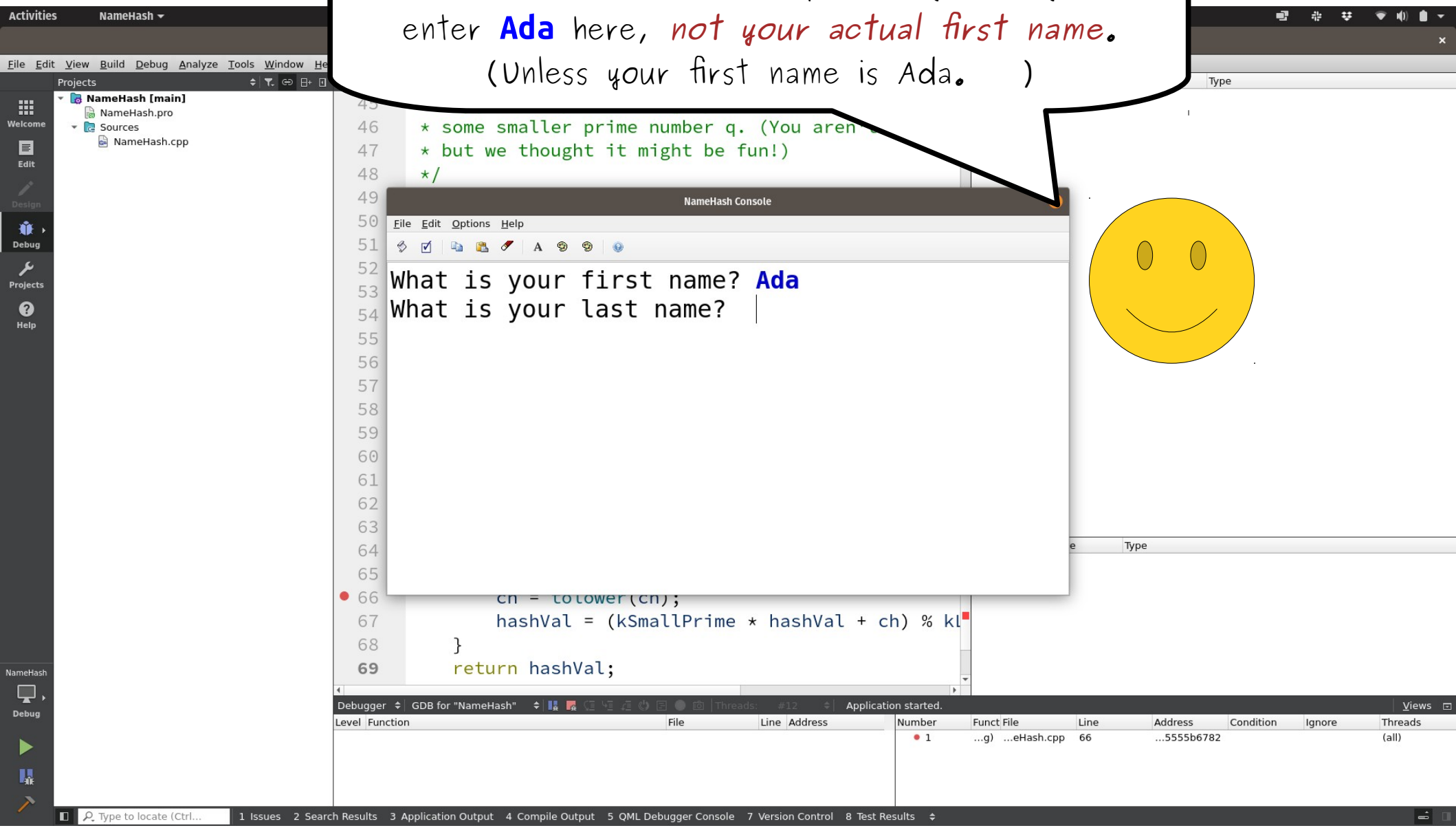
NameHash Debug

Type to locate (Ctrl… 1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results

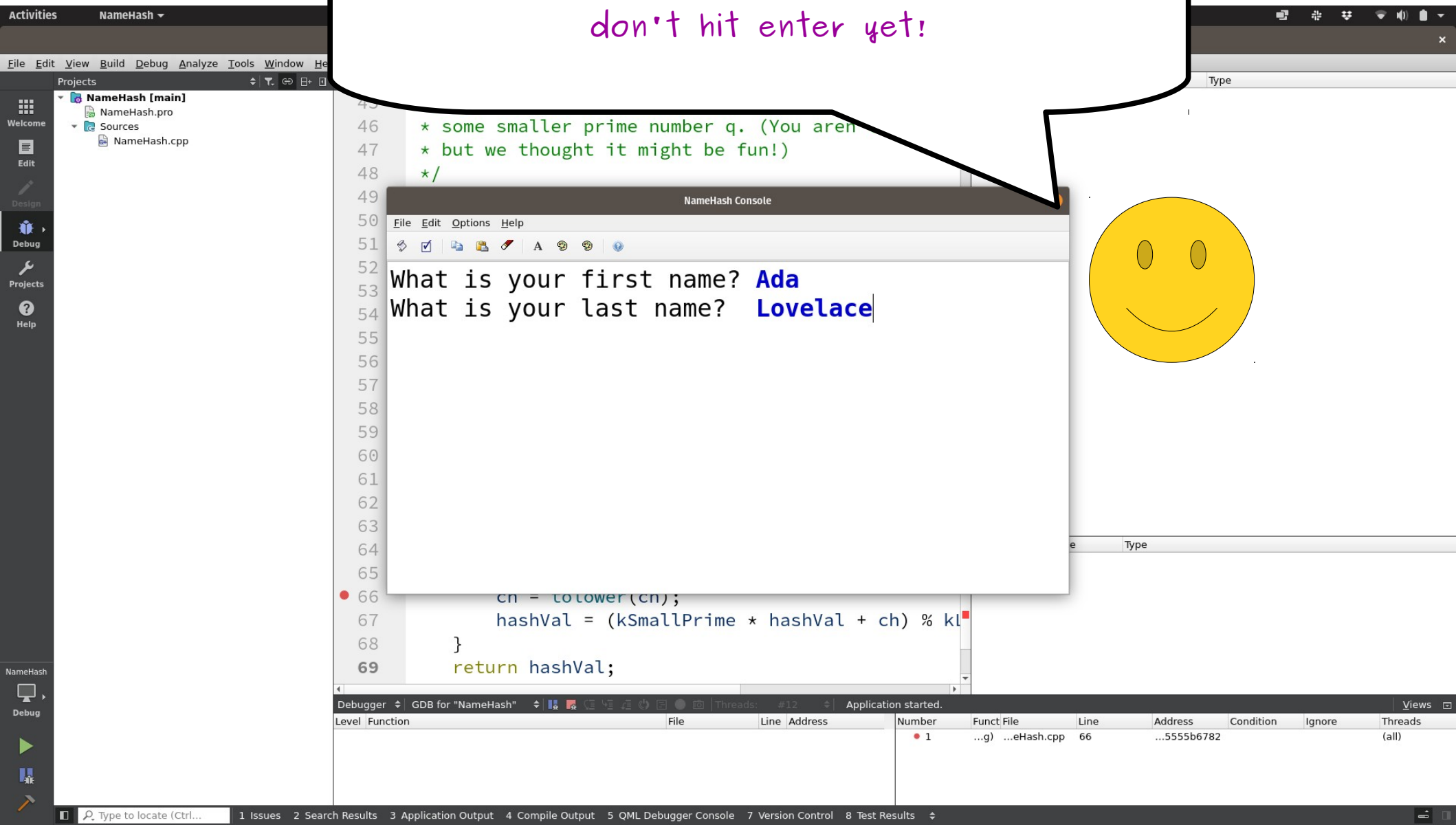
… you should see something like this! Notice that a bunch of extra panels popped up in Qt Creator. We'll talk about what each of these windows mean in a second.



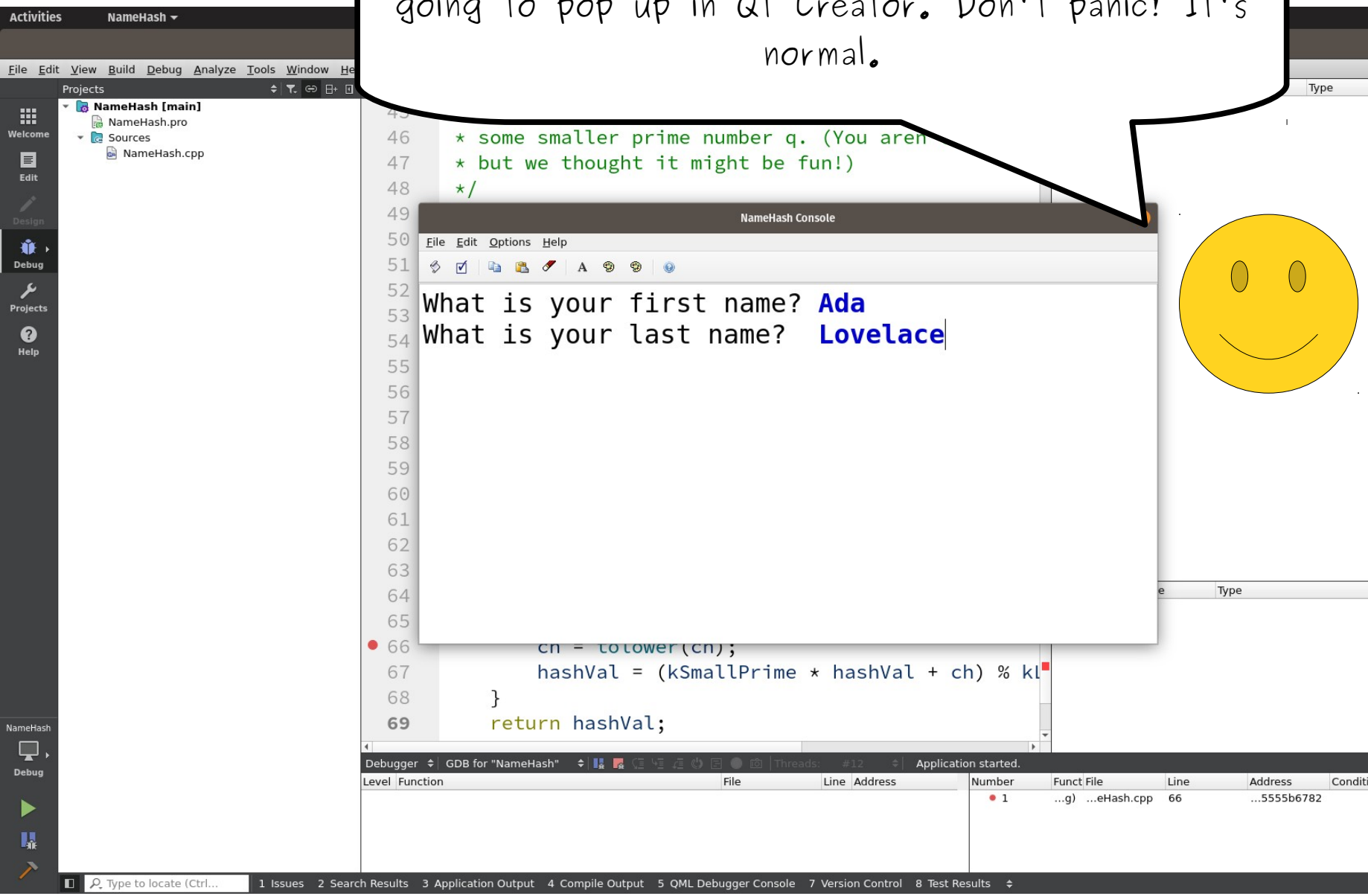
In the meantime, type in the first name **Ada** and hit enter, as shown here. We specifically want you to enter **Ada** here, *not your actual first name.* (Unless your first name is Ada.)



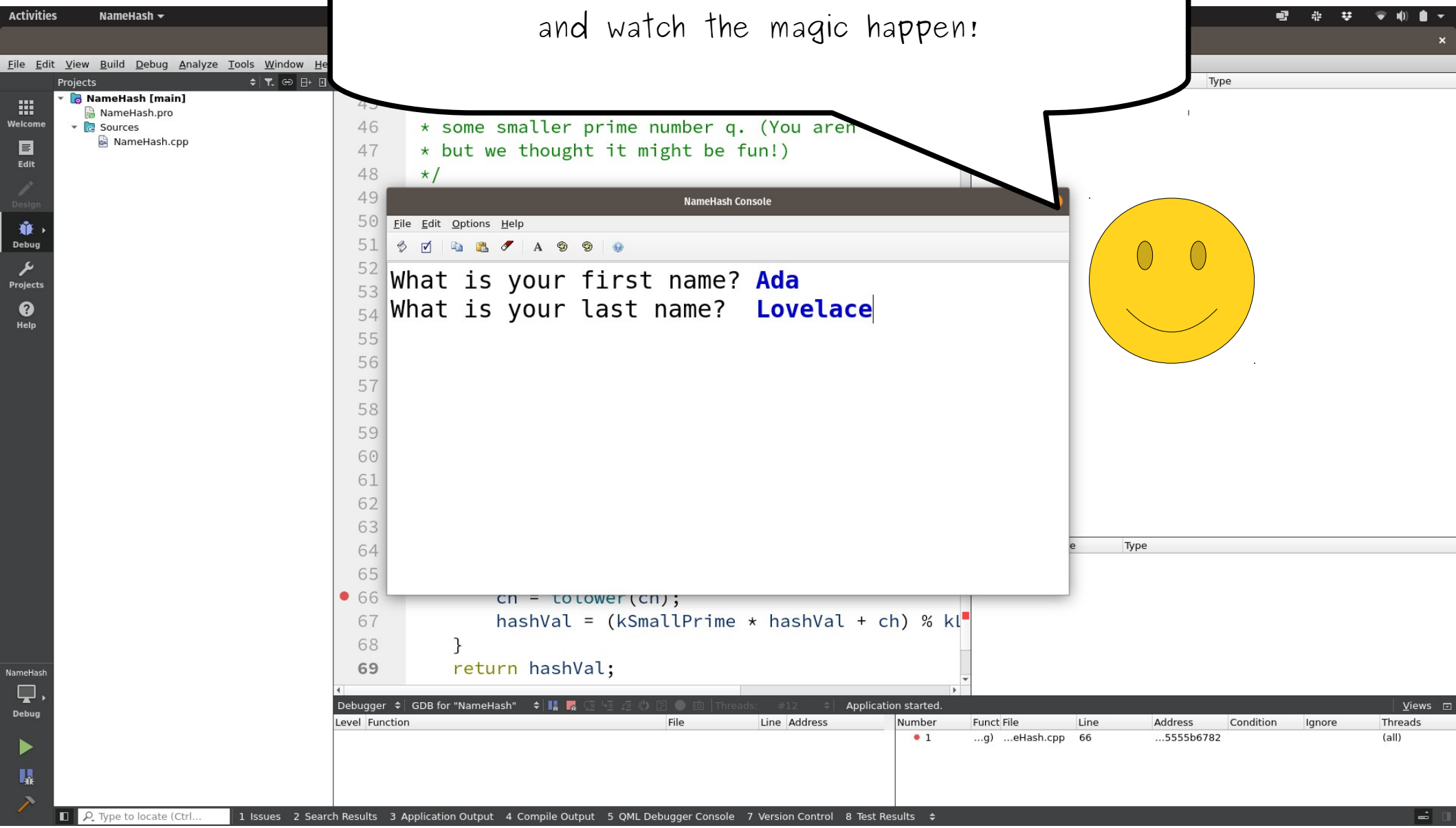
Now, type in **Lovelace** as a last name, but don't hit enter yet!

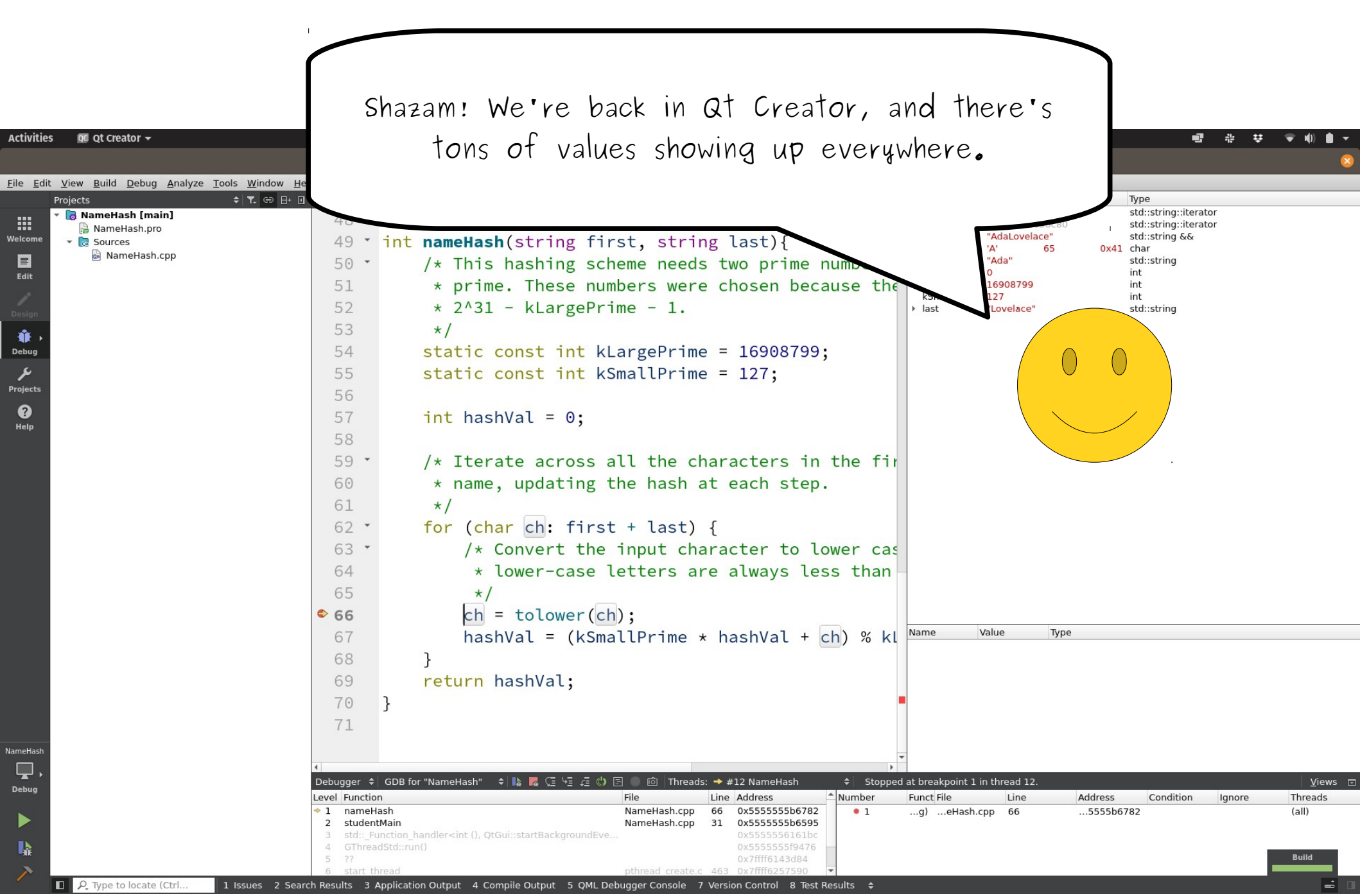


As soon as you hit enter, a bunch of things are going to pop up in Qt Creator. Don't panic! It's normal.



With that said, hit enter,
and watch the magic happen!




Shazam! We're back in Qt Creator, and there's tons of values showing up everywhere.
Activities
Qt Creator
File Edit View Build Debug Analyze Tools Window
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
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NameHash
Debug
int nameHash(string first, string last){
/* This hashing scheme needs two prime numb
* prime. These numbers were chosen because the
* 2^31 - kLargePrime - 1.
*/
static const int kLargePrime = 16908799;
static const int kSmallPrime = 127;
int hashVal = 0;
/* Iterate across all the characters in the fir
* name, updating the hash at each step.
*/
for (char ch: first + last) {
/* Convert the input character to lower cas
* lower-case letters are always less than
*/
ch = tolower(ch);
hashVal = (kSmallPrime * hashVal + ch) % kL
}
return hashVal;
}
Type
std::string::iterator
std::string::iterator
"AdaLovelace" std::string &&
'A' 65 0x41 char
"Ada" std::string
0 int
16908799 int
127 int
last "Lovelace" std::string
Name Value Type
Debugger GDB for "NameHash" Threads: #12 NameHash
Stopped at breakpoint 1 in thread 12.
Views
Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Build
Type to locate (Ctrl...
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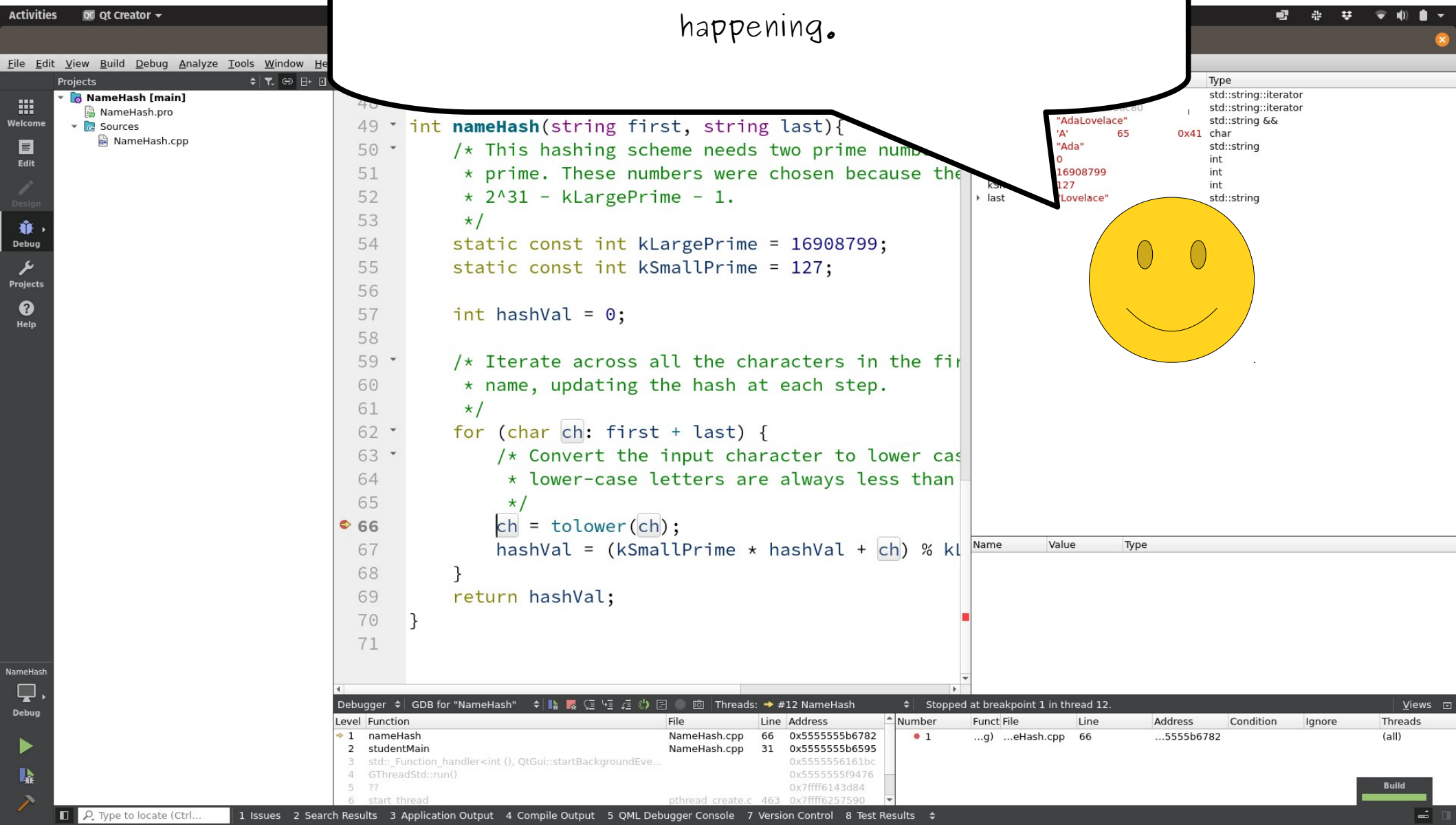
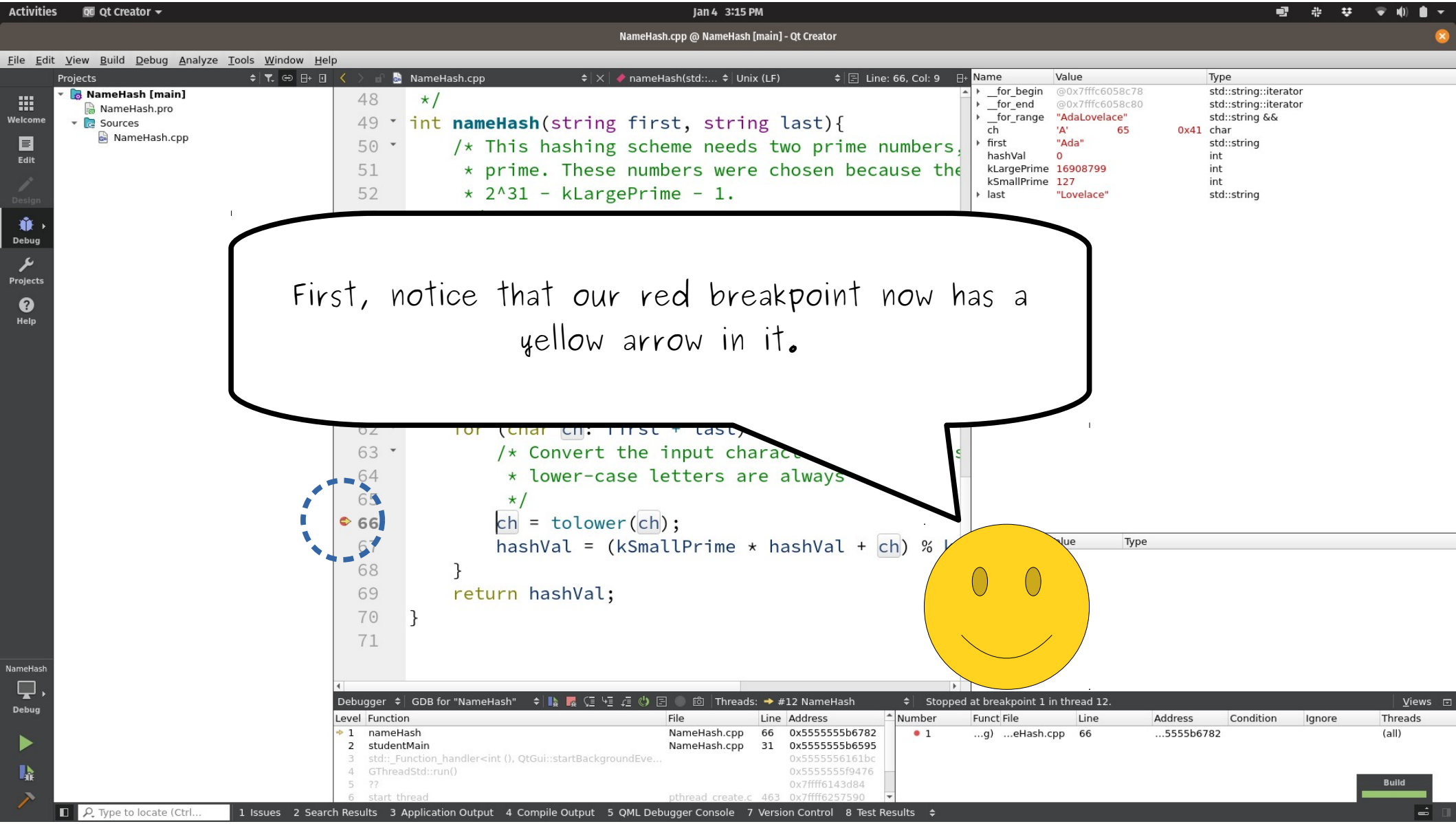
There's a lot going on right here. Let's see what's happening.




Activities
Qt Creator
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NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
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NameHash [main]
NameHash.pro
Sources
NameHash.cpp
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 66, Col: 9
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
63 /* Convert the input charac
64 * lower-case letters are always
65 */
66 ch = tolower(ch);
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'A' 65 0x41 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Type
First, notice that our red breakpoint now has a yellow arrow in it.
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped at breakpoint 1 in thread 12.
Views
Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Build
Type to locate (Ctrl...
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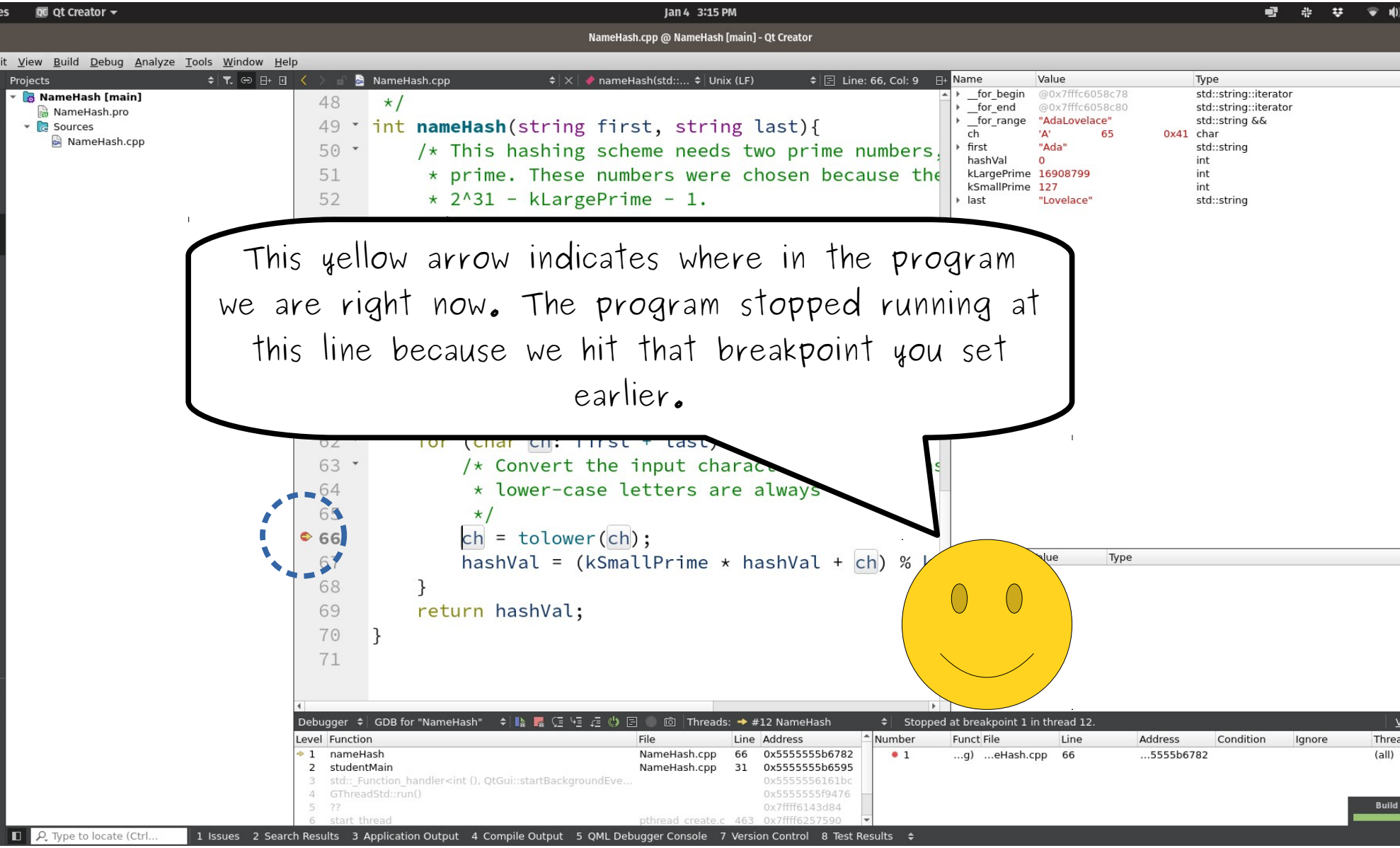
Activities
Qt Creator
Jan 4 3:15 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
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NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
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Help
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 66, Col: 9
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
63 /* Convert the input charac
64 * lower-case letters are always
65 */
66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % k
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
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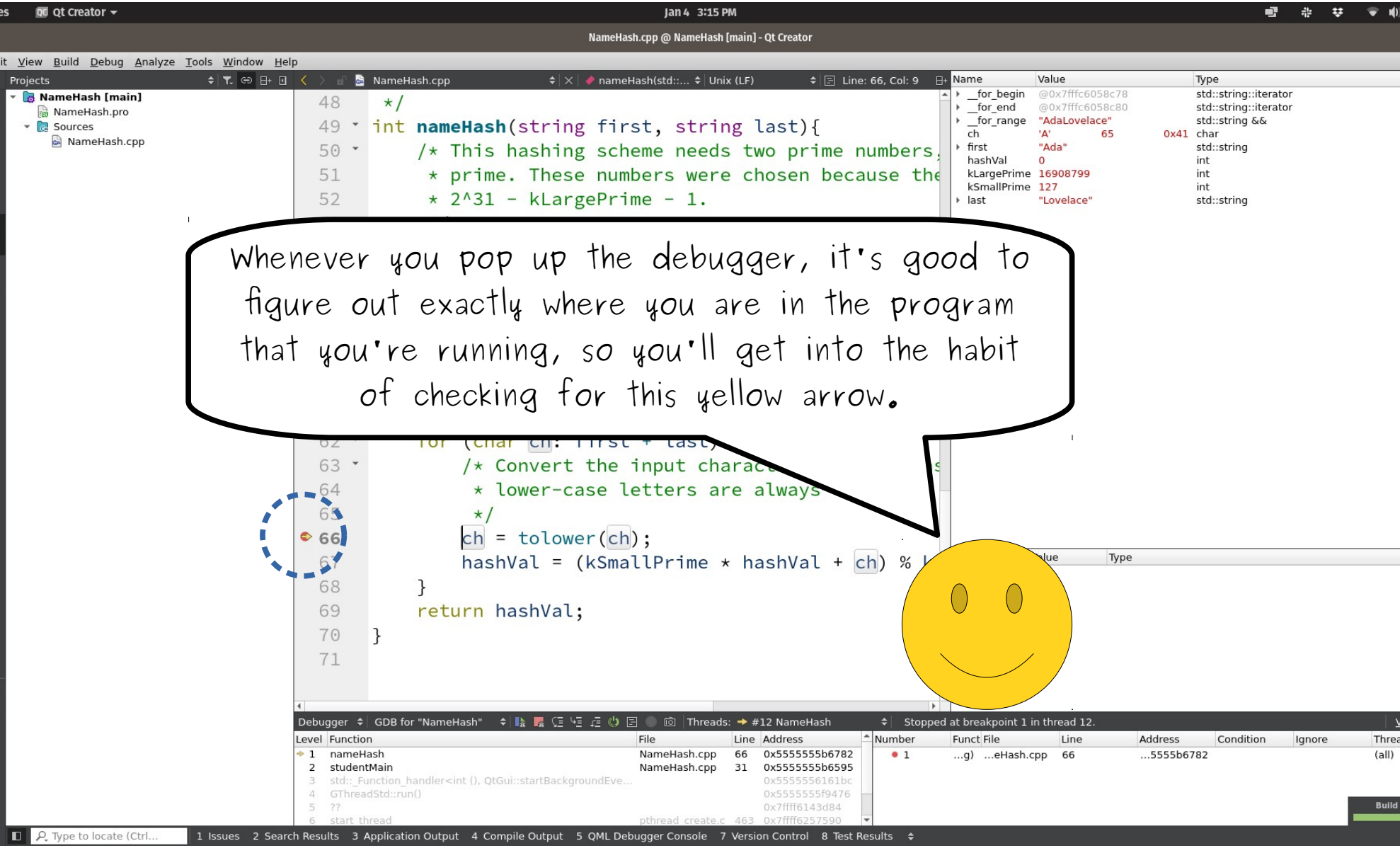
__for_range "AdaLovelace" std::string &&
ch 'A' 65 0x41 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
This yellow arrow indicates where in the program we are right now. The program stopped running at this line because we hit that breakpoint you set earlier.
Debugger GDB for "NameHash"
Threads: #12 NameHash
Stopped at breakpoint 1 in thread 12.
Views
Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Build
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results
NameHash
Debug


Activities
Qt Creator
Jan 4 3:15 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
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Projects
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NameHash.cpp
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Unix (LF)
Line: 66, Col: 9
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
63 /* Convert the input charac
64 * lower-case letters are always
65 */
66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % k
68 }
69 return hashVal;
70 }
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Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
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ch 'A' 65 0x41 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Whenever you pop up the debugger, it's good to figure out exactly where you are in the program that you're running, so you'll get into the habit of checking for this yellow arrow.
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped at breakpoint 1 in thread 12. Views
Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
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Type to locate (Ctrl...
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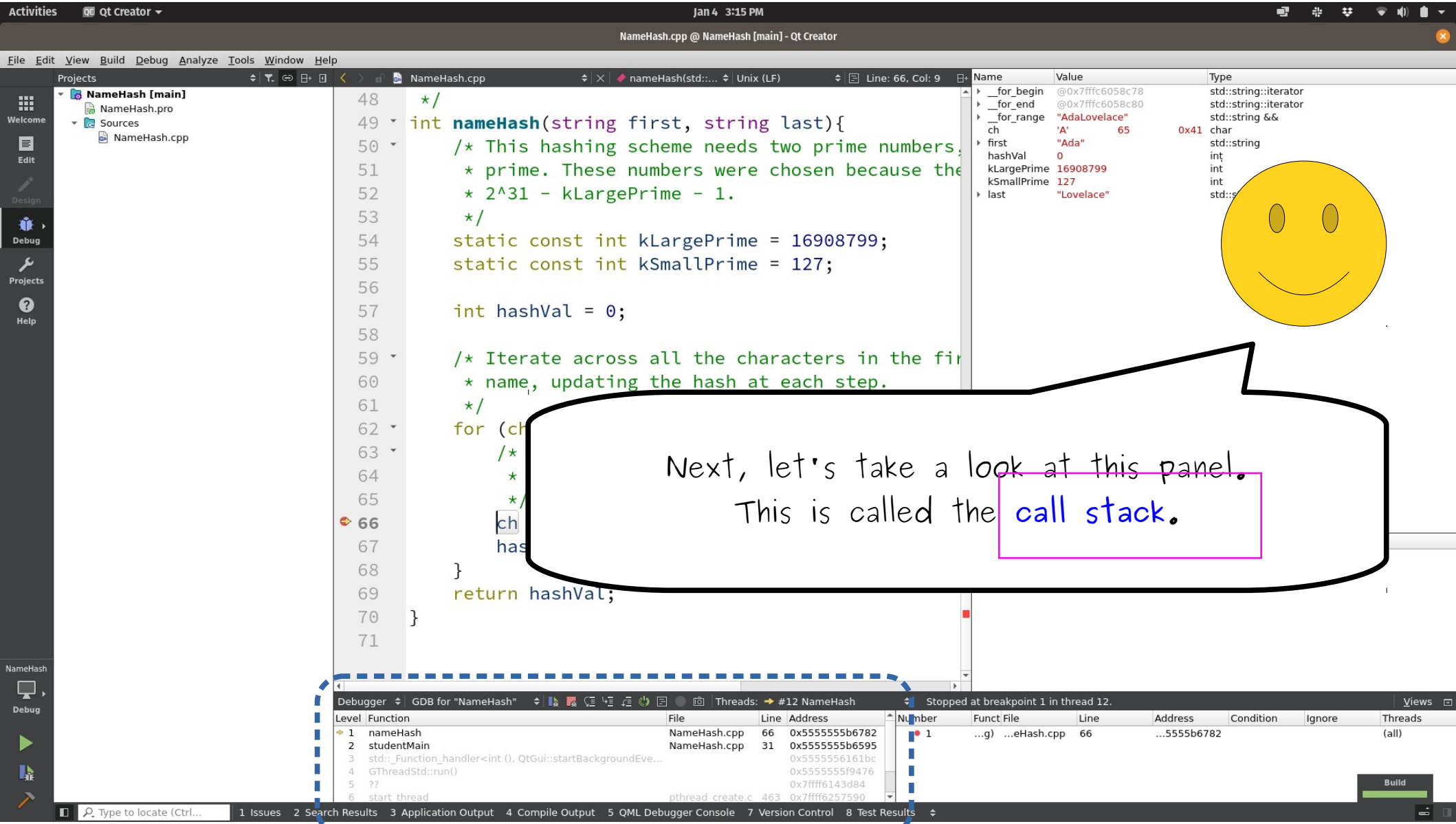
Activities
Qt Creator
Jan 4 3:15 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 66, Col: 9
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int hashVal = 0;
58
59 /* Iterate across all the characters in the fir
60 * name, updating the hash at each step.
61 */
62 for (ch
63 /*
64 *
65 */
66 ch
67 has
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
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ch 'A' 65 0x41 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::
Next, let's take a look at this panel.
This is called the call stack.
Debugger
GDB for "NameHash"
Threads: #12 NameHash
Stopped at breakpoint 1 in thread 12.
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Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
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4 GThreadStd::run() 0x5555555f9476
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Type to locate (Ctrl...
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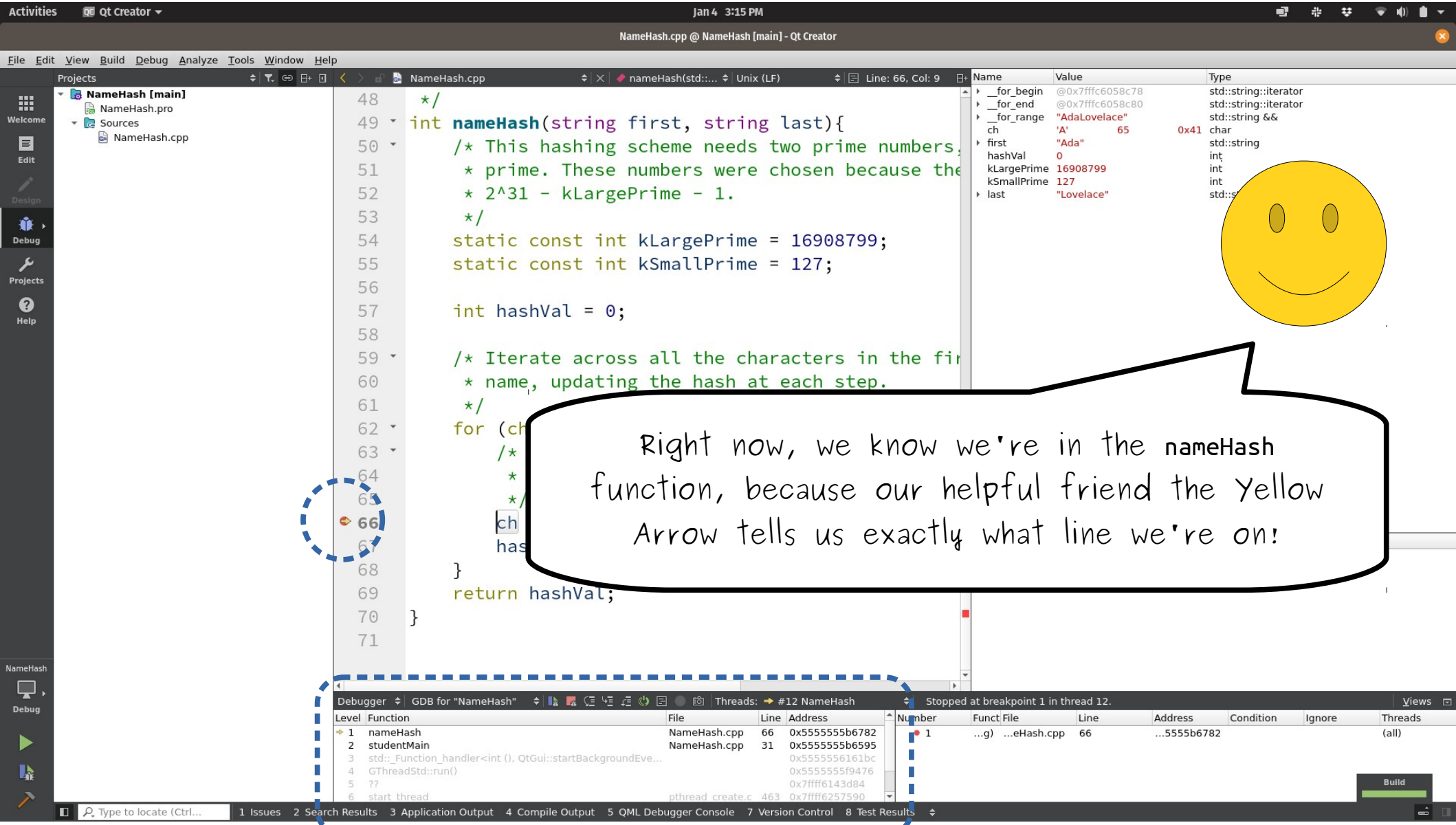
Activities
Qt Creator
Jan 4 3:15 PM
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Line: 66, Col: 9
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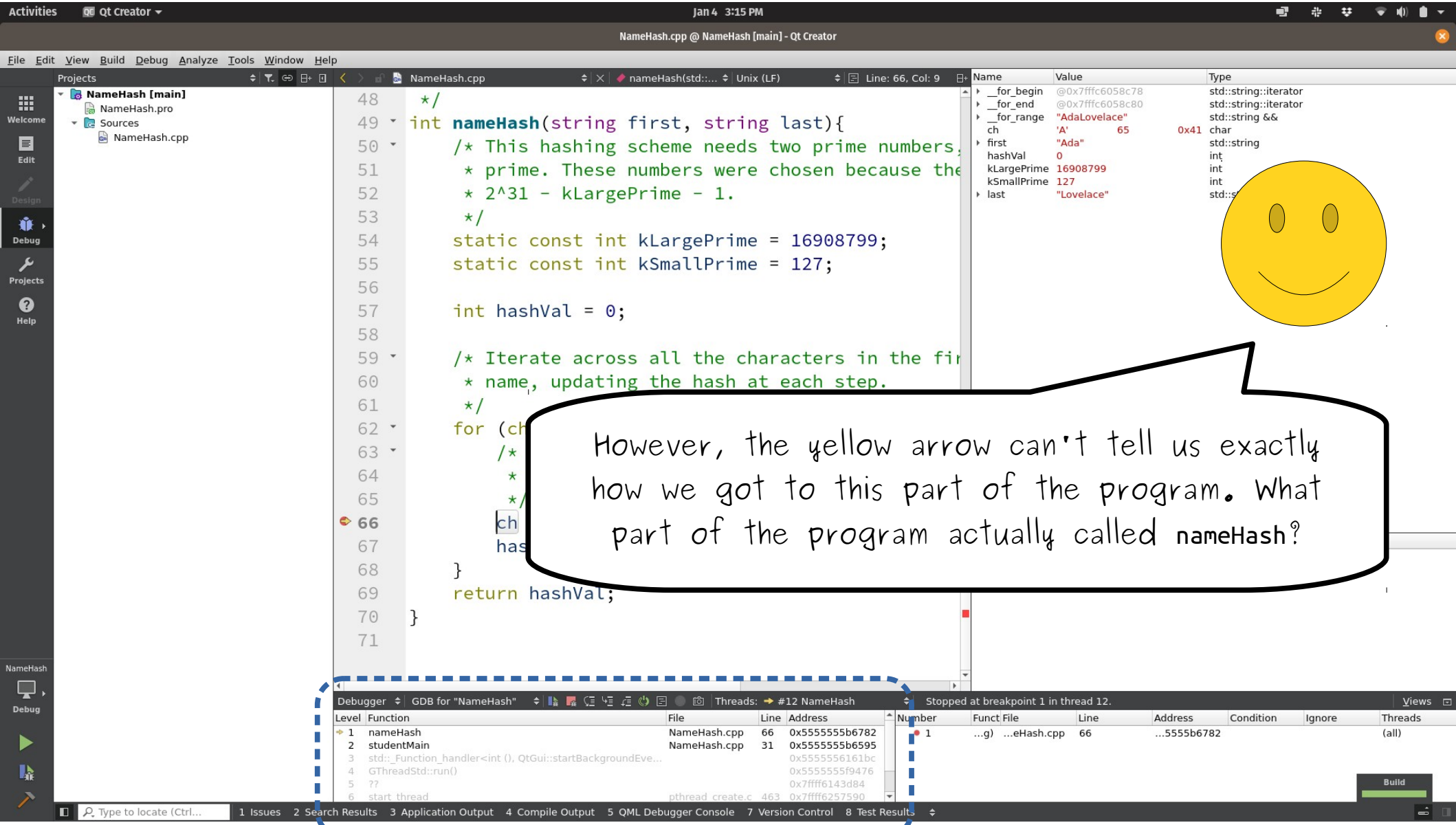
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int hashVal = 0;
58
59 /* Iterate across all the characters in the fir
60 * name, updating the hash at each step.
61 */
62 for (ch
63 /*
64 *
65 */
66 ch
67 has
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'A' 65 0x41 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::s
Right now, we know we're in the nameHash function, because our helpful friend the Yellow Arrow tells us exactly what line we're on!
Debugger GDB for "NameHash" Threads: #12 NameHash
Stopped at breakpoint 1 in thread 12.
Views
Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Build
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results
NameHash
Debug


Activities
Qt Creator
Jan 4 3:15 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 66, Col: 9
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int hashVal = 0;
58
59 /* Iterate across all the characters in the fir
60 * name, updating the hash at each step.
61 */
62 for (ch
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65 */
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68 }
69 return hashVal;
70 }
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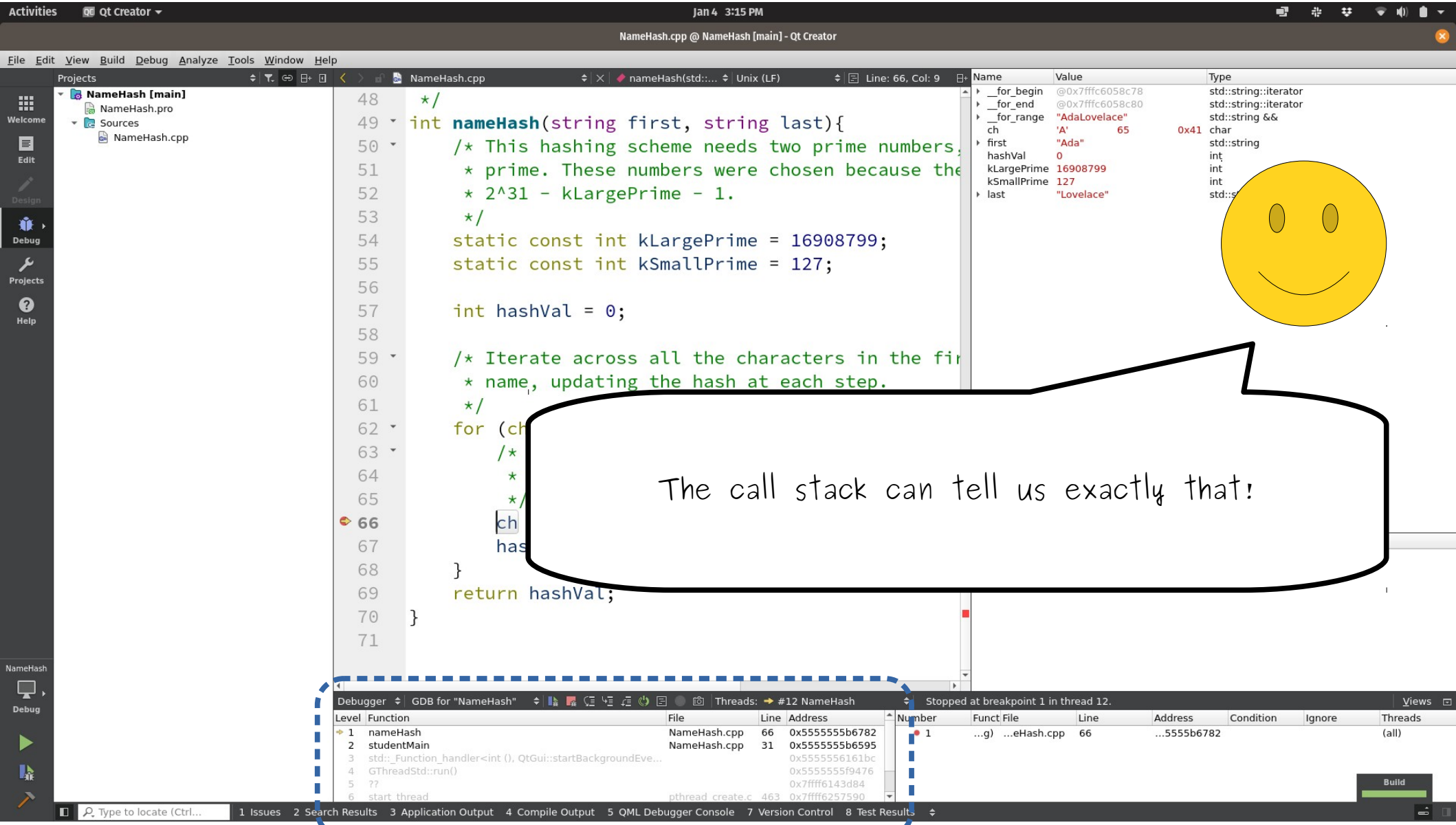
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'A' 65 0x41 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::s
However, the yellow arrow can't tell us exactly how we got to this part of the program. What part of the program actually called nameHash?
Debugger GDB for "NameHash" Threads: #12 NameHash
Stopped at breakpoint 1 in thread 12.
Views
Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Build
NameHash
Debug
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Activities
Qt Creator
Jan 4 3:15 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 66, Col: 9
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int hashVal = 0;
58
59 /* Iterate across all the characters in the fir
60 * name, updating the hash at each step.
61 */
62 for (ch
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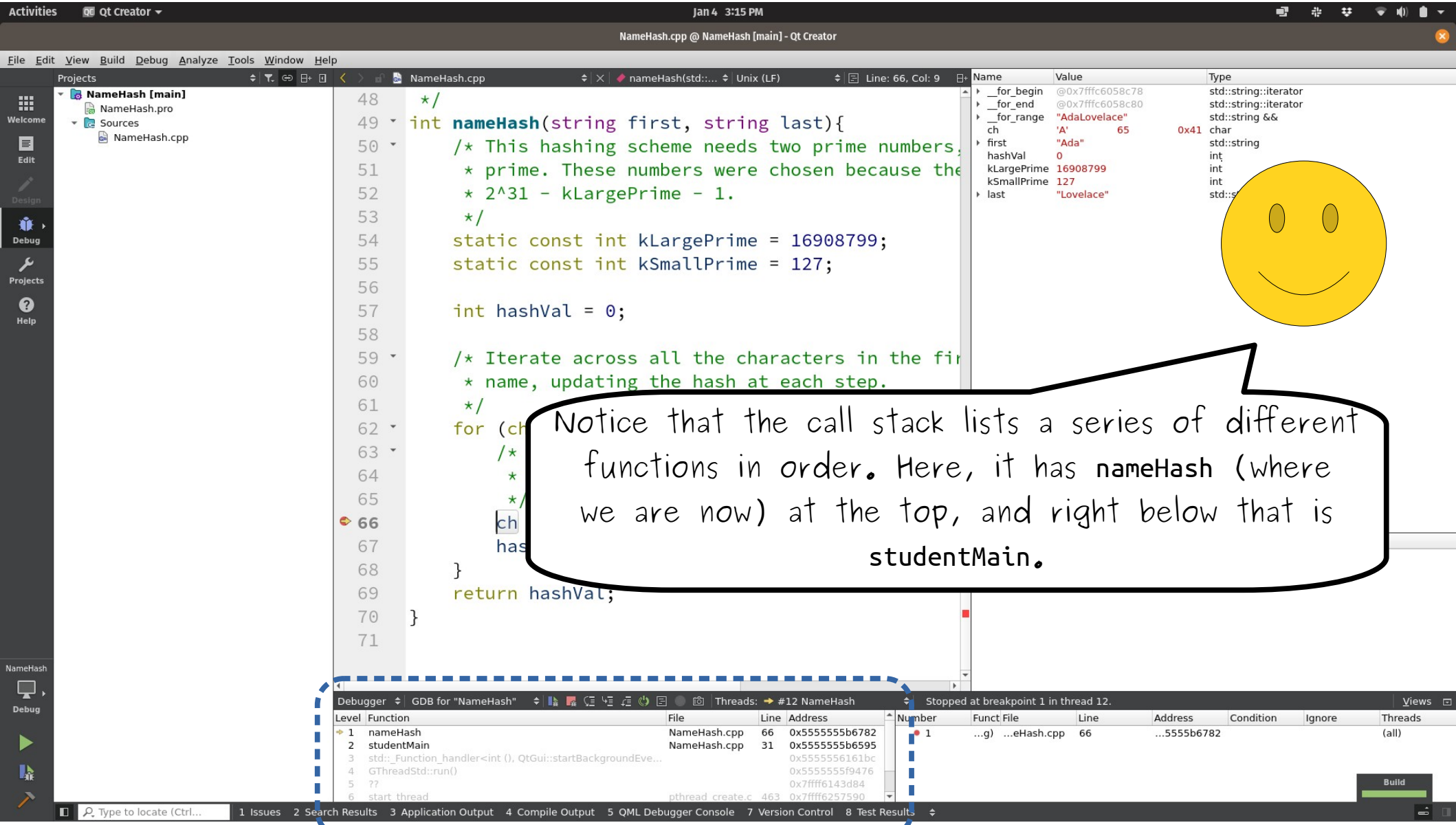
64 *
65 */
66 ch
67 has
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'A' 65 0x41 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::
The call stack can tell us exactly that!
Debugger
GDB for "NameHash"
Threads: #12 NameHash
Stopped at breakpoint 1 in thread 12.
Views
Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Build
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results
NameHash
Debug


Activities
Qt Creator
Jan 4 3:15 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 66, Col: 9
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int hashVal = 0;
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59 /* Iterate across all the characters in the fir
60 * name, updating the hash at each step.
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67 has
68 }
69 return hashVal;
70 }
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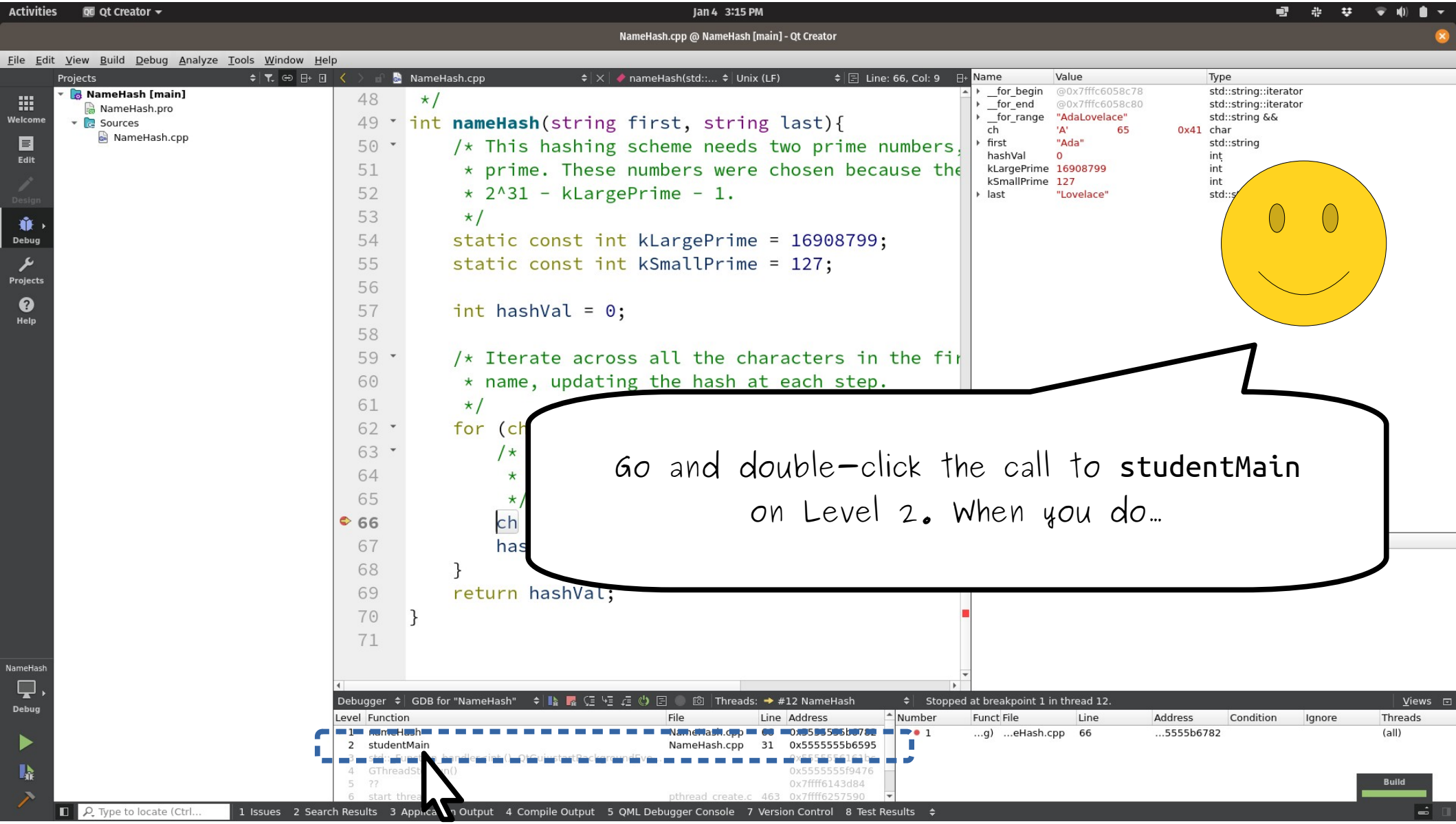
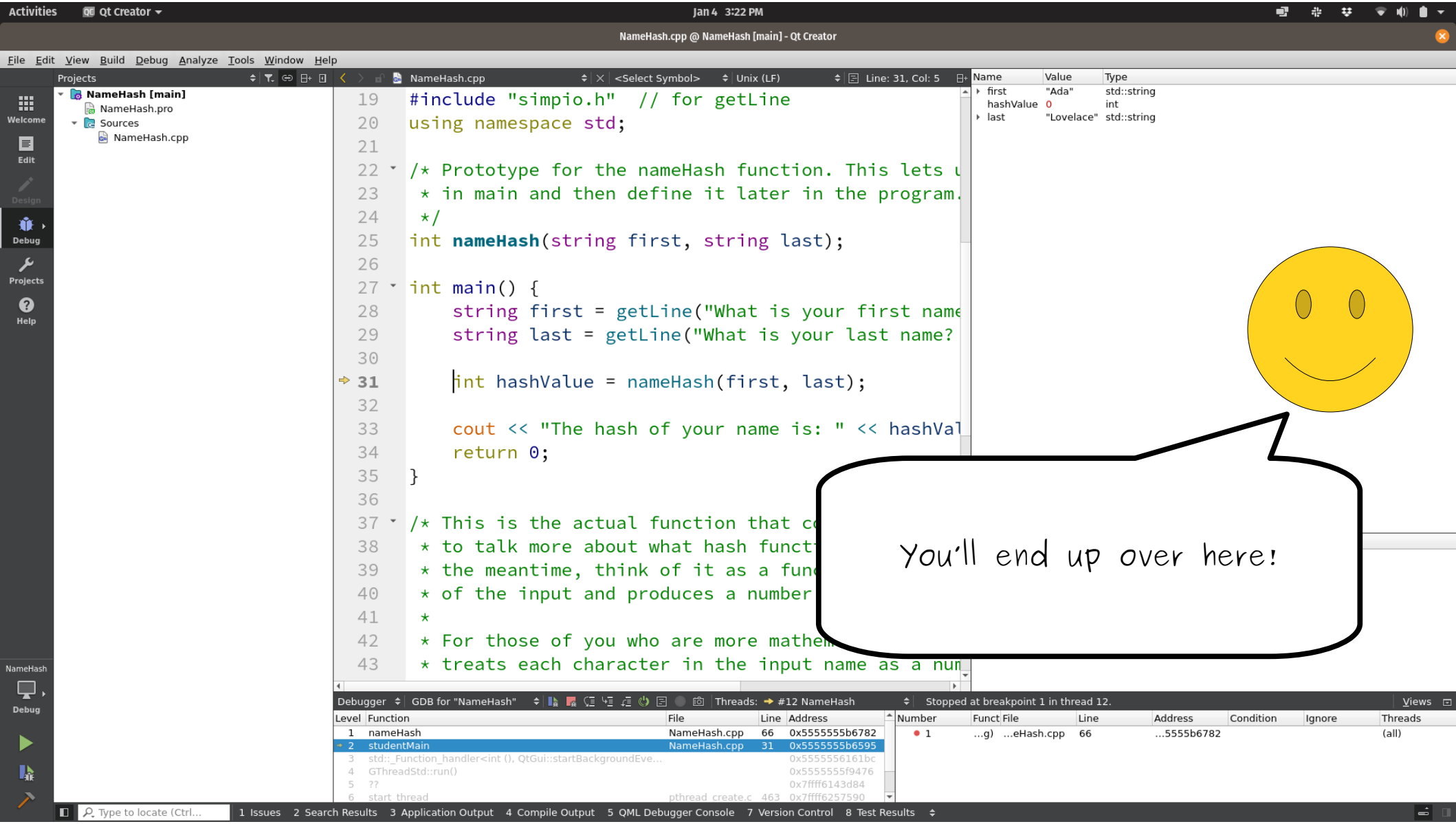
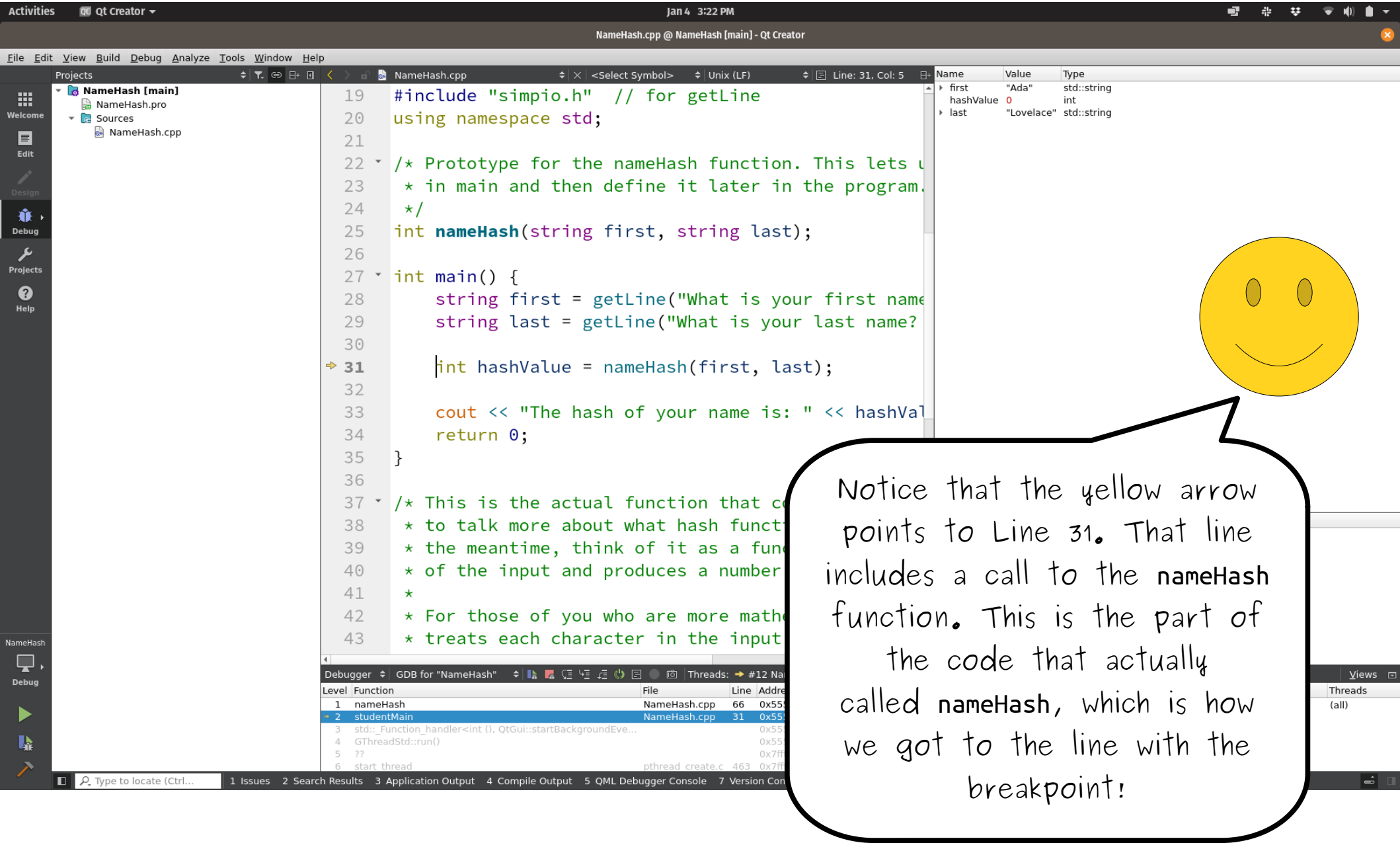
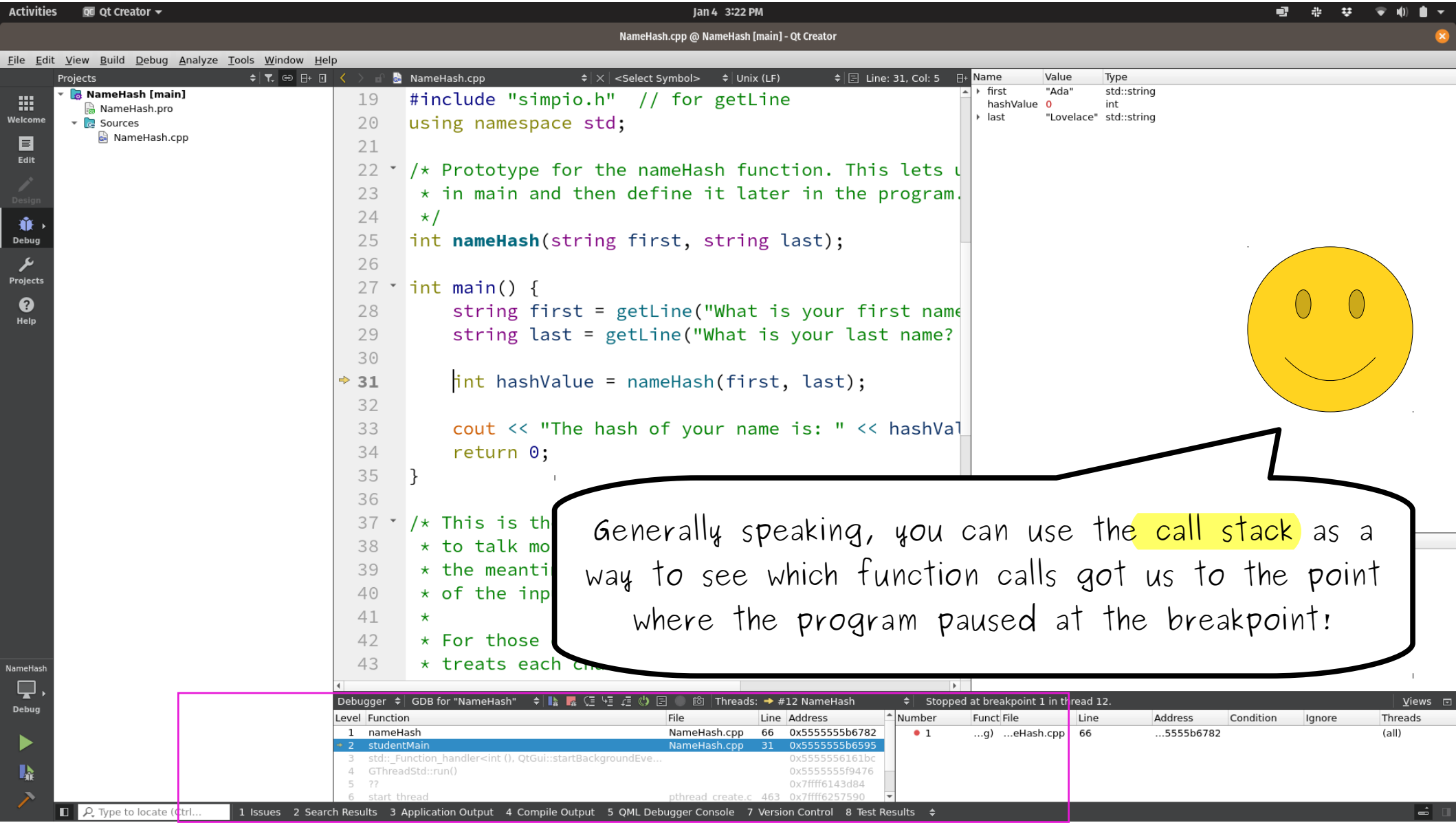
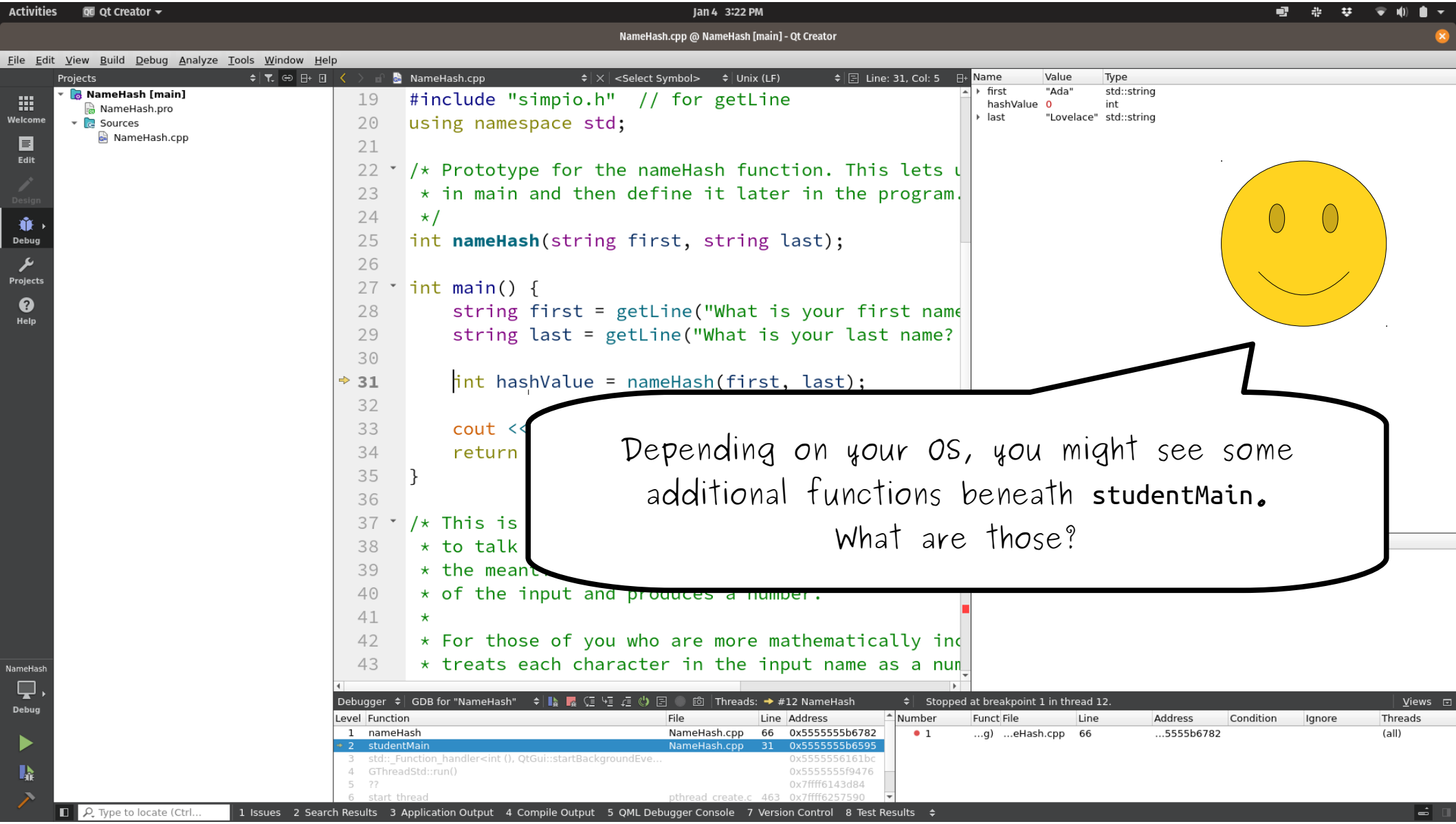
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'A' 65 0x41 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::s
Notice that the call stack lists a series of different functions in order. Here, it has nameHash (where we are now) at the top, and right below that is studentMain.
Debugger GDB for "NameHash" Threads: #12 NameHash
Stopped at breakpoint 1 in thread 12.
Views
Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Build
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results
NameHash
Debug

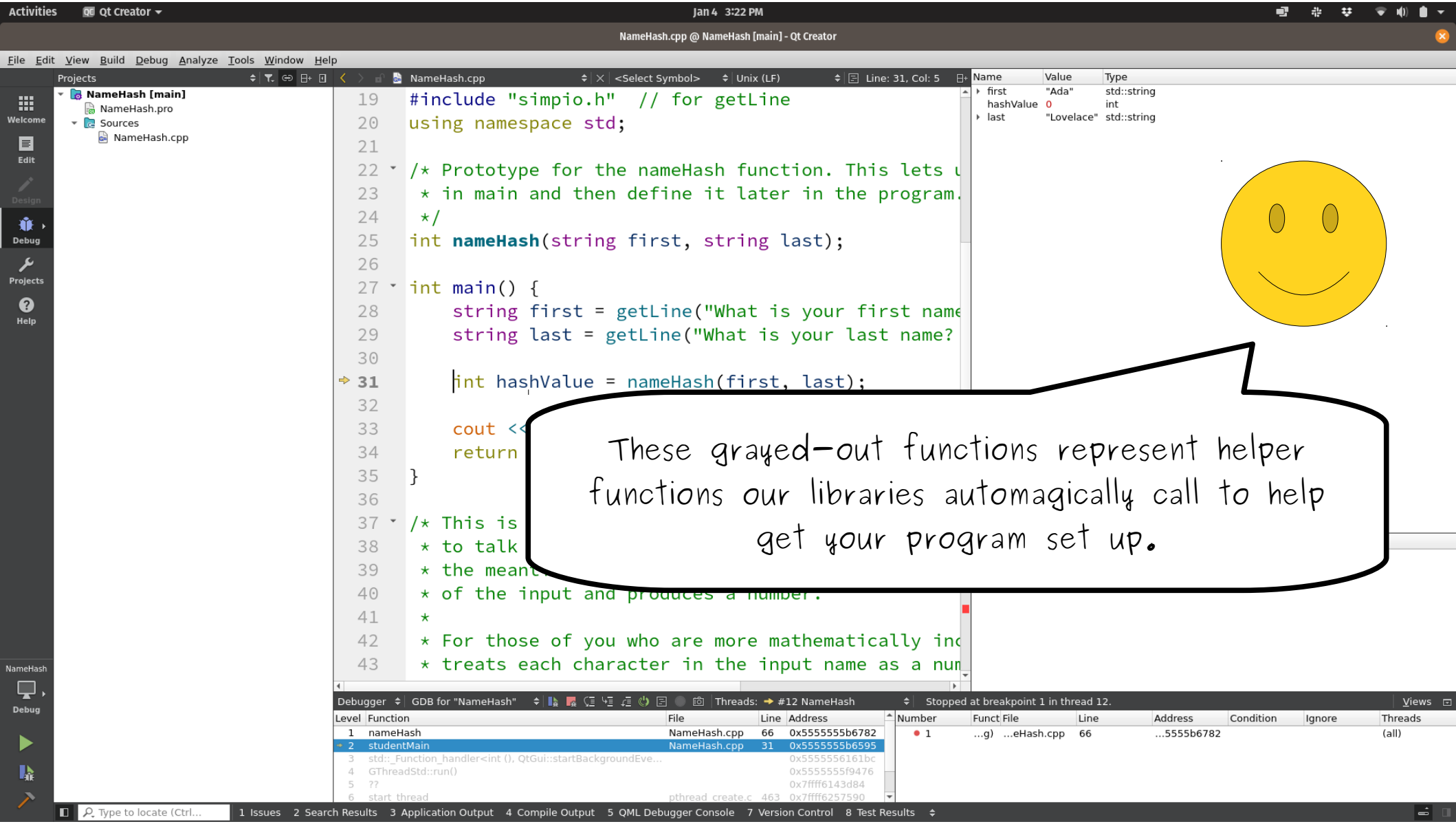

Activities
Qt Creator
Jan 4 3:15 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash.cpp
nameHash(std::... Unix (LF)
Line: 66, Col: 9
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int hashVal = 0;
58
59 /* Iterate across all the characters in the fir
60 * name, updating the hash at each step.
61 */
62 for (ch
63 /*
64 *
65 */
66 ch
67 has
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'A' 65 0x41 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::s
Go and double-click the call to studentMain on Level 2. When you do…
Debugger GDB for "NameHash"
Threads: #12 NameHash
Stopped at breakpoint 1 in thread 12.
Views
Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
2 studentMain NameHash.cpp 31 0x5555555b6595
4 GThreadSt...n() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thre... pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Build
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Activities
Qt Creator
Jan 4 3:22 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
<Select Symbol>
Unix (LF)
Line: 31, Col: 5
19 #include "simpio.h" // for getLine
20 using namespace std;
21
22 /* Prototype for the nameHash function. This lets u
23 * in main and then define it later in the program.
24 */
25 int nameHash(string first, string last);
26
27 int main() {
28 string first = getLine("What is your first name
29 string last = getLine("What is your last name?
30
31 int hashValue = nameHash(first, last);
32
33 cout << "The hash of your name is: " << hashVal
34 return 0;
35 }
36
37 /* This is the actual function that c
38 * to talk more about what hash funct
39 * the meantime, think of it as a func
40 * of the input and produces a number
41 *
42 * For those of you who are more mathem
43 * treats each character in the input name as a num
Name Value Type
first "Ada" std::string
hashValue 0 int
last "Lovelace" std::string
You'll end up over here!
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped at breakpoint 1 in thread 12. Views
Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Activities
Qt Creator
Jan 4 3:22 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
<Select Symbol>
Unix (LF)
Line: 31, Col: 5
19 #include "simpio.h" // for getLine
20 using namespace std;
21
22 /* Prototype for the nameHash function. This lets u
23 * in main and then define it later in the program.
24 */
25 int nameHash(string first, string last);
26
27 int main() {
28 string first = getLine("What is your first name
29 string last = getLine("What is your last name?
30
31 int hashValue = nameHash(first, last);
32
33 cout << "The hash of your name is: " << hashVal
34 return 0;
35 }
36
37 /* This is the actual function that c
38 * to talk more about what hash funct
39 * the meantime, think of it as a fun
40 * of the input and produces a number
41 *
42 * For those of you who are more mathe
43 * treats each character in the input
Name Value Type
first "Ada" std::string
hashValue 0 int
last "Lovelace" std::string
Debugger
GDB for "NameHash"
Threads:
Level Function File Line
1 nameHash NameHash.cpp 66
2 studentMain NameHash.cpp 31
3 std::_Function_handler<int (), QtGui::startBackgroundEve...
4 GThreadStd::run()
5 ??
6 start_thread pthread_create.c 463
Views
Threads
(all)
Type to locate (Ctrl...
1 Issues
2 Search Results
3 Application Output
4 Compile Output
5 QML Debugger Console
7 Version Con
Notice that the yellow arrow points to Line 31. That line includes a call to the nameHash function. This is the part of the code that actually called nameHash, which is how we got to the line with the breakpoint!


Activities
Qt Creator
Jan 4 3:22 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
<Select Symbol>
Unix (LF)
Line: 31, Col: 5
19 #include "simpio.h" // for getLine
20 using namespace std;
21
22 /* Prototype for the nameHash function. This lets u
23 * in main and then define it later in the program.
24 */
25 int nameHash(string first, string last);
26
27 int main() {
28 string first = getLine("What is your first name
29 string last = getLine("What is your last name?
30
31 int hashValue = nameHash(first, last);
32
33 cout << "The hash of your name is: " << hashVal
34 return 0;
35 }
36
37 /* This is th
38 * to talk mo
39 * the meanti
40 * of the inp
41 *
42 * For those
43 * treats each
Name Value Type
first "Ada" std::string
hashValue 0 int
last "Lovelace" std::string
Generally speaking, you can use the call stack as a way to see which function calls got us to the point where the program paused at the breakpoint!
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped at breakpoint 1 in thread 12. Views
Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Activities
Qt Creator
Jan 4 3:22 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
<Select Symbol>
Unix (LF)
Line: 31, Col: 5
19 #include "simpio.h" // for getLine
20 using namespace std;
21
22 /* Prototype for the nameHash function. This lets u
23 * in main and then define it later in the program.
24 */
25 int nameHash(string first, string last);
26
27 int main() {
28 string first = getLine("What is your first name
29 string last = getLine("What is your last name?
30
31 int hashValue = nameHash(first, last);
32
33 cout <<
34 return
35 }
36
37 /* This is
38 * to talk
39 * the meant
40 * of the input and produces a number.
41 *
42 * For those of you who are more mathematically inc
43 * treats each character in the input name as a num
Name Value Type
first "Ada" std::string
hashValue 0 int
last "Lovelace" std::string
Depending on your OS, you might see some additional functions beneath studentMain. What are those?
Debugger GDB for "NameHash" Threads: #12 NameHash
Stopped at breakpoint 1 in thread 12.
Views
Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Activities
Qt Creator
Jan 4 3:22 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
<Select Symbol>
Unix (LF)
Line: 31, Col: 5
19 #include "simpio.h" // for getLine
20 using namespace std;
21
22 /* Prototype for the nameHash function. This lets u
23 * in main and then define it later in the program.
24 */
25 int nameHash(string first, string last);
26
27 int main() {
28 string first = getLine("What is your first name
29 string last = getLine("What is your last name?
30
31 int hashValue = nameHash(first, last);
32
33 cout <<
34 return
35 }
36
37 /* This is
38 * to talk
39 * the mean
40 * of the input and produces a number.
41 *
42 * For those of you who are more mathematically inc
43 * treats each character in the input name as a nun
Name Value Type
first "Ada" std::string
hashValue 0 int
last "Lovelace" std::string
These grayed-out functions represent helper functions our libraries automagically call to help get your program set up.
Debugger
GDB for "NameHash"
Threads: #12 NameHash
Stopped at breakpoint 1 in thread 12.
Views
Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
1 Issues
2 Search Results
3 Application Output
4 Compile Output
5 QML Debugger Console
7 Version Control
8 Test Results

Activities Qt Creator Jan 4 3:22 PM

NameHash.cpp @ NameHash [main] - Qt Creator

File Edit View Build Debug Analyze Tools Window Help

Projects

- NameHash [main]
  - NameHash.pro
  - Sources
    - NameHash.cpp

NameHash.cpp | <Select Symbol> | Unix (LF) | Line: 31, Col: 5

```
19  #include "simpio.h"  // for getLine
20  using namespace std;
21
22  /* Prototype for the nameHash function. This lets u
23   * in main and then define it later in the program.
24   */
25  int nameHash(string first, string last);
26
27  int main() {
28      string first = getLine("What is your first name
29      string last = getLine("What is your last name?
30
31      int hashValue = nameHash(first, last);
32
33      cout <<
34      return
35  }
36
37  /* This is
38   * to talk
39   * the meant
40   * of the input and produces a number.
41   *
42   * For those of you who are more mathematically inc
43   * treats each character in the input name as a num
```

Name	Value	Type
first	"Ada"	std::string
hashValue	0	int
last	"Lovelace"	std::string

You don't need to worry about these. They'll show up in all the programs you run and you can safely ignore them.

Debugger | GDB for "NameHash" | Threads: #12 NameHash | Stopped at breakpoint 1 in thread 12. | Views

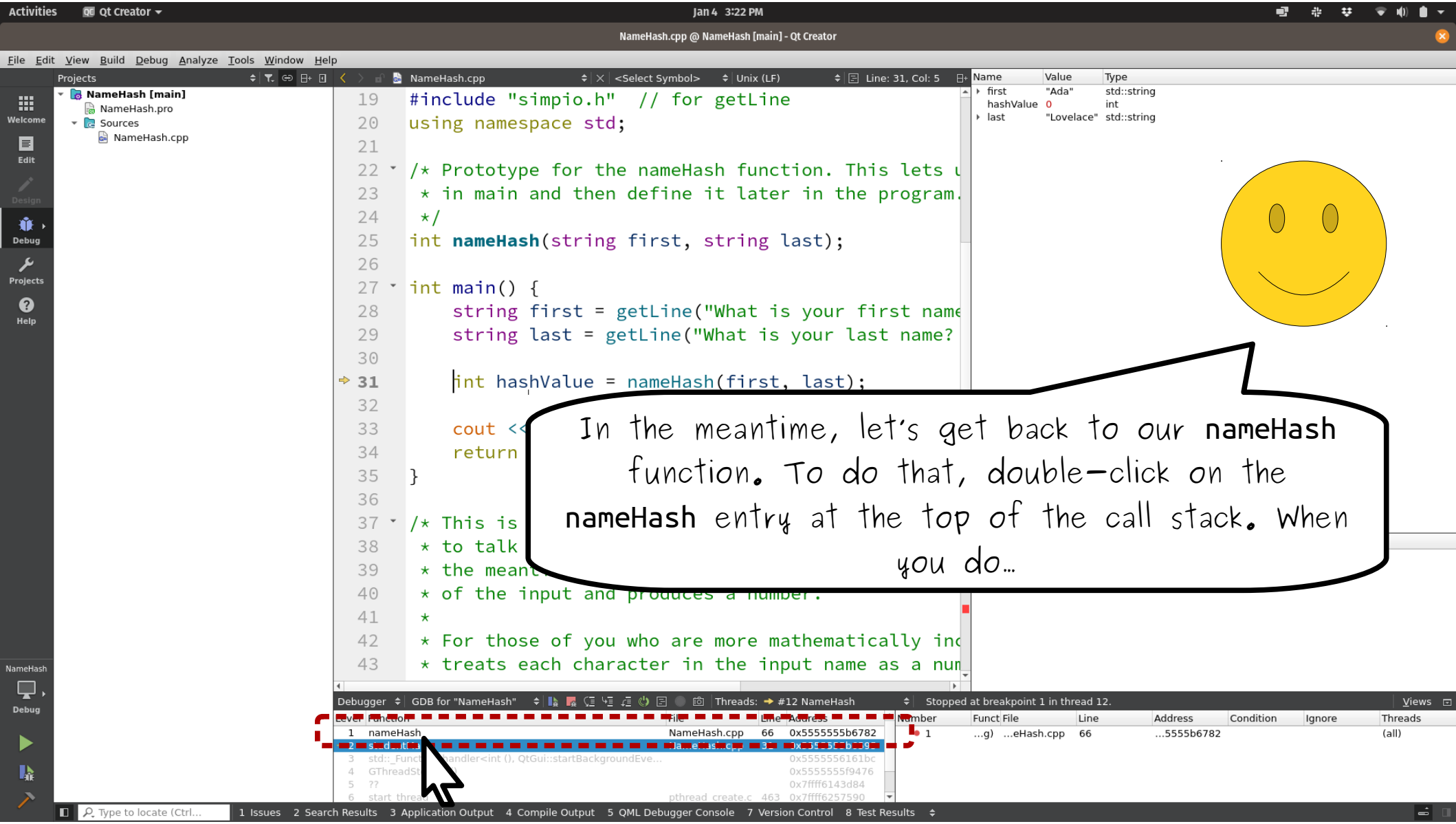
Level	Function	File	Line	Address
1	nameHash	NameHash.cpp	66	0x5555555b6782
2	studentMain	NameHash.cpp	31	0x5555555b6595
3	std::_Function_handler<int (), QtGui::startBackgroundEve...			0x5555556161bc
4	GThreadStd::run()			0x5555555f9476
5	??			0x7ffff6143d84
6	start_thread	pthread_create.c	463	0x7ffff6257590

Number	Funct	File	Line	Address	Condition	Ignore	Threads
1	...g)	...eHash.cpp	66	...5555b6782			(all)

Welcome Edit Design Debug Projects Help

NameHash Debug

Type to locate (Ctrl... 1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Activities
Qt Creator
Jan 4 3:22 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
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NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
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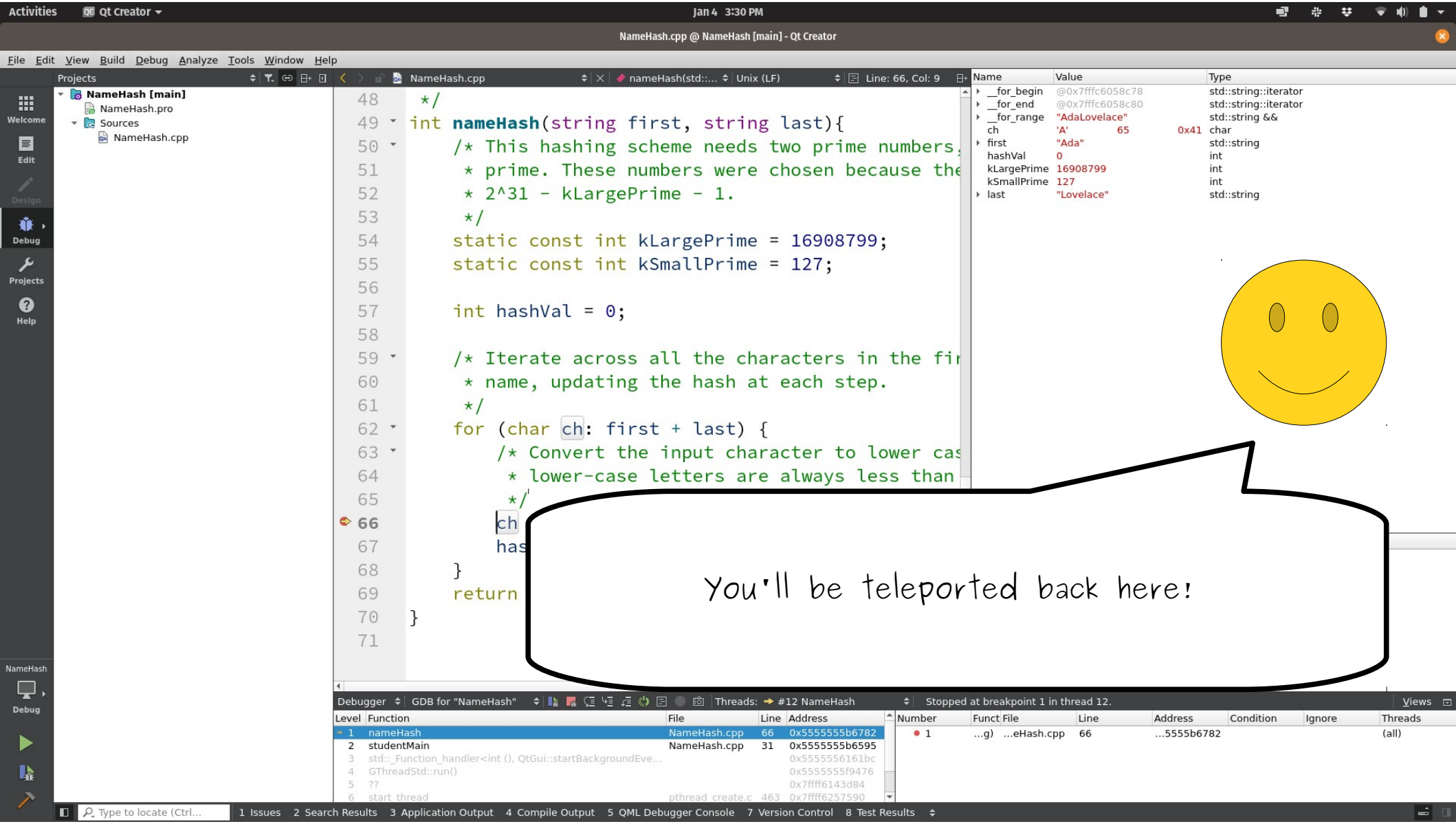
NameHash
Debug
NameHash.cpp
<Select Symbol>
Unix (LF)
Line: 31, Col: 5
19 #include "simpio.h" // for getLine
20 using namespace std;
21
22 /* Prototype for the nameHash function. This lets u
23 * in main and then define it later in the program.
24 */
25 int nameHash(string first, string last);
26
27 int main() {
28 string first = getLine("What is your first name
29 string last = getLine("What is your last name?
30
31 int hashValue = nameHash(first, last);
32
33 cout <<
34 return
35 }
36
37 /* This is
38 * to talk
39 * the mean
40 * of the input and produces a number.
41 *
42 * For those of you who are more mathematically inc
43 * treats each character in the input name as a num
Name Value Type
first "Ada" std::string
hashValue 0 int
last "Lovelace" std::string
In the meantime, let's get back to our nameHash function. To do that, double-click on the nameHash entry at the top of the call stack. When you do…
Debugger GDB for "NameHash"
Threads: #12 NameHash
Stopped at breakpoint 1 in thread 12.
Views
Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadSt 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number File Line Address Condition Ignore Threads
1 ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Activities
Qt Creator
Jan 4 3:30 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
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NameHash.cpp
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Projects
Help
NameHash
Debug
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 66, Col: 9
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int hashVal = 0;
58
59 /* Iterate across all the characters in the fir
60 * name, updating the hash at each step.
61 */
62 for (char ch: first + last) {
63 /* Convert the input character to lower cas
64 * lower-case letters are always less than
65 */
66 ch
67 has
68 }
69 return
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'A' 65 0x41 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
You'll be teleported back here!
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped at breakpoint 1 in thread 12. Views
Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
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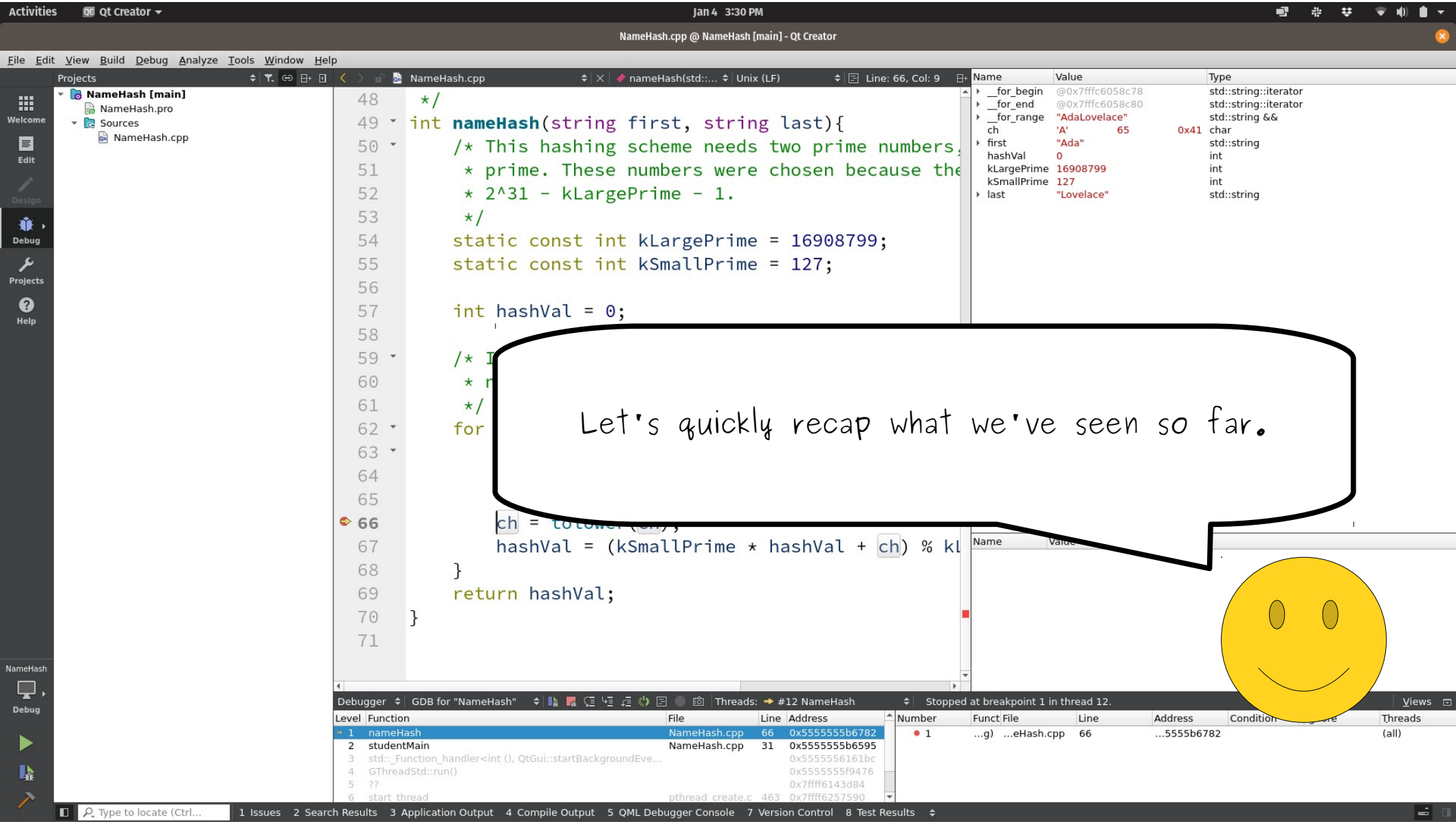
Activities
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52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int hashVal = 0;
58
59 /* I
60 * r
61 */
62 for
63
64
65
66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % kL
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
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ch 'A' 65 0x41 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Let's quickly recap what we've seen so far.
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped at breakpoint 1 in thread 12. Views
Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
2 studentMain NameHash.cpp 31 0x5555555b6595
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6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
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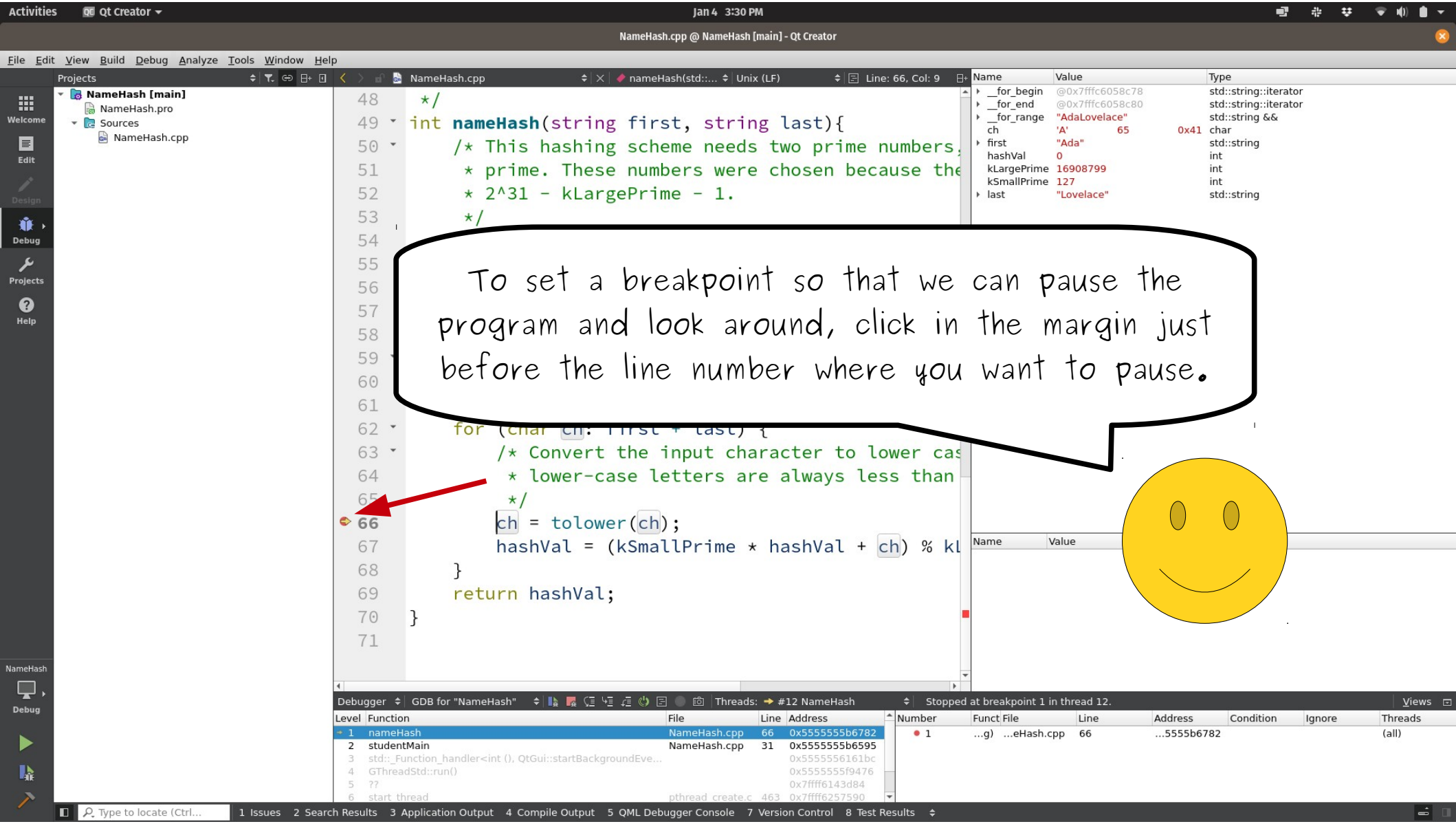
Activities
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52 * 2^31 - kLargePrime - 1.
53 */
62 for (char ch: first + last) {
63 /* Convert the input character to lower cas
64 * lower-case letters are always less than
65 */
66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % kL
68 }
69 return hashVal;
70 }
71
Name Value Type
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first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
To set a breakpoint so that we can pause the program and look around, click in the margin just before the line number where you want to pause.
Name Value
Debugger GDB for "NameHash" Threads: #12 NameHash
Stopped at breakpoint 1 in thread 12.
Views
Level Function File Line Address
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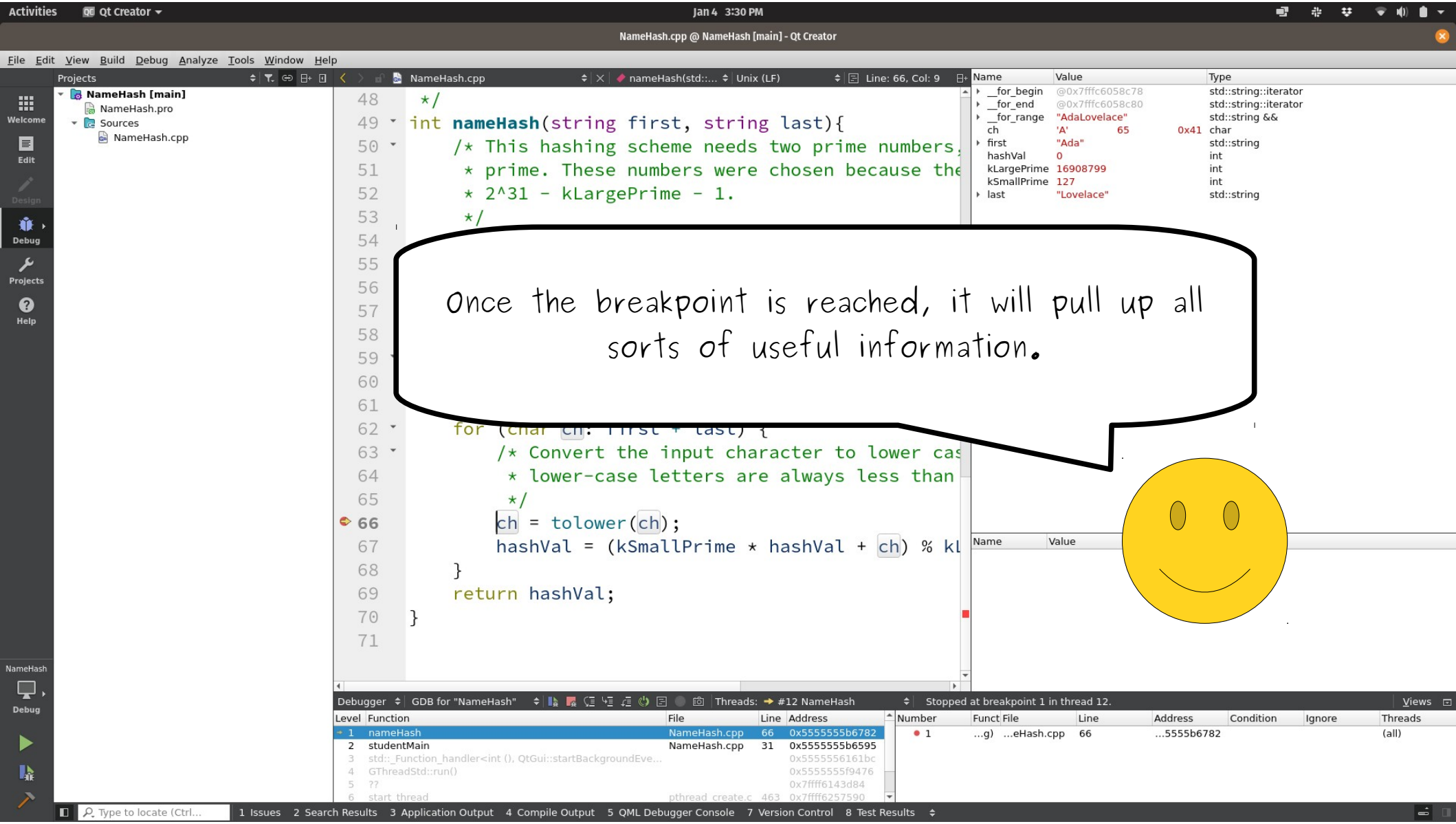
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Activities
Qt Creator
Jan 4 3:30 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
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Line: 66, Col: 9
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51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54
55
56
57
58
59
60
61
62 for (char ch: first + last) {
63 /* Convert the input character to lower cas
64 * lower-case letters are always less than
65 */
66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % kL
68 }
69 return hashVal;
70 }
71
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__for_begin @0x7fffc6058c78 std::string::iterator
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__for_range "AdaLovelace" std::string &&
ch 'A' 65 0x41 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Once the breakpoint is reached, it will pull up all sorts of useful information.
Name Value
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped at breakpoint 1 in thread 12. Views
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2 studentMain NameHash.cpp 31 0x5555555b6595
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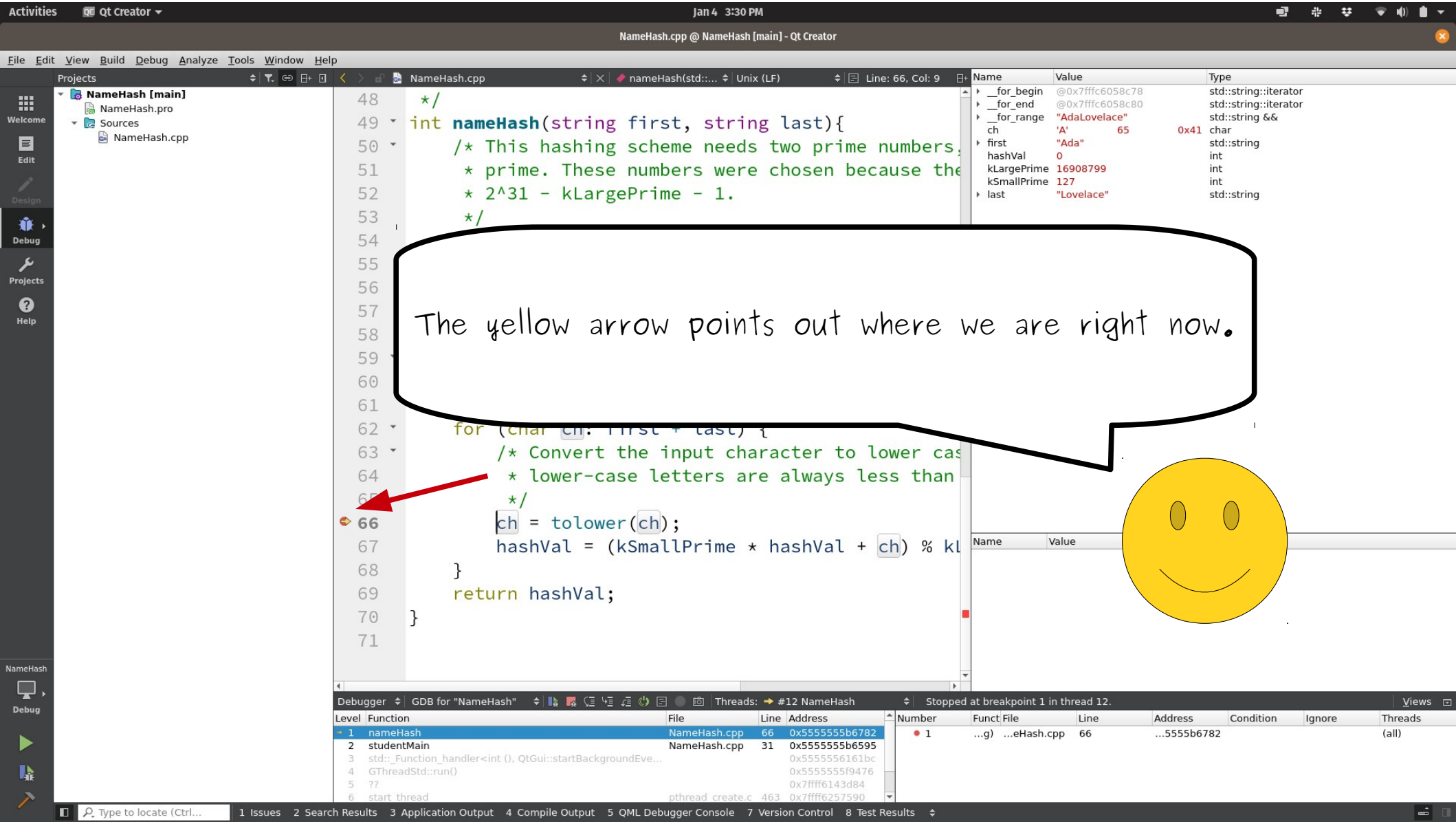
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67 hashVal = (kSmallPrime * hashVal + ch) % kL
68 }
69 return hashVal;
70 }
71
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__for_range "AdaLovelace" std::string &&
ch 'A' 65 0x41 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
The yellow arrow points out where we are right now.
Name Value
Debugger GDB for "NameHash" Threads: #12 NameHash
Stopped at breakpoint 1 in thread 12.
Views
Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
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Number Funct File Line Address Condition Ignore Threads
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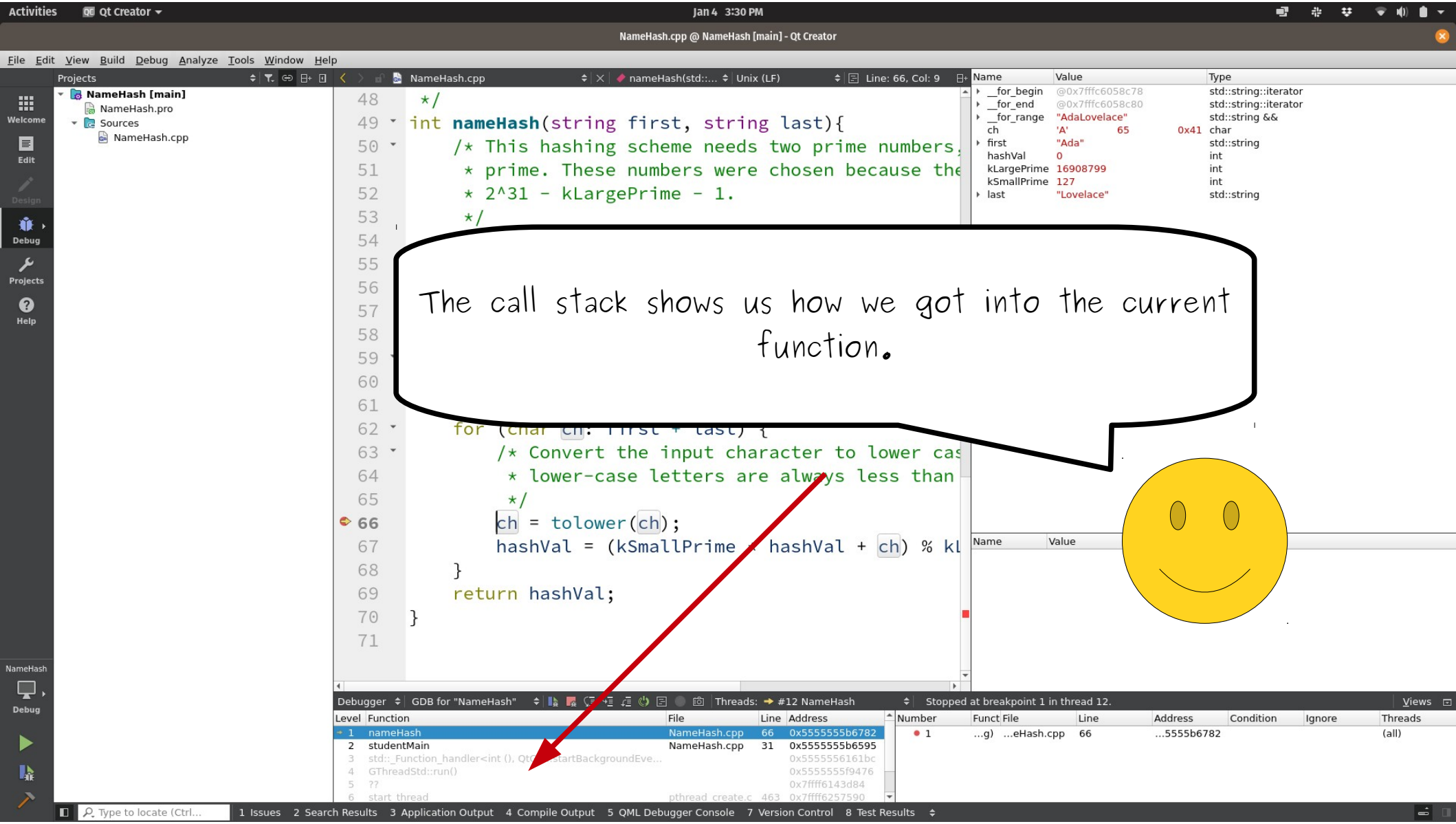
Activities
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50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54
55
56
57
58
59
60
61
62 for (char ch: first + last) {
63 /* Convert the input character to lower cas
64 * lower-case letters are always less than
65 */
66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % kL
68 }
69 return hashVal;
70 }
71
The call stack shows us how we got into the current function.
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'A' 65 0x41 char
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hashVal 0 int
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kSmallPrime 127 int
last "Lovelace" std::string
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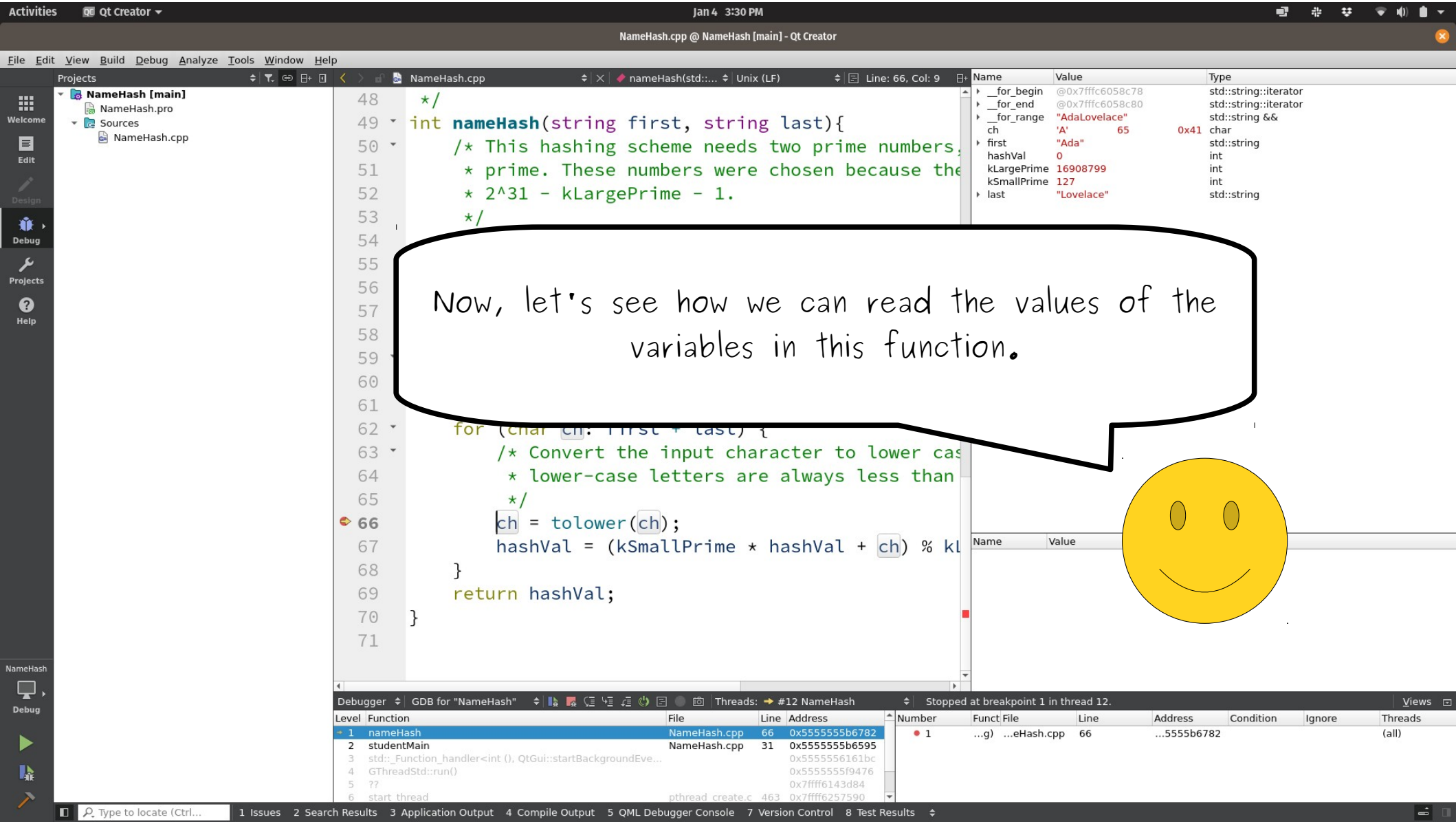
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63 /* Convert the input character to lower cas
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66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % kL
68 }
69 return hashVal;
70 }
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ch 'A' 65 0x41 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Now, let's see how we can read the values of the variables in this function.
Name Value
Debugger GDB for "NameHash"
Threads: #12 NameHash
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1 nameHash NameHash.cpp 66 0x5555555b6782
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1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
NameHash
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Type to locate (Ctrl...
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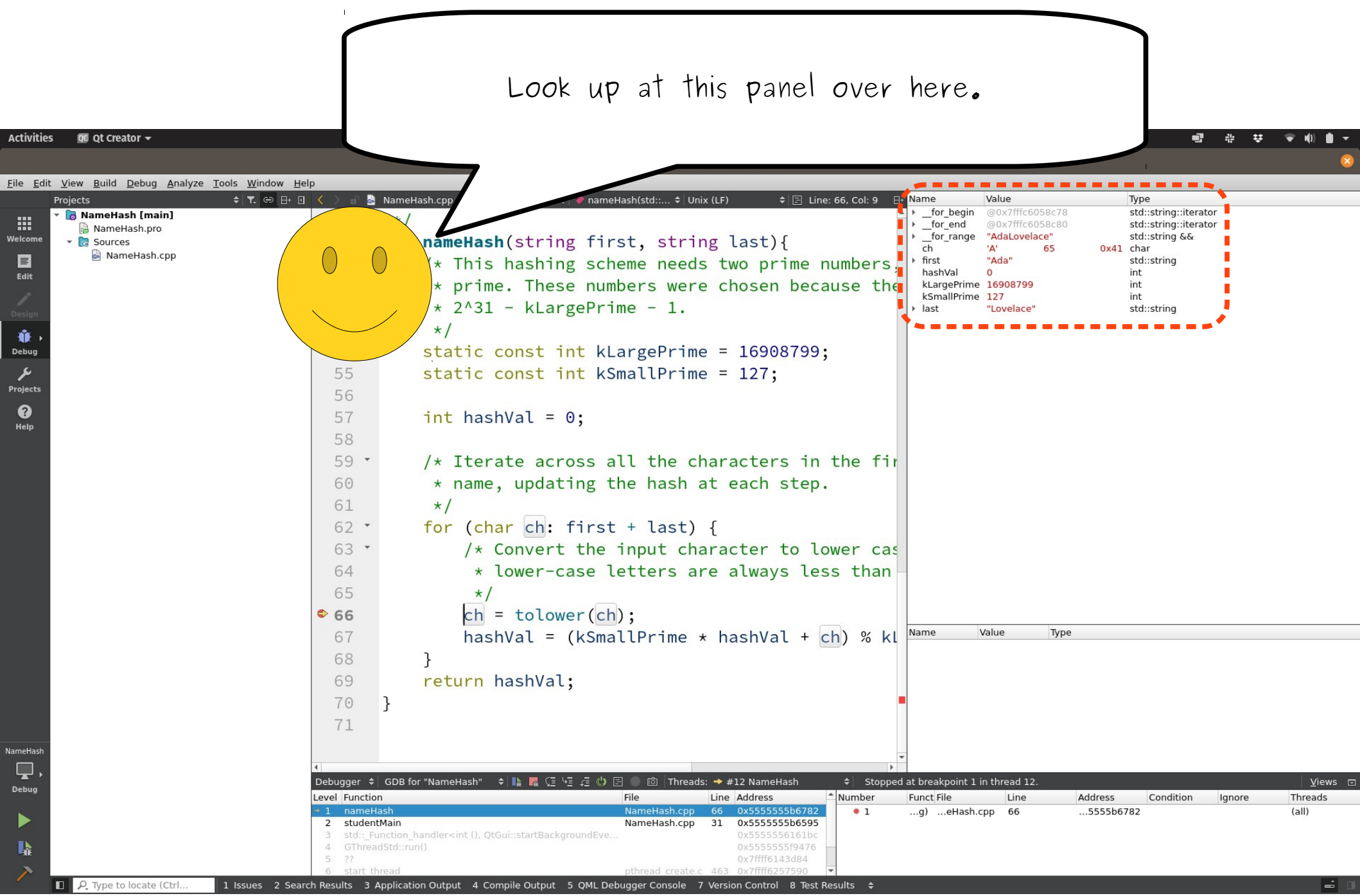
Look up at this panel over here.
Activities
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NameHash [main]
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* prime. These numbers were chosen because the
* 2^31 - kLargePrime - 1.
*/
static const int kLargePrime = 16908799;
static const int kSmallPrime = 127;
int hashVal = 0;
/* Iterate across all the characters in the fir
* name, updating the hash at each step.
*/
for (char ch: first + last) {
/* Convert the input character to lower cas
* lower-case letters are always less than
*/
ch = tolower(ch);
hashVal = (kSmallPrime * hashVal + ch) % kL
}
return hashVal;
}
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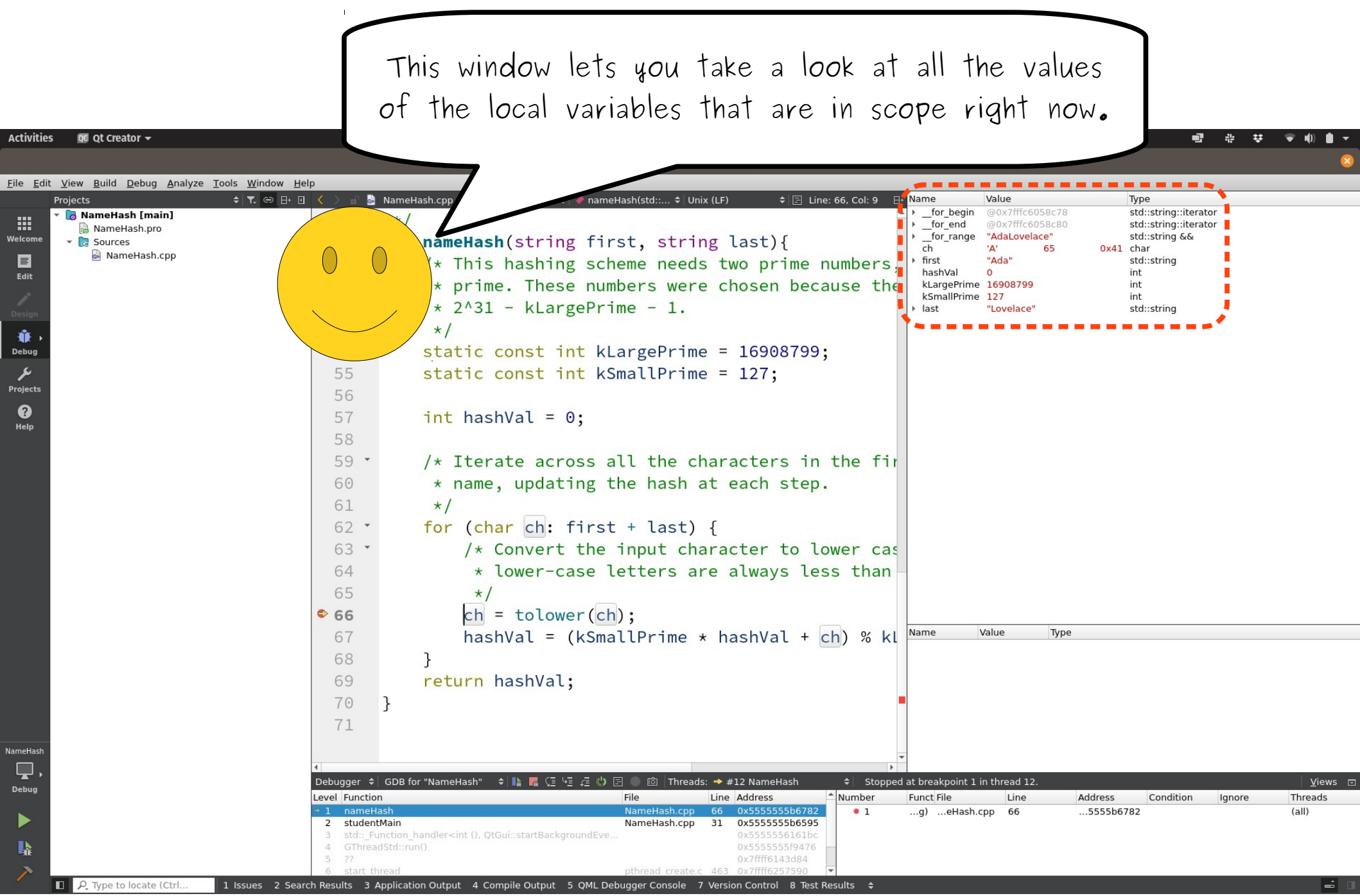
This window lets you take a look at all the values of the local variables that are in scope right now.
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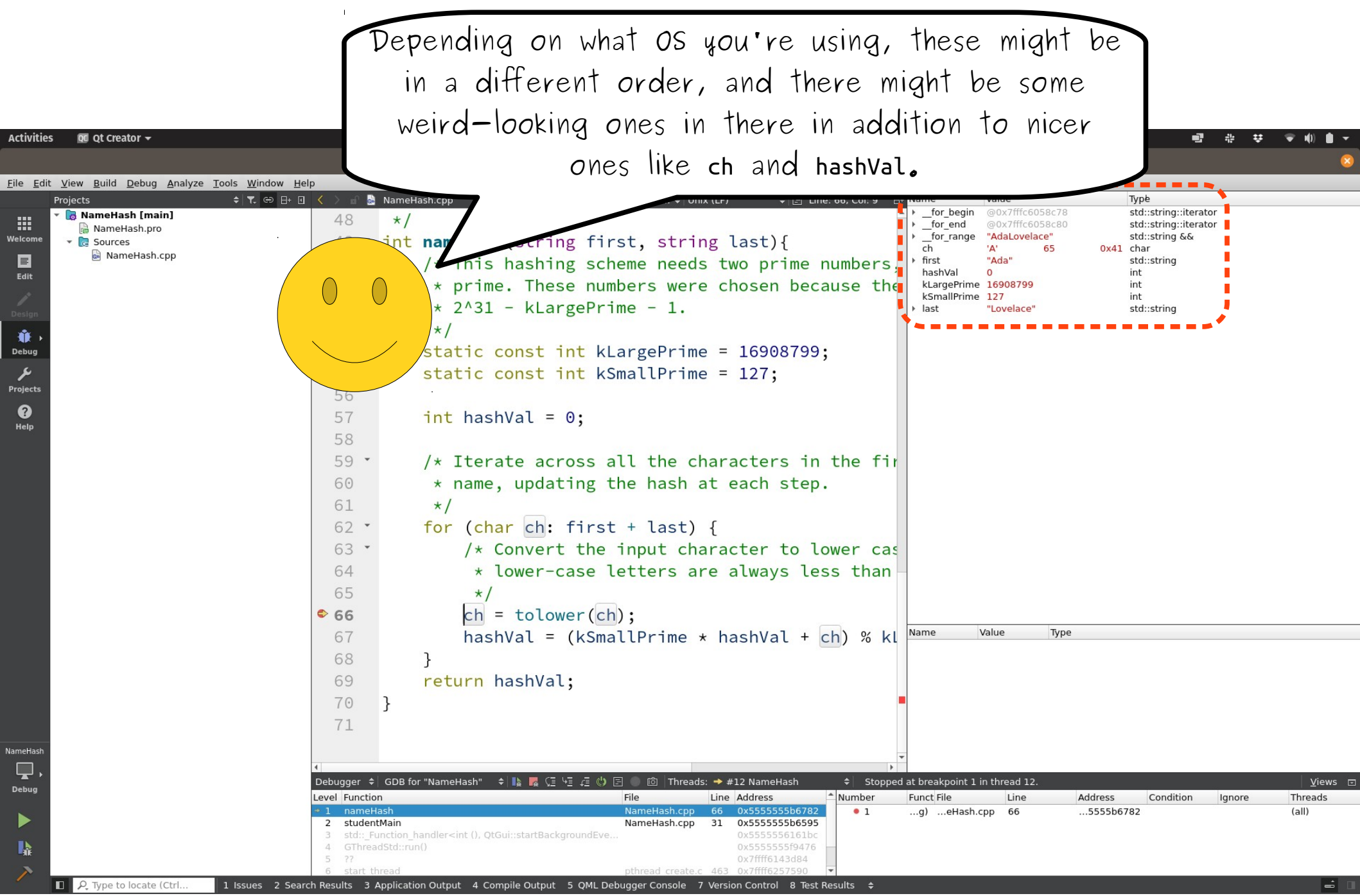
Depending on what OS you're using, these might be in a different order, and there might be some weird-looking ones in there in addition to nicer ones like ch and hashVal.
Activities
Qt Creator
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NameHash [main]
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Projects
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NameHash
Debug
48 */
int nam string first, string last){
/* This hashing scheme needs two prime numbers,
* prime. These numbers were chosen because the
* 2^31 - kLargePrime - 1.
*/
static const int kLargePrime = 16908799;
static const int kSmallPrime = 127;
56
57 int hashVal = 0;
58
59 /* Iterate across all the characters in the fir
60 * name, updating the hash at each step.
61 */
62 for (char ch: first + last) {
63 /* Convert the input character to lower cas
64 * lower-case letters are always less than
65 */
66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % kL
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'A' 65 0x41 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Name Value Type
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped at breakpoint 1 in thread 12. Views
Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
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If we ignore the weird-looking ones, we can see some nice, familiar names.

```
 */
int nam                first, string last){
    /*          hashing scheme needs two prime numbers,
     * prime. These numbers were chosen because the
     * 2^31 - kLargePrime - 1.
     */
    static const int kLargePrime = 16908799;
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    for (char ch: first + last) {
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         */
        ch = tolower(ch);
        hashVal = (kSmallPrime * hashVal + ch) % kL
    }
    return hashVal;
}
```
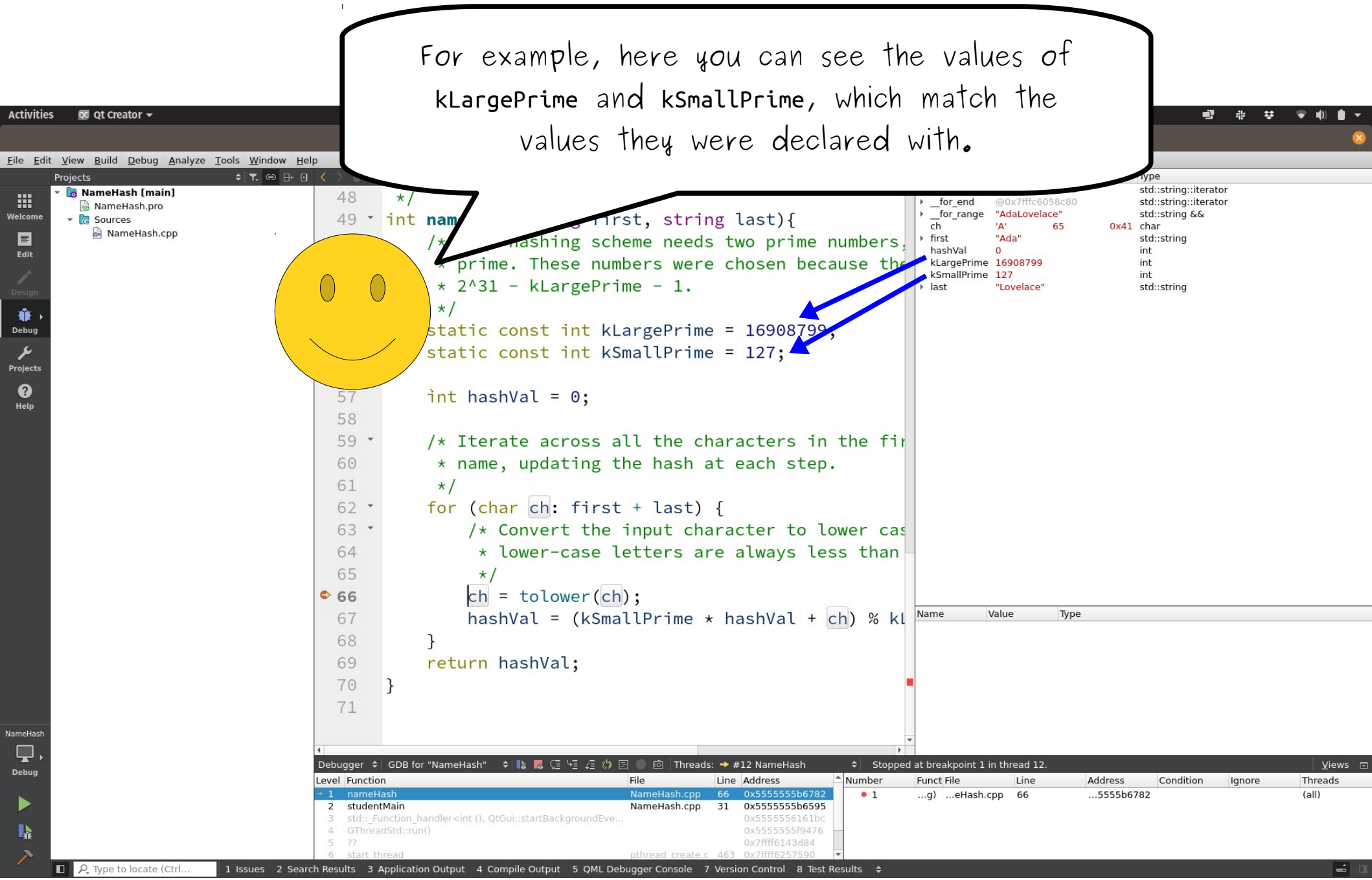

				Type
__for_end	@0x7fffc6058c80			std::string::iterator
__for_range	"AdaLovelace"			std::string &&
ch	'A'	65	0x41	char
first	"Ada"			std::string
hashVal	0			int
kLargePrime	16908799			int
kSmallPrime	127			int
last	"Lovelace"			std::string

Level	Function	File	Line	Address
1	nameHash	NameHash.cpp	66	0x5555555b6782
2	studentMain	NameHash.cpp	31	0x5555555b6595
3	std::_Function_handler<int (), QtGui::startBackgroundEve...			0x5555556161bc
4	GThreadStd::run()			0x5555555f9476
5	??			0x7ffff6143d84
6	start_thread	pthread_create.c	463	0x7ffff6257590

Number	Funct	File	Line	Address	Condition	Ignore	Threads
1	...g)	...eHash.cpp	66	...5555b6782			(all)


For example, here you can see the values of kLargePrime and kSmallPrime, which match the values they were declared with.
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kLargePrime 16908799 int
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last "Lovelace" std::string
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Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
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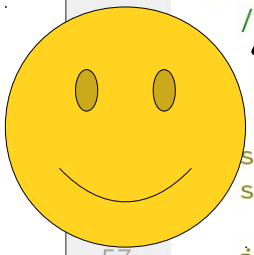
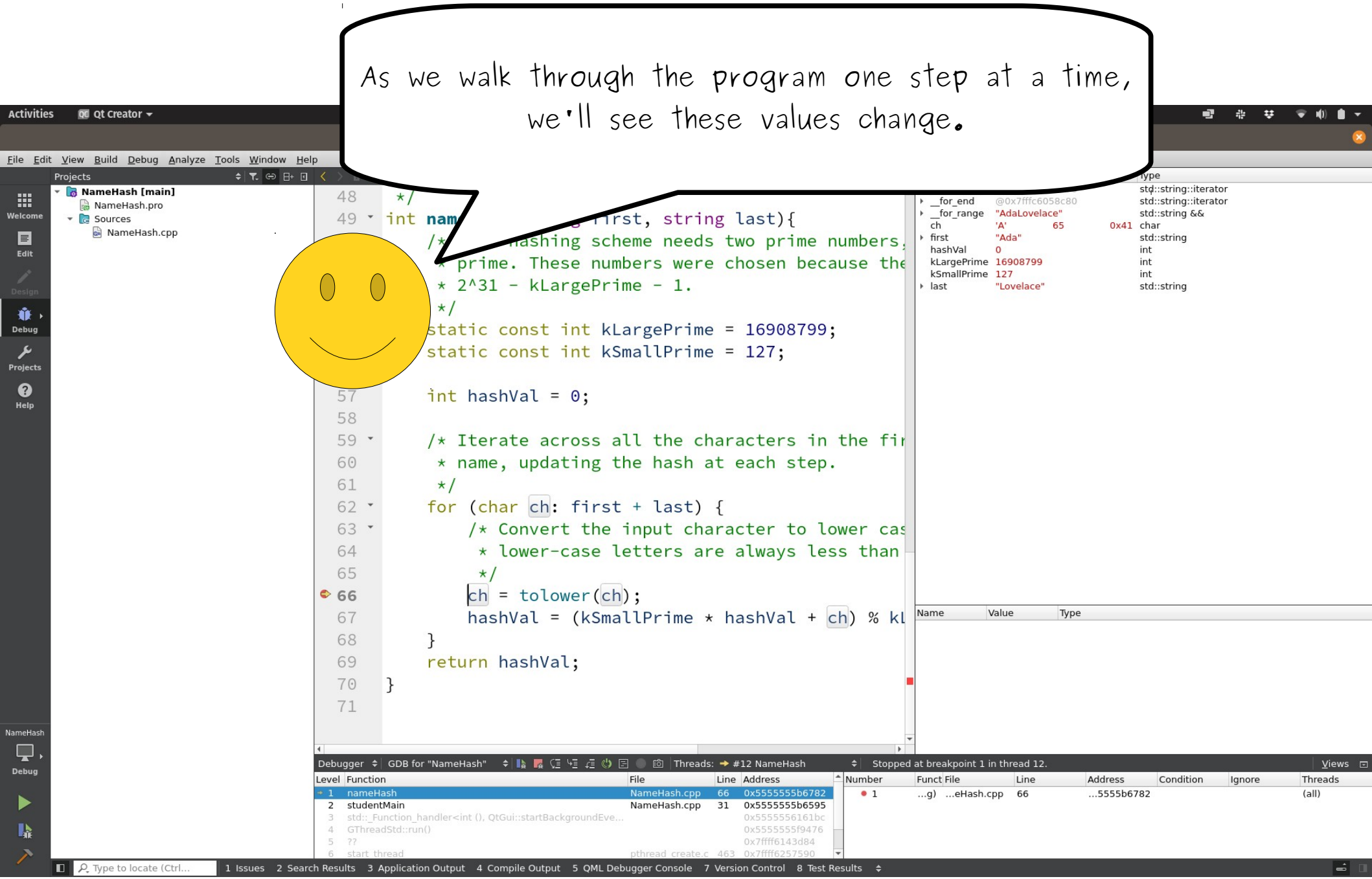
We can also see that, at this point, **hashVal** is still zero.



```
 */
int nam                    first, string last){
    /*          hashing scheme needs two prime numbers,
     * prime. These numbers were chosen because the
     * 2^31 - kLargePrime - 1.
     */
    static const int kLargePrime = 16908799;
    static const int kSmallPrime = 127;

    int hashVal = 0;

    /* Iterate across all the characters in the fir
     * name, updating the hash at each step.
     */
    for (char ch: first + last) {
        /* Convert the input character to lower cas
         * lower-case letters are always less than
         */
        ch = tolower(ch);
        hashVal = (kSmallPrime * hashVal + ch) % kL
    }
    return hashVal;
}
```


As we walk through the program one step at a time, we'll see these values change.
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67 hashVal = (kSmallPrime * hashVal + ch) % kL
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first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
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Debugger GDB for "NameHash" Threads: #12 NameHash Stopped at breakpoint 1 in thread 12. Views
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Number Funct File Line Address Condition Ignore Threads
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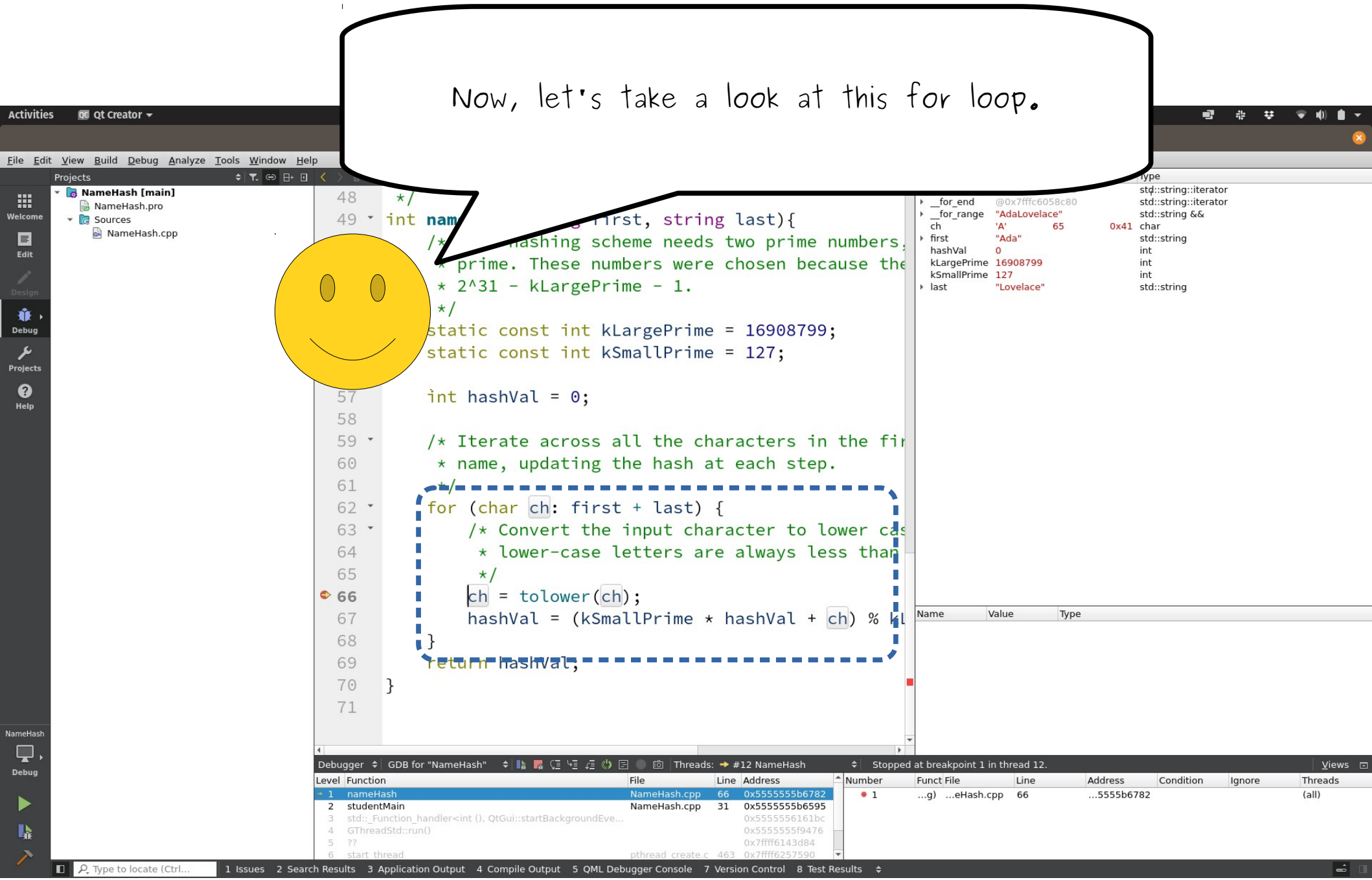
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Now, let's take a look at this for loop.
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49 int nam first, string last){
/* hashing scheme needs two prime numbers,
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static const int kLargePrime = 16908799;
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65 */
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68 }
69 return hashVal;
70 }
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first "Ada" std::string
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NameHash
Debug
Type to locate (Ctrl...
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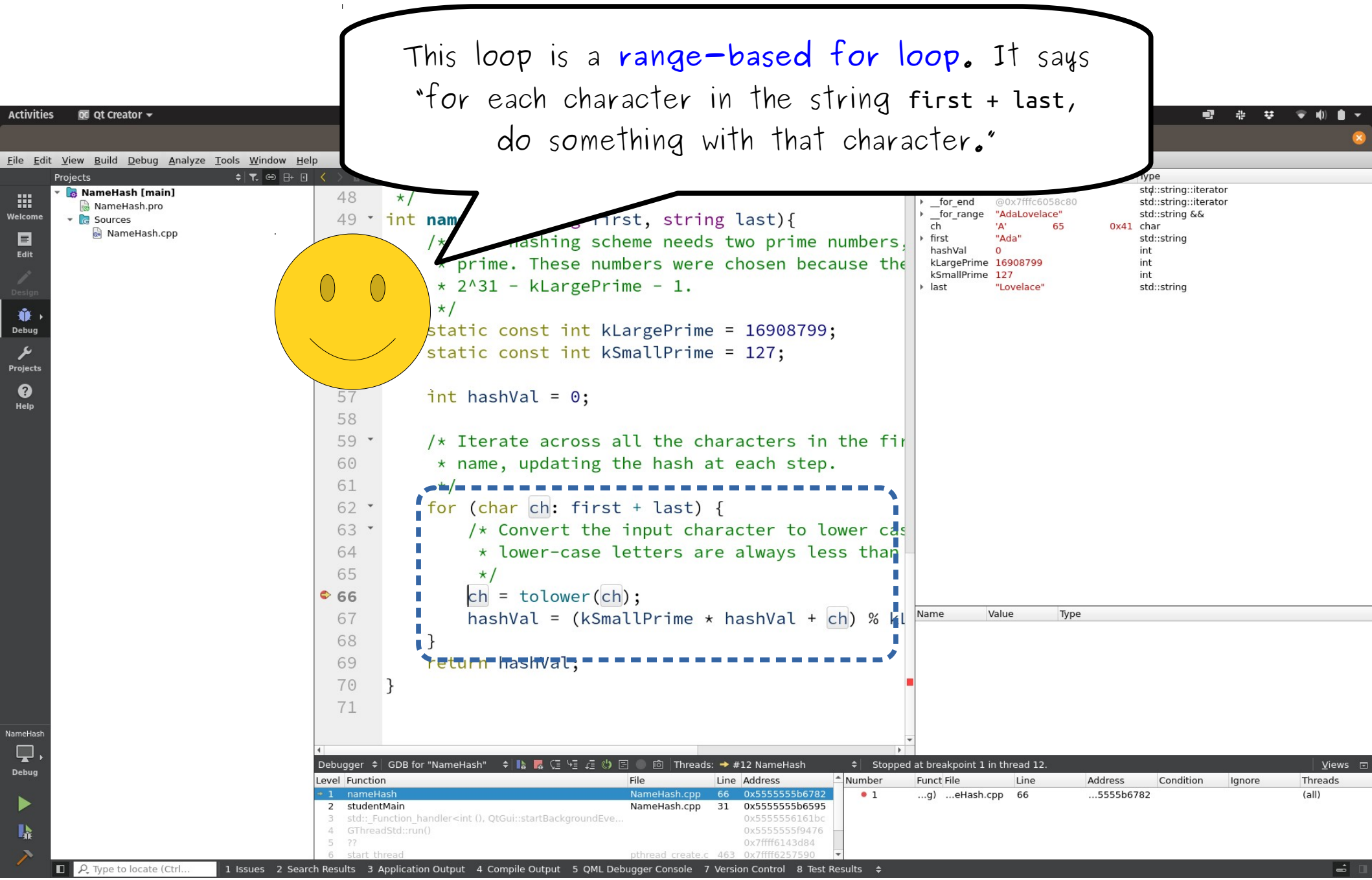
This loop is a range-based for loop. It says "for each character in the string first + last, do something with that character."
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49 int nam first, string last){
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Type to locate (Ctrl...
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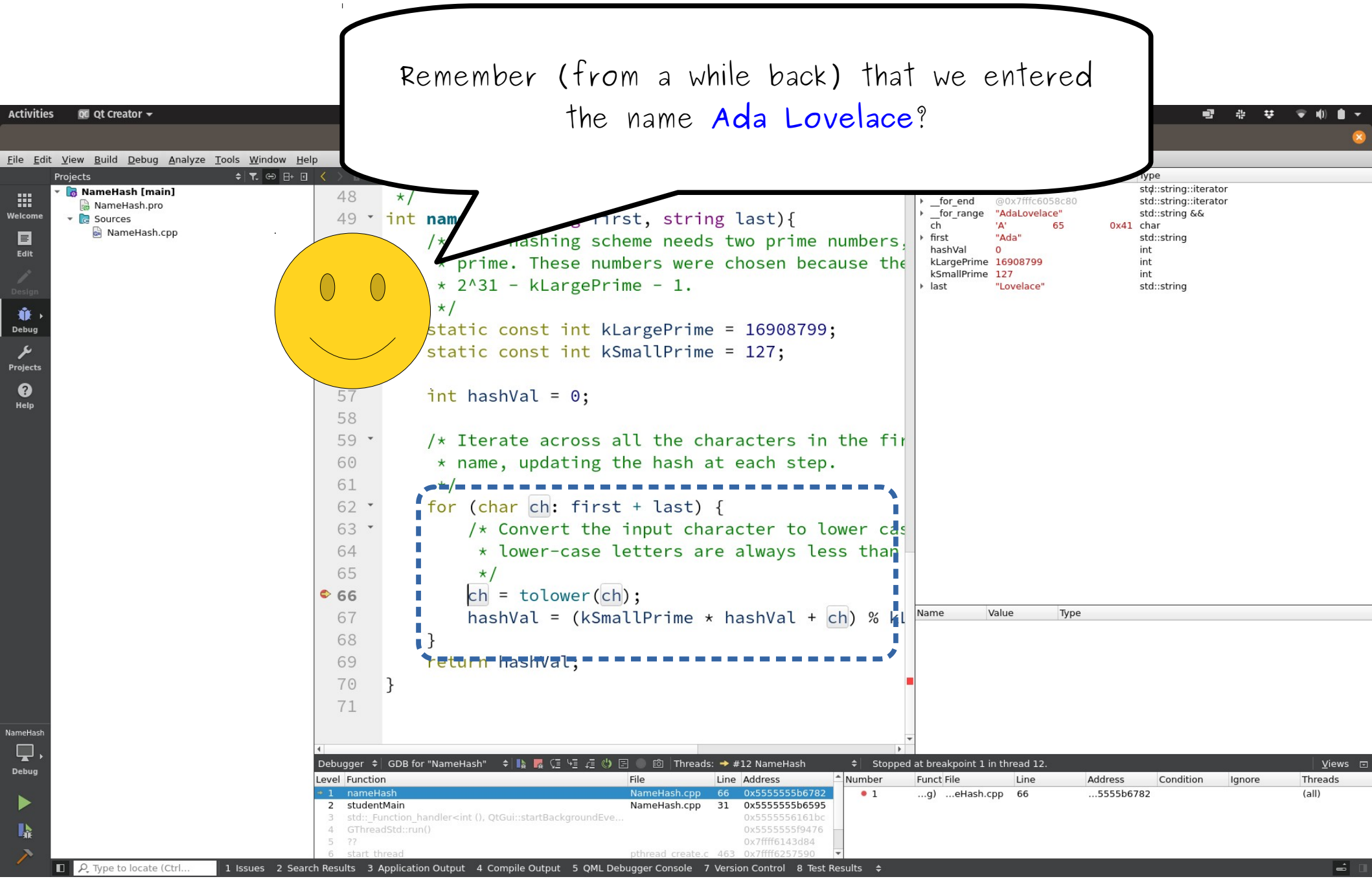
Remember (from a while back) that we entered the name Ada Lovelace?
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69 return hashVal;
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first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
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Type to locate (Ctrl...
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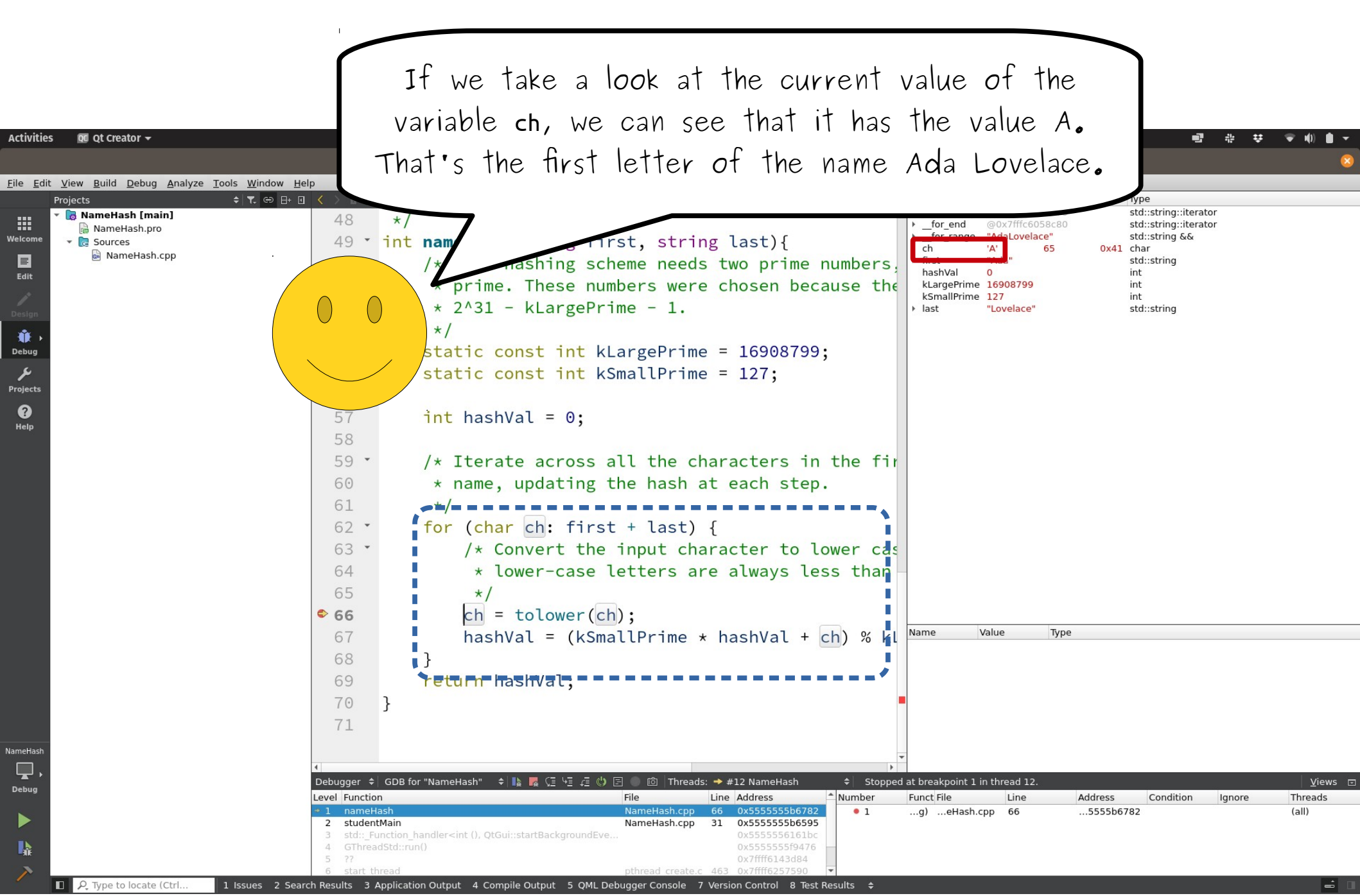
If we take a look at the current value of the variable ch, we can see that it has the value A. That's the first letter of the name Ada Lovelace.
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NameHash
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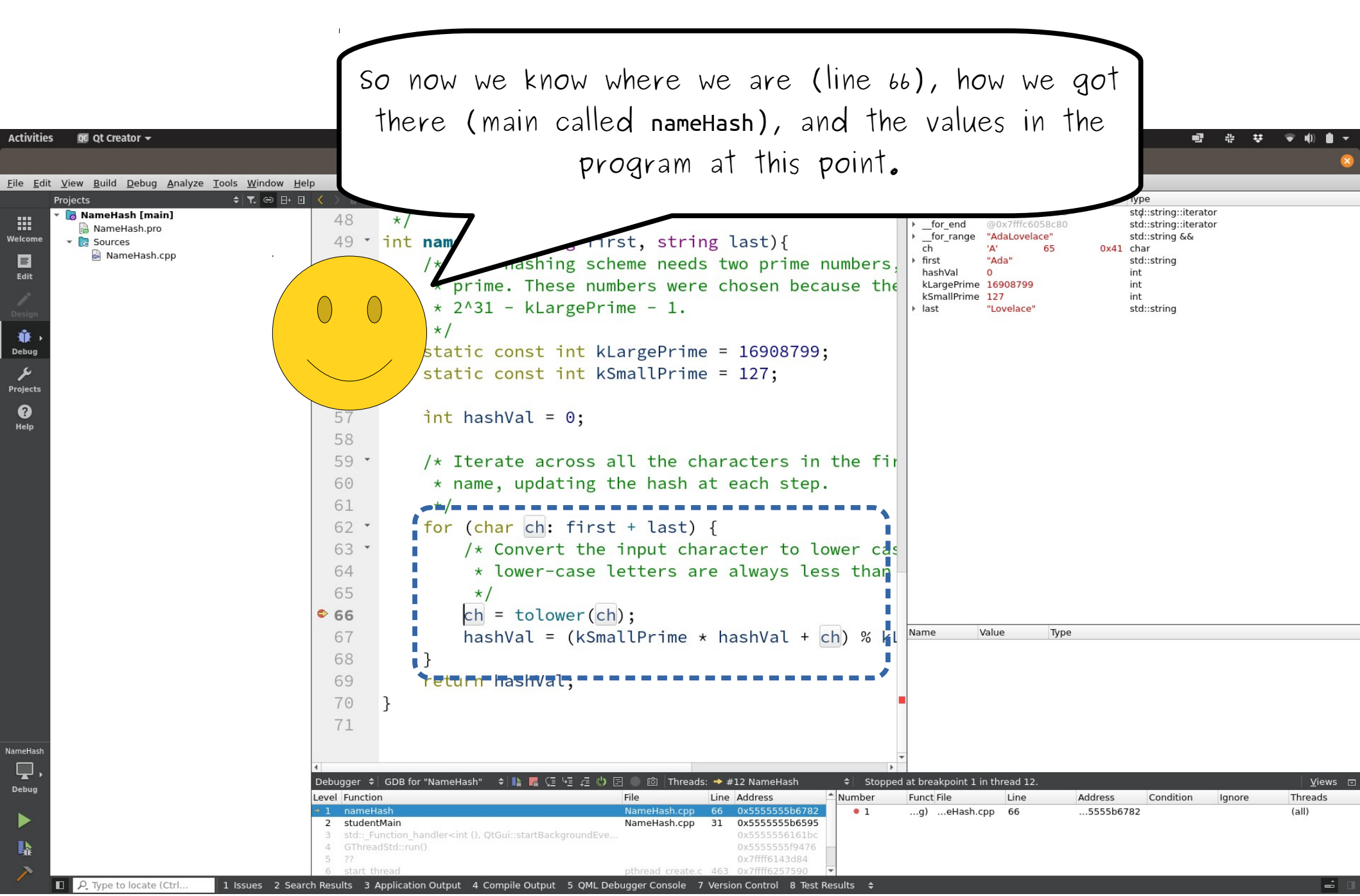
So now we know where we are (line 66), how we got there (main called nameHash), and the values in the program at this point.
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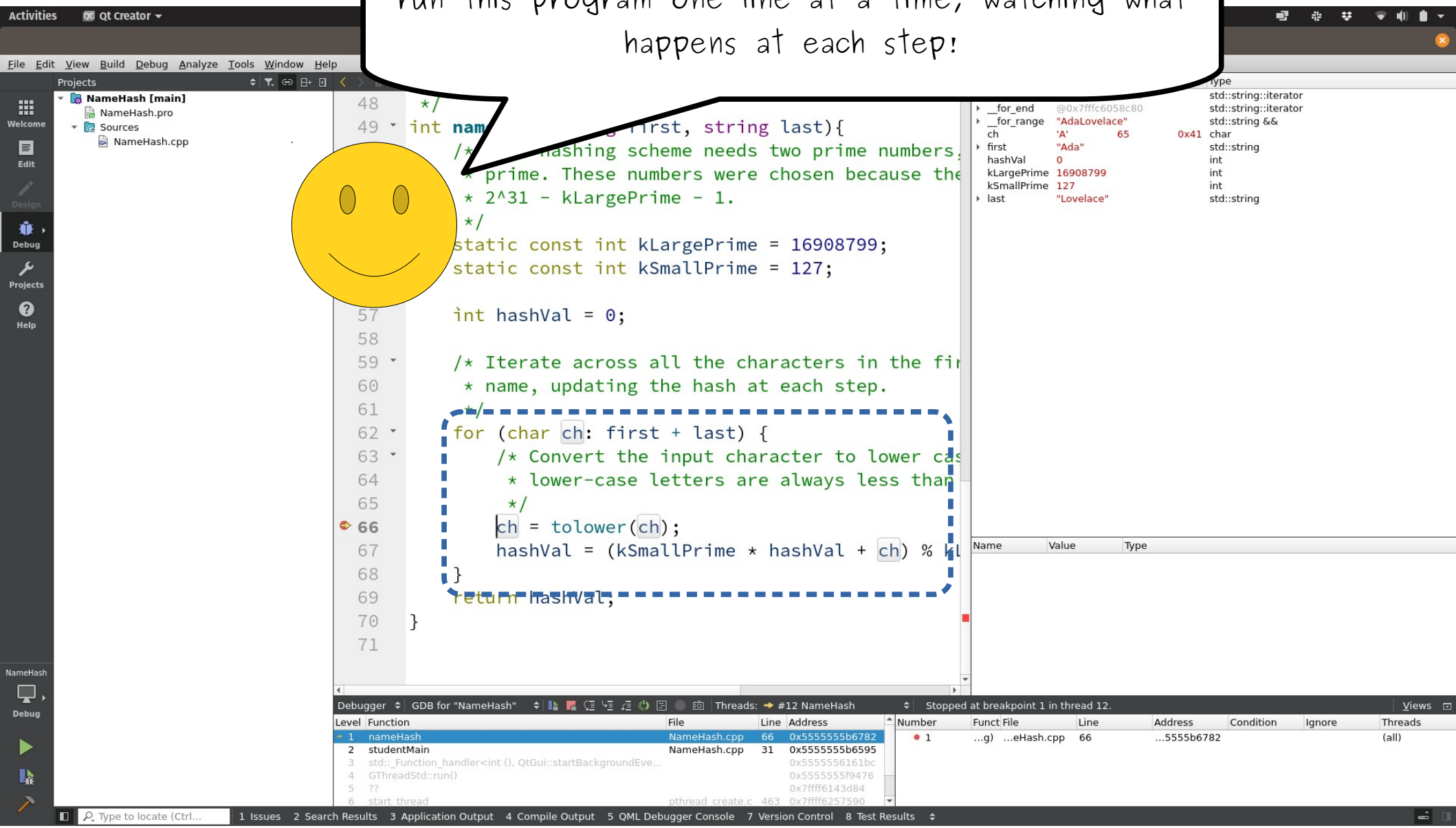
Now, let's do something really cool – we're going to run this program one line at a time, watching what happens at each step!
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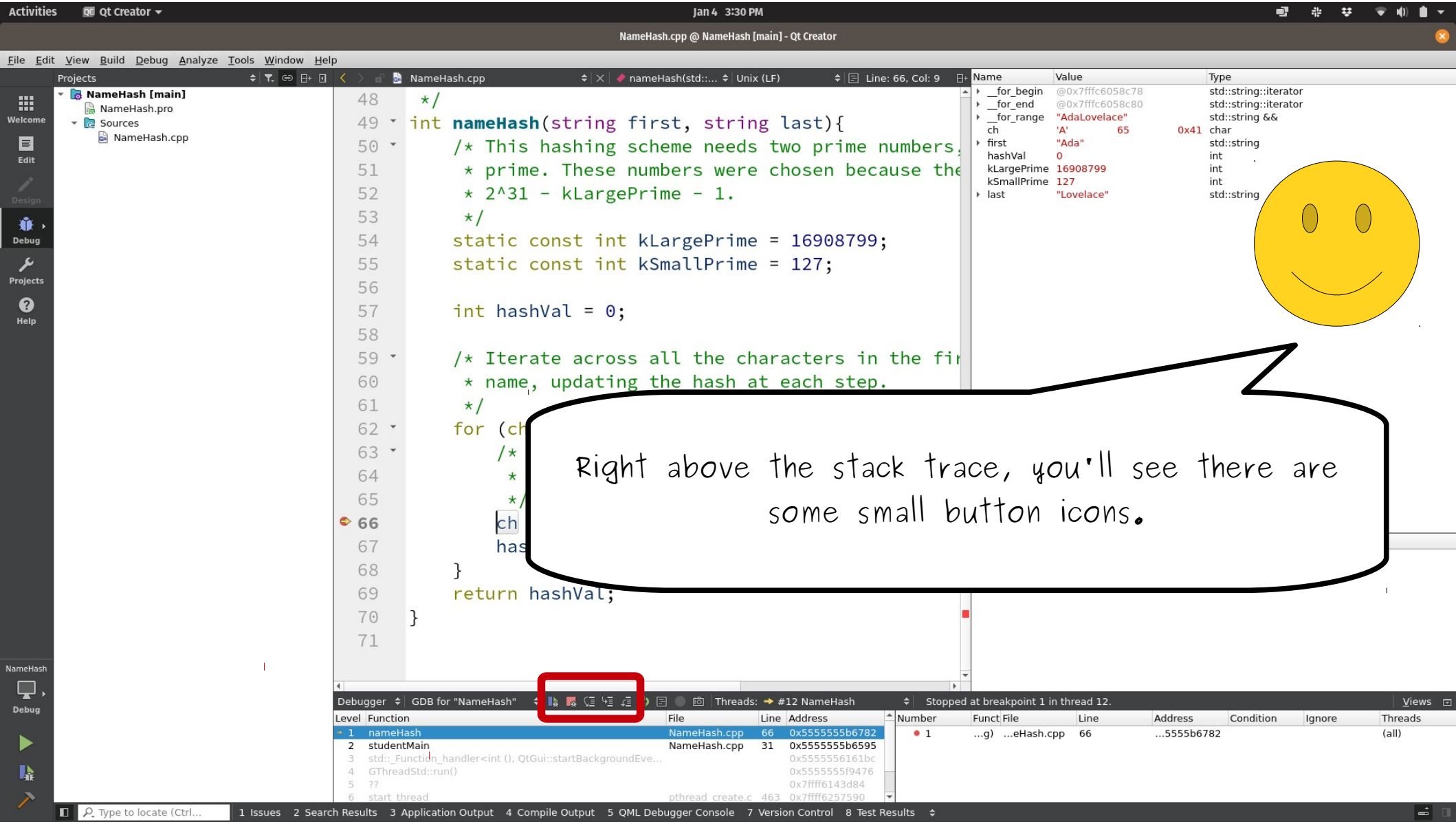
Activities
Qt Creator
Jan 4 3:30 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 66, Col: 9
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int hashVal = 0;
58
59 /* Iterate across all the characters in the fir
60 * name, updating the hash at each step.
61 */
62 for (ch
63 /*
64 *
65 */
66 ch
67 has
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69 return hashVal;
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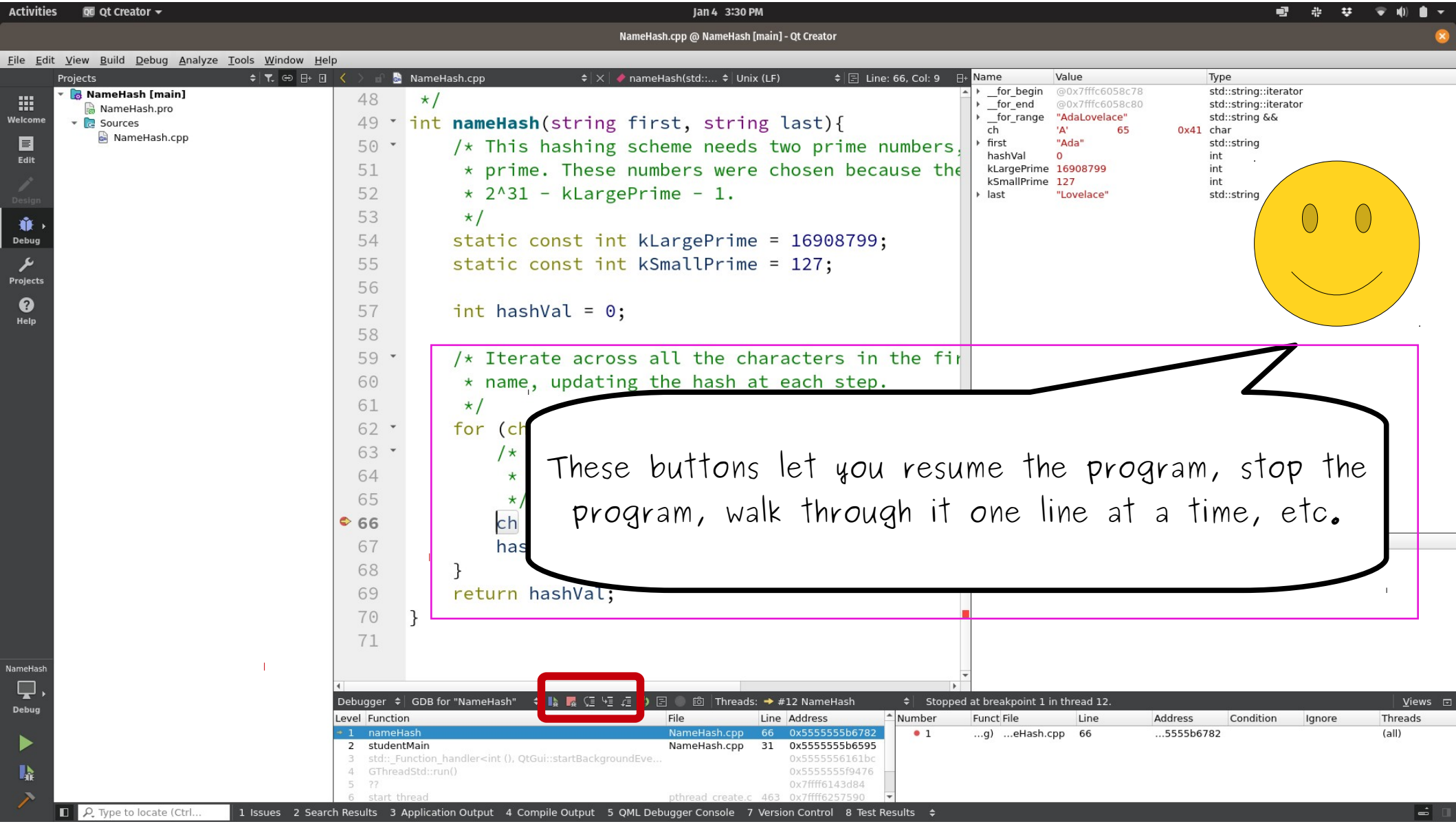
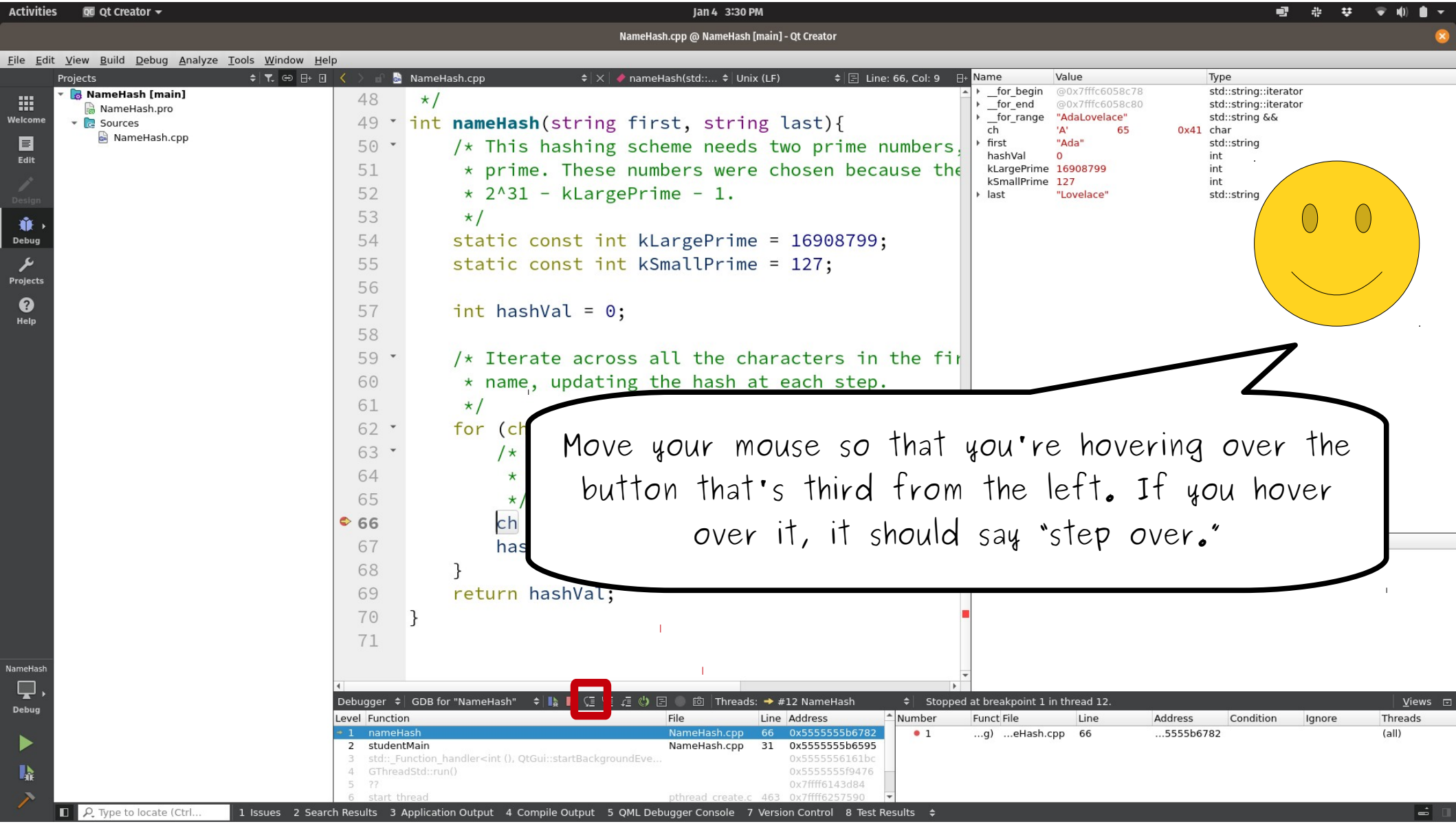
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'A' 65 0x41 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Right above the stack trace, you'll see there are some small button icons.
Debugger GDB for "NameHash"
Threads: #12 NameHash
Stopped at breakpoint 1 in thread 12.
Views
Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
NameHash
Debug
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Activities
Qt Creator
Jan 4 3:30 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 66, Col: 9
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int hashVal = 0;
58
59 /* Iterate across all the characters in the fir
60 * name, updating the hash at each step.
61 */
62 for (ch
63 /*
64 *
65 */
66 ch
67 has
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'A' 65 0x41 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
These buttons let you resume the program, stop the program, walk through it one line at a time, etc.
Debugger GDB for "NameHash"
Threads: #12 NameHash
Stopped at breakpoint 1 in thread 12.
Views
Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
NameHash
Debug
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Activities
Qt Creator
Jan 4 3:30 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 66, Col: 9
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int hashVal = 0;
58
59 /* Iterate across all the characters in the fir
60 * name, updating the hash at each step.
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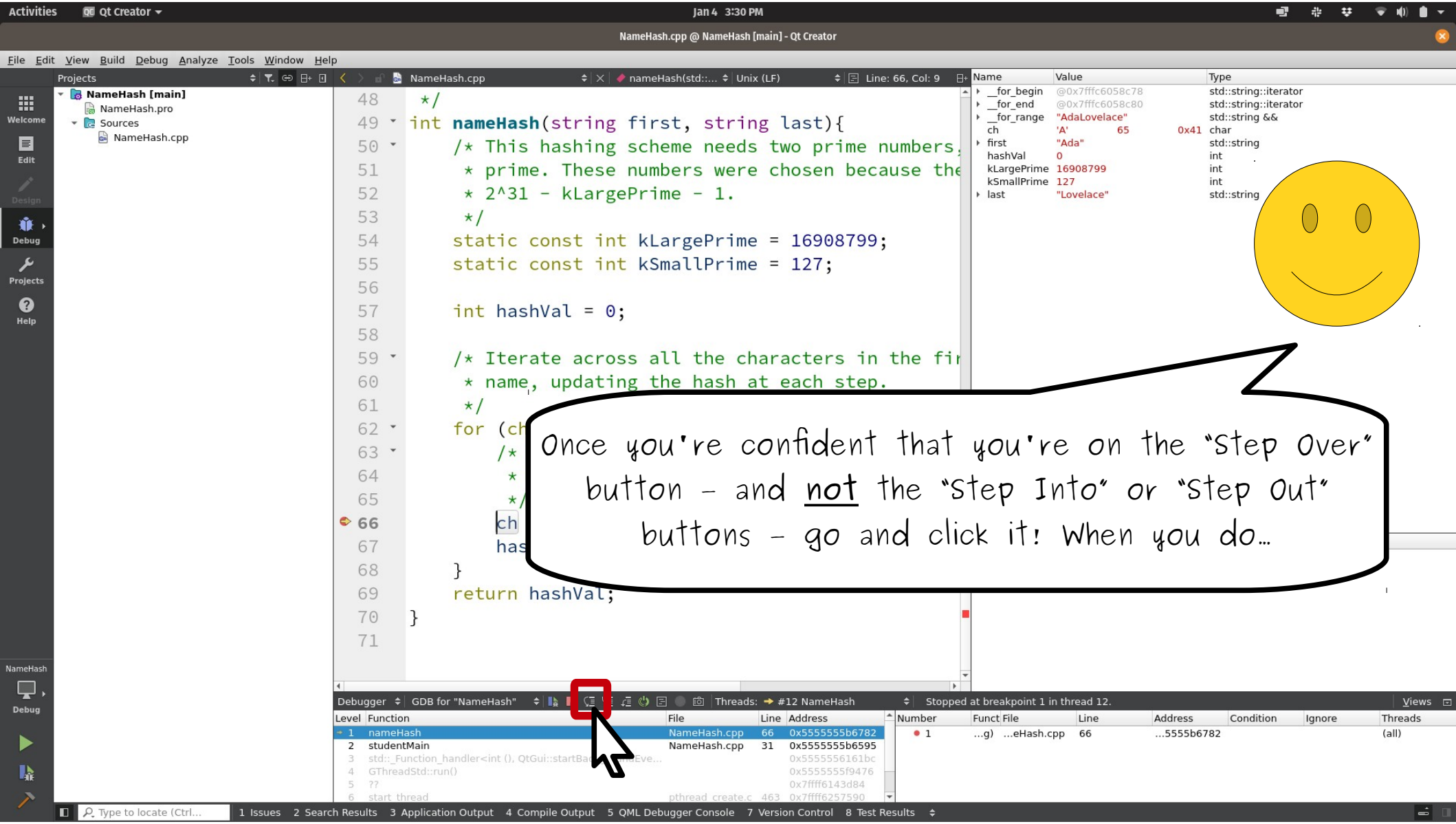
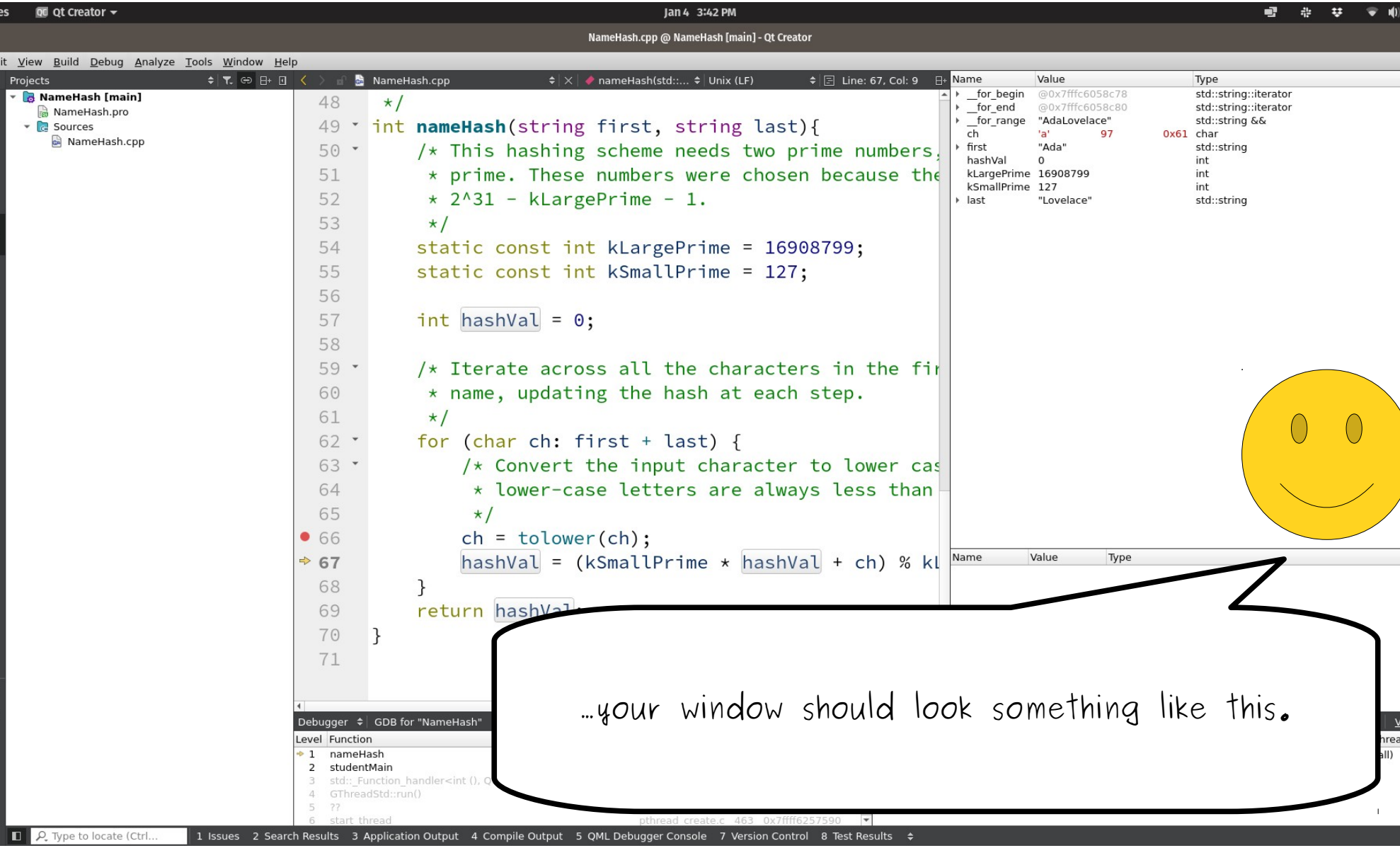
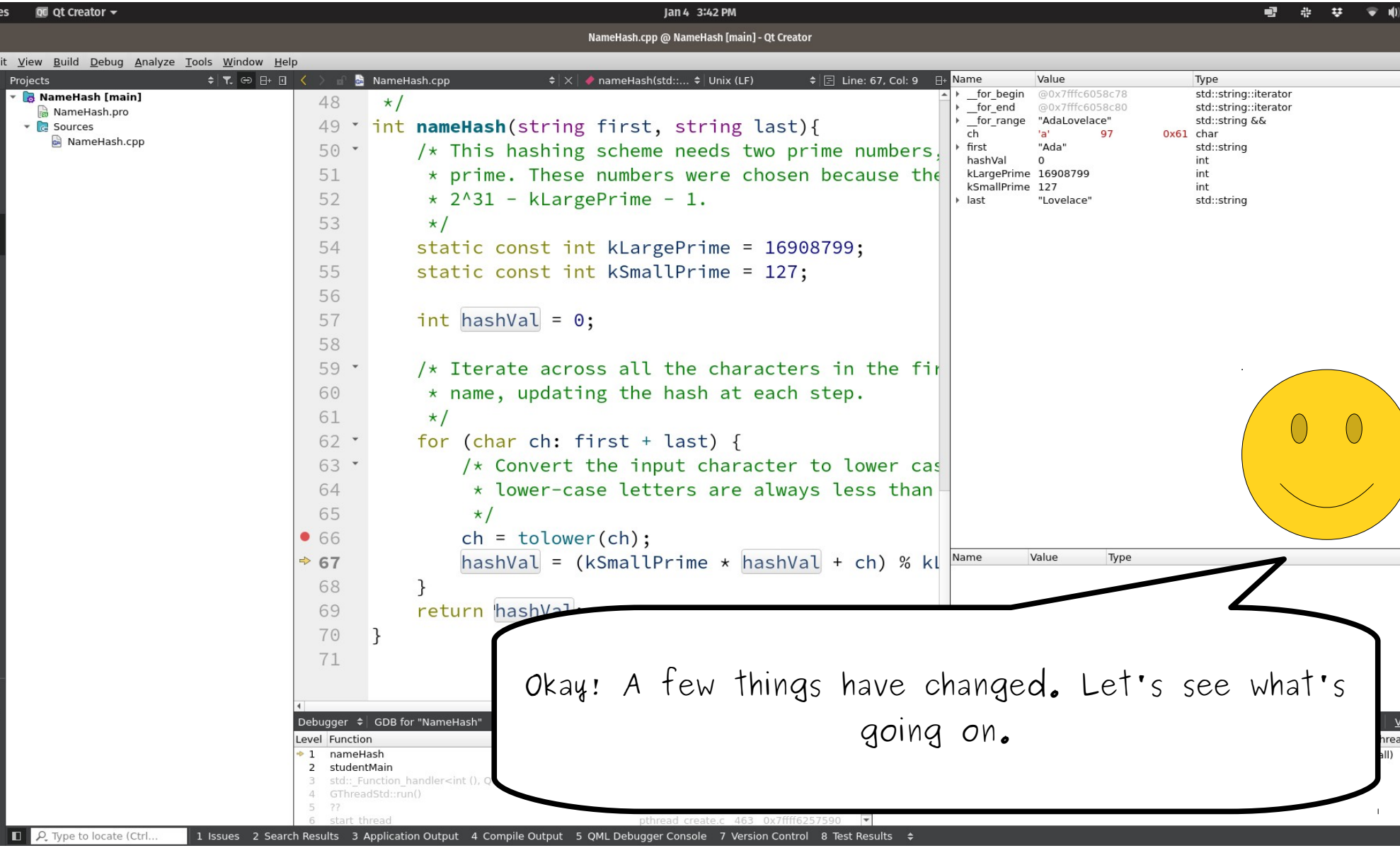
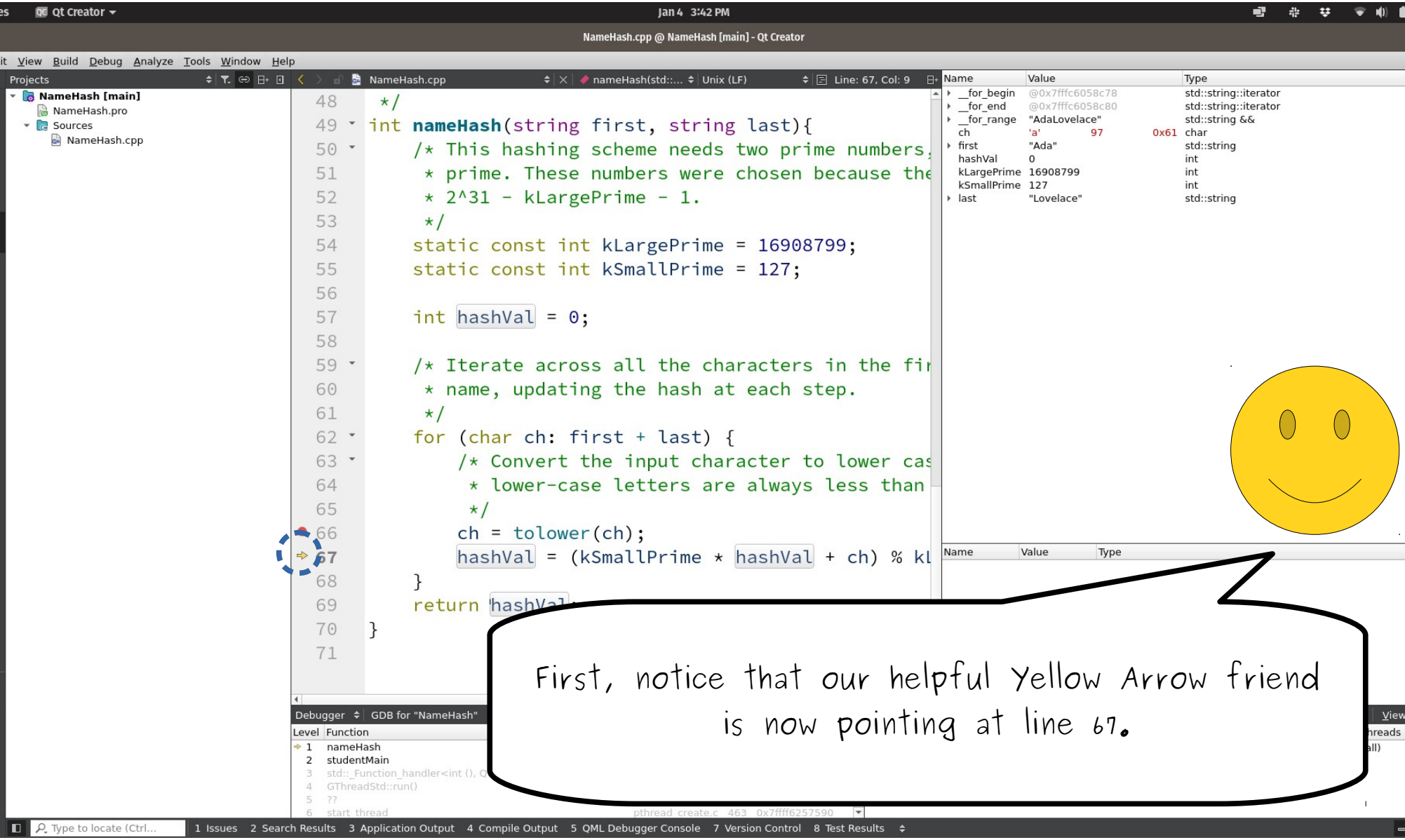
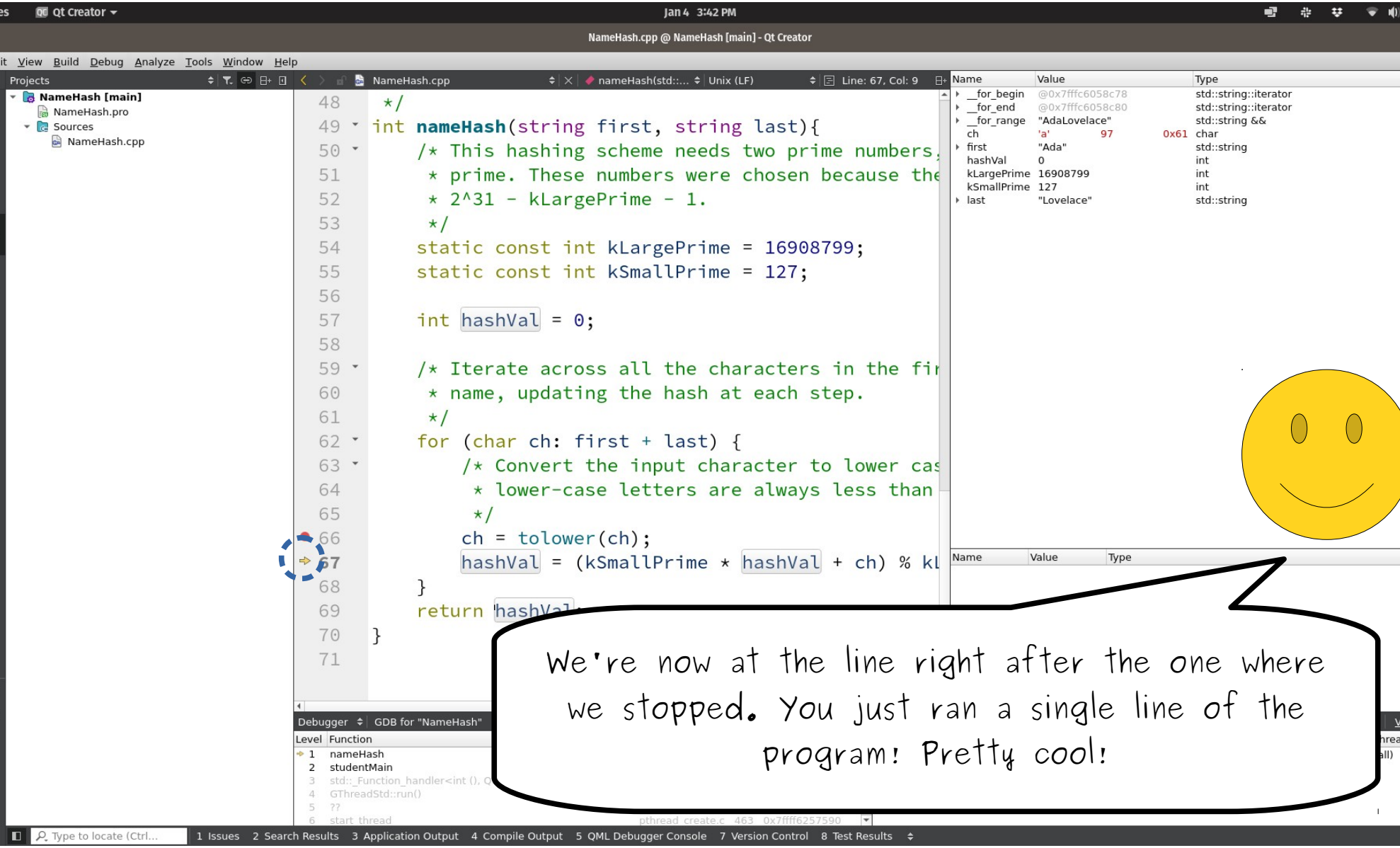
62 for (ch
63 /*
64 *
65 */
66 ch
67 has
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'A' 65 0x41 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Move your mouse so that you're hovering over the button that's third from the left. If you hover over it, it should say "step over."
Debugger GDB for "NameHash"
Threads: #12 NameHash
Stopped at breakpoint 1 in thread 12.
Views
Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results

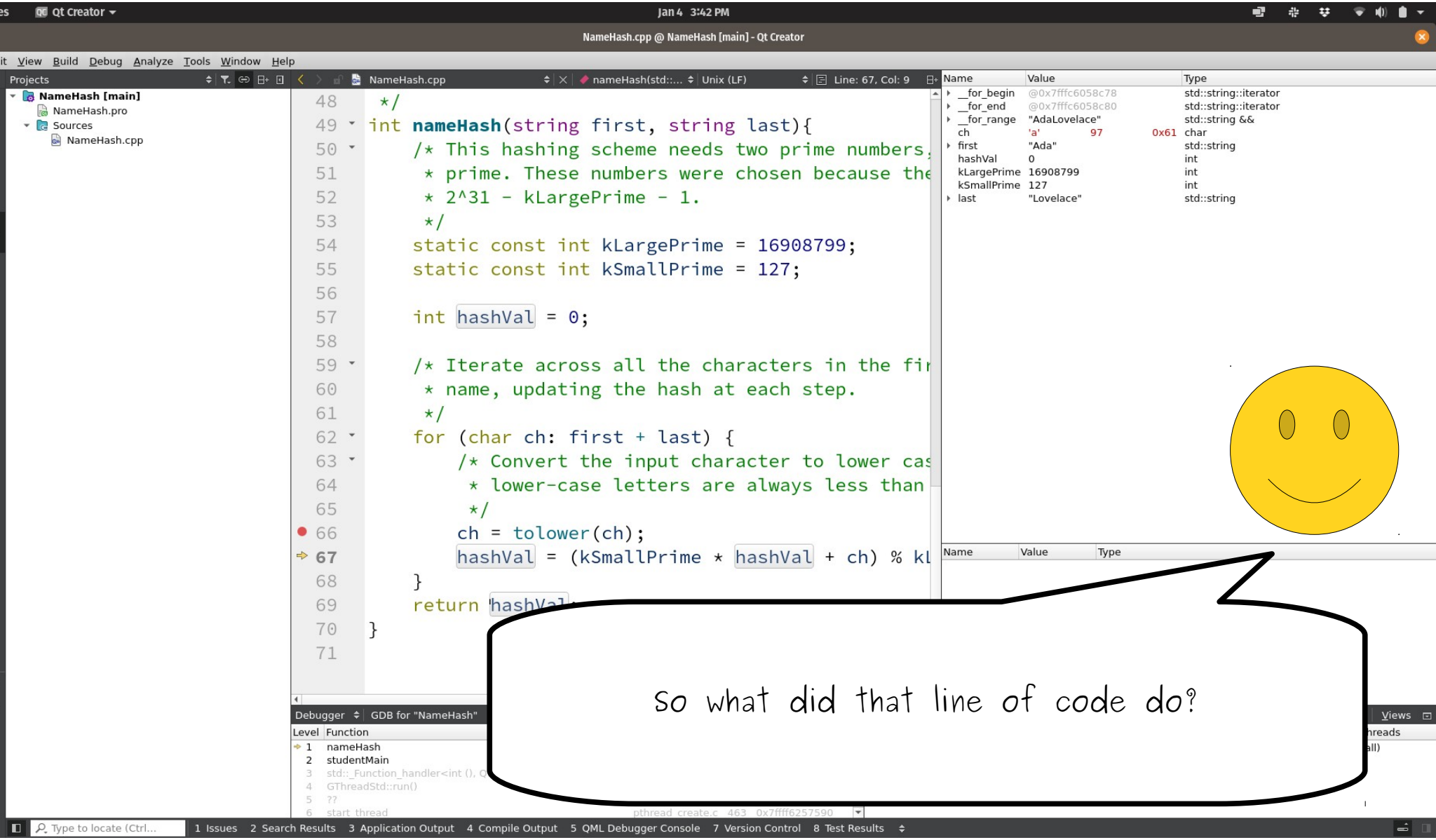

Activities
Qt Creator
Jan 4 3:30 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 66, Col: 9
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int hashVal = 0;
58
59 /* Iterate across all the characters in the fir
60 * name, updating the hash at each step.
61 */
62 for (ch
63 /*
64 *
65 */
66 ch
67 has
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'A' 65 0x41 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Once you're confident that you're on the "Step Over" button - and not the "Step Into" or "Step Out" buttons - go and click it! When you do...
Debugger GDB for "NameHash"
Threads: #12 NameHash
Stopped at breakpoint 1 in thread 12.
Views
Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBa...Eve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Activities
Qt Creator
Jan 4 3:42 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 67, Col: 9
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int hashVal = 0;
58
59 /* Iterate across all the characters in the fir
60 * name, updating the hash at each step.
61 */
62 for (char ch: first + last) {
63 /* Convert the input character to lower cas
64 * lower-case letters are always less than
65 */
66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % kL
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'a' 97 0x61 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Name Value Type
Debugger GDB for "NameHash"
Level Function
1 nameHash
2 studentMain
3 std::_Function_handler<int (), G
4 GThreadStd::run()
5 ??
6 start_thread
pthread_create.c 463 0x7ffff6257590
Views
NameHash
Debug
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results
...your window should look something like this.


Activities
Qt Creator
Jan 4 3:42 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 67, Col: 9
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int hashVal = 0;
58
59 /* Iterate across all the characters in the fir
60 * name, updating the hash at each step.
61 */
62 for (char ch: first + last) {
63 /* Convert the input character to lower cas
64 * lower-case letters are always less than
65 */
66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % kL
68 }
69 return hashVal
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'a' 97 0x61 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Name Value Type
Okay! A few things have changed. Let's see what's going on.
Debugger GDB for "NameHash"
Level Function
1 nameHash
2 studentMain
3 std::_Function_handler<int (), G
4 GThreadStd::run()
5 ??
6 start_thread
pthread_create.c 463 0x7ffff6257590
Views
NameHash
Debug
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Activities
Qt Creator
Jan 4 3:42 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 67, Col: 9
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int hashVal = 0;
58
59 /* Iterate across all the characters in the fir
60 * name, updating the hash at each step.
61 */
62 for (char ch: first + last) {
63 /* Convert the input character to lower cas
64 * lower-case letters are always less than
65 */
66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % kL
68 }
69 return hashVal
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'a' 97 0x61 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Name Value Type
Debugger GDB for "NameHash"
Level Function
1 nameHash
2 studentMain
3 std::_Function_handler<int (), G
4 GThreadStd::run()
5 ??
6 start_thread
pthread_create.c 463 0x7ffff6257590
Views
NameHash
Debug
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results
First, notice that our helpful Yellow Arrow friend is now pointing at line 67.


Activities
Qt Creator
Jan 4 3:42 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 67, Col: 9
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int hashVal = 0;
58
59 /* Iterate across all the characters in the fir
60 * name, updating the hash at each step.
61 */
62 for (char ch: first + last) {
63 /* Convert the input character to lower cas
64 * lower-case letters are always less than
65 */
66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % kL
68 }
69 return hashVal
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'a' 97 0x61 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Name Value Type
We're now at the line right after the one where we stopped. You just ran a single line of the program! Pretty cool!
NameHash
Debug
Debugger GDB for "NameHash"
Level Function
1 nameHash
2 studentMain
3 std::_Function_handler<int (), G
4 GThreadStd::run()
5 ??
6 start_thread
pthread_create.c 463 0x7ffff6257590
Views
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Activities
Qt Creator
Jan 4 3:42 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 67, Col: 9
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int hashVal = 0;
58
59 /* Iterate across all the characters in the fir
60 * name, updating the hash at each step.
61 */
62 for (char ch: first + last) {
63 /* Convert the input character to lower cas
64 * lower-case letters are always less than
65 */
66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % kL
68 }
69 return hashVal
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'a' 97 0x61 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Name Value Type
so what did that line of code do?
Debugger GDB for "NameHash"
Level Function
1 nameHash
2 studentMain
3 std::_Function_handler<int (), G
4 GThreadStd::run()
5 ??
6 start_thread
pthread_create.c 463 0x7ffff6257590
Views
NameHash
Debug
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results

Activities Qt Creator Jan 4 3:42 PM

NameHash.cpp @ NameHash [main] - Qt Creator

File Edit View Build Debug Analyze Tools Window Help

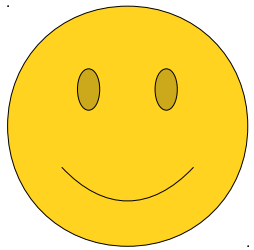
Projects

- NameHash [main]
  - NameHash.pro
  - Sources
    - NameHash.cpp

NameHash.cpp | nameHash(std::... | Unix (LF) | Line: 67, Col: 9

```
48  */
49  int nameHash(string first, string last){
50      /* This hashing scheme needs two prime numbers,
51       * prime. These numbers were chosen because the
52       * 2^31 - kLargePrime - 1.
53       */
54      static const int kLargePrime = 16908799;
55      static const int kSmallPrime = 127;
56
57      int hashVal = 0;
58
59      /* Iterate across all the characters in the fir
60       * name, updating the hash at each step.
61       */
62      for (char ch: first + last) {
63          /* Convert the input character to lower cas
64           * lower-case letters are always less than
65           */
66          ch = tolower(ch);
67          hashVal = (kSmallPrime * hashVal + ch) % kL
68      }
69      return hashVal
70  }
71
```

Name	Value	Type
__for_begin	@0x7fffc6058c78	std::string::iterator
__for_end	@0x7fffc6058c80	std::string::iterator
__for_range	"AdaLovelace"	std::string &&
ch	'a' 97 0x61	char
first	"Ada"	std::string
hashVal	0	int
kLargePrime	16908799	int
kSmallPrime	127	int
last	"Lovelace"	std::string



Name	Value	Type

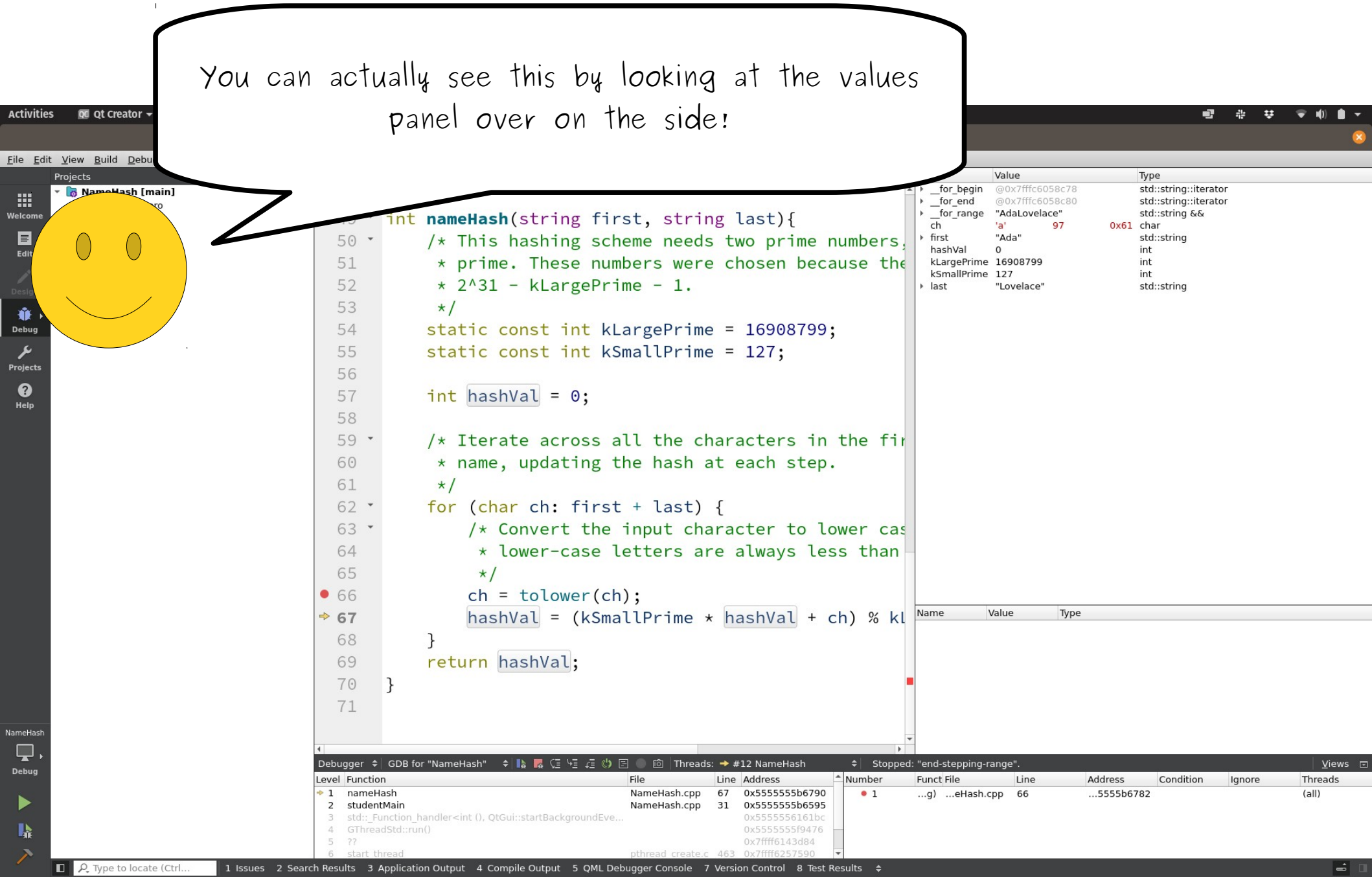
Debugger | GDB for "NameHash"

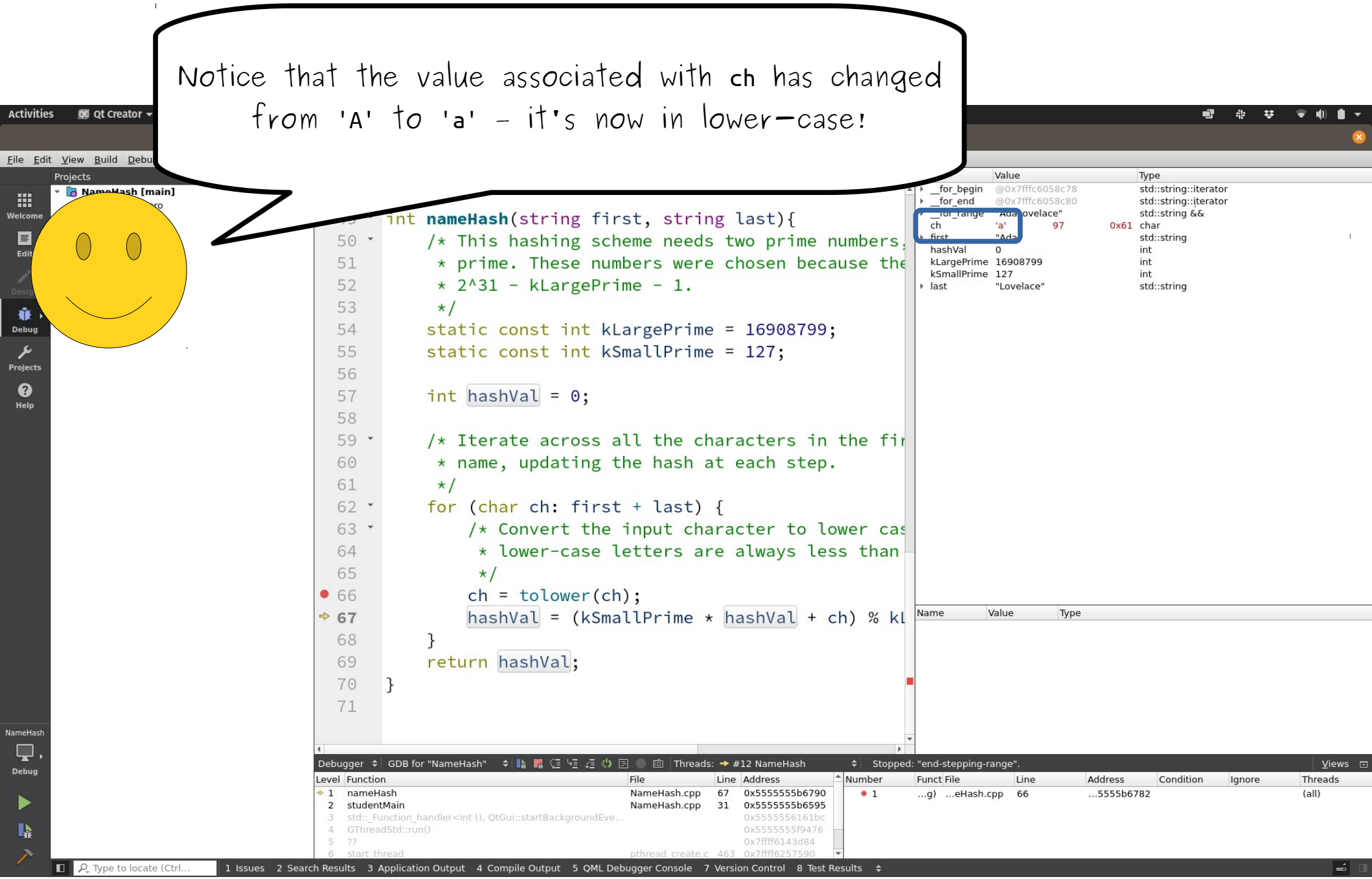
Level	Function
1	nameHash
2	studentMain
3	std::_Function_handler<int (), G
4	GThreadStd::run()
5	??
6	start_thread

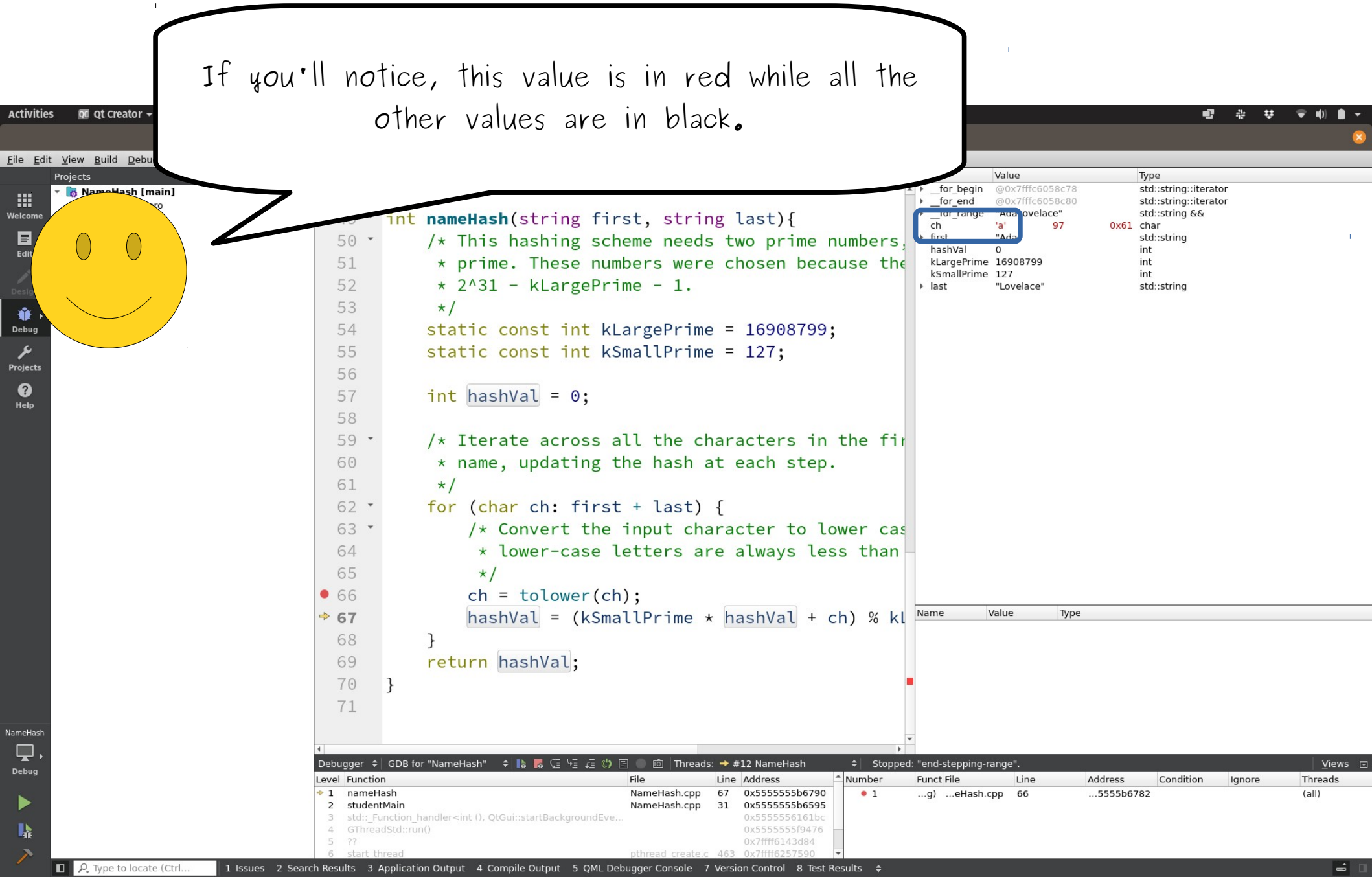
pthread_create.c 463 0x7ffff6257590

This line converts ch to lower case. The tolower function takes in a character and returns a lower-case version of it, so this overwrites ch with a lower-case version of itself.

Type to locate (Ctrl... 1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


You can actually see this by looking at the values panel over on the side!
Activities
Qt Creator
File Edit View Build Debu
Projects
NameHash [main]
Welcome
Edit
Debug
Projects
Help
NameHash
Debug
int nameHash(string first, string last){
/* This hashing scheme needs two prime numbers,
* prime. These numbers were chosen because the
* 2^31 - kLargePrime - 1.
*/
static const int kLargePrime = 16908799;
static const int kSmallPrime = 127;
int hashVal = 0;
/* Iterate across all the characters in the fir
* name, updating the hash at each step.
*/
for (char ch: first + last) {
/* Convert the input character to lower cas
* lower-case letters are always less than
*/
ch = tolower(ch);
hashVal = (kSmallPrime * hashVal + ch) % kL
}
return hashVal;
}
Value
Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'a' 97 0x61 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Name
Value
Type
Debugger
GDB for "NameHash"
Threads: #12 NameHash
Stopped: "end-stepping-range".
Views
Level Function File Line Address
1 nameHash NameHash.cpp 67 0x5555555b6790
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
1 Issues
2 Search Results
3 Application Output
4 Compile Output
5 QML Debugger Console
7 Version Control
8 Test Results


Notice that the value associated with ch has changed from 'A' to 'a' - it's now in lower-case!
Activities
Qt Creator
File Edit View Build Debu
Projects
NameHash [main]
Welcome
Edit
Debug
Projects
Help
NameHash
Debug
int nameHash(string first, string last){
/* This hashing scheme needs two prime numbers,
* prime. These numbers were chosen because the
* 2^31 - kLargePrime - 1.
*/
static const int kLargePrime = 16908799;
static const int kSmallPrime = 127;
int hashVal = 0;
/* Iterate across all the characters in the fir
* name, updating the hash at each step.
*/
for (char ch: first + last) {
/* Convert the input character to lower cas
* lower-case letters are always less than
*/
ch = tolower(ch);
hashVal = (kSmallPrime * hashVal + ch) % kL
}
return hashVal;
}
Value
Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "Ada Lovelace" std::string &&
ch 'a' 97 0x61 char
first "Ada std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Name
Value
Type
Debugger
GDB for "NameHash"
Threads: #12 NameHash
Stopped: "end-stepping-range".
Views
Level Function File Line Address
1 nameHash NameHash.cpp 67 0x5555555b6790
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
1 Issues
2 Search Results
3 Application Output
4 Compile Output
5 QML Debugger Console
7 Version Control
8 Test Results


If you'll notice, this value is in red while all the other values are in black.
Activities
Qt Creator
File Edit View Build Debu
Projects
NameHash [main]
Welcome
Edit
Debug
Projects
Help
NameHash
Debug
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* prime. These numbers were chosen because the
* 2^31 - kLargePrime - 1.
*/
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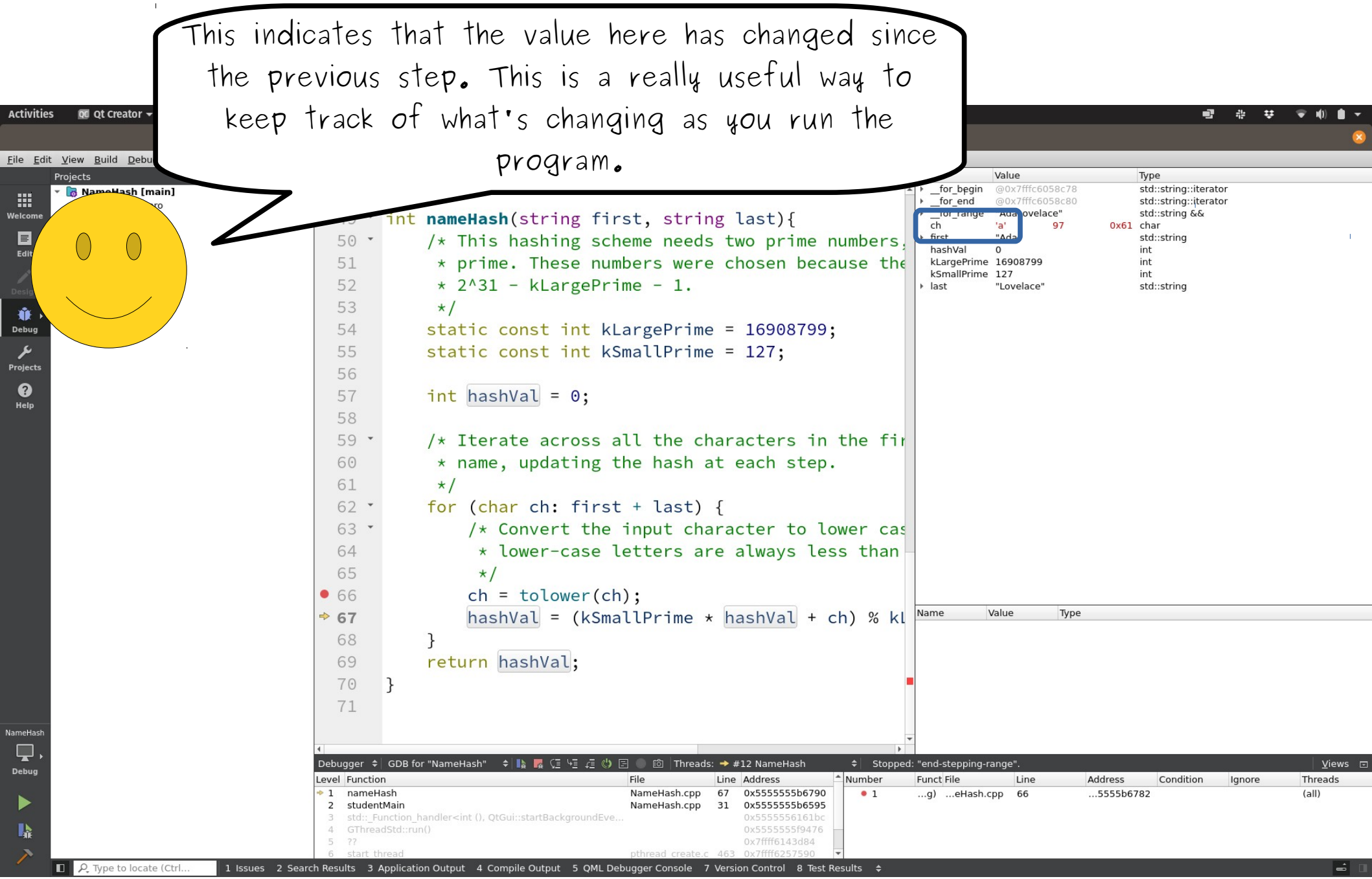
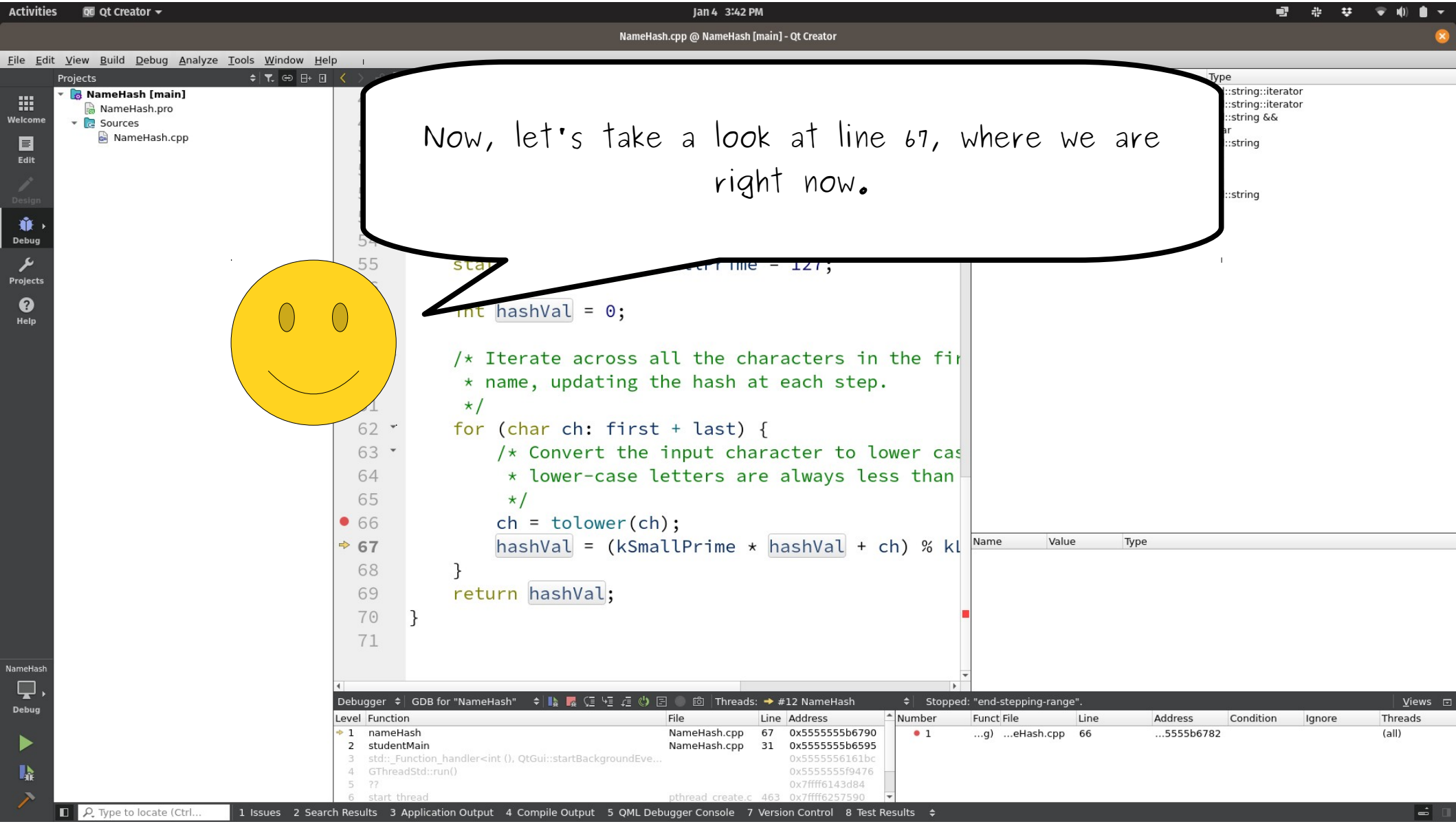
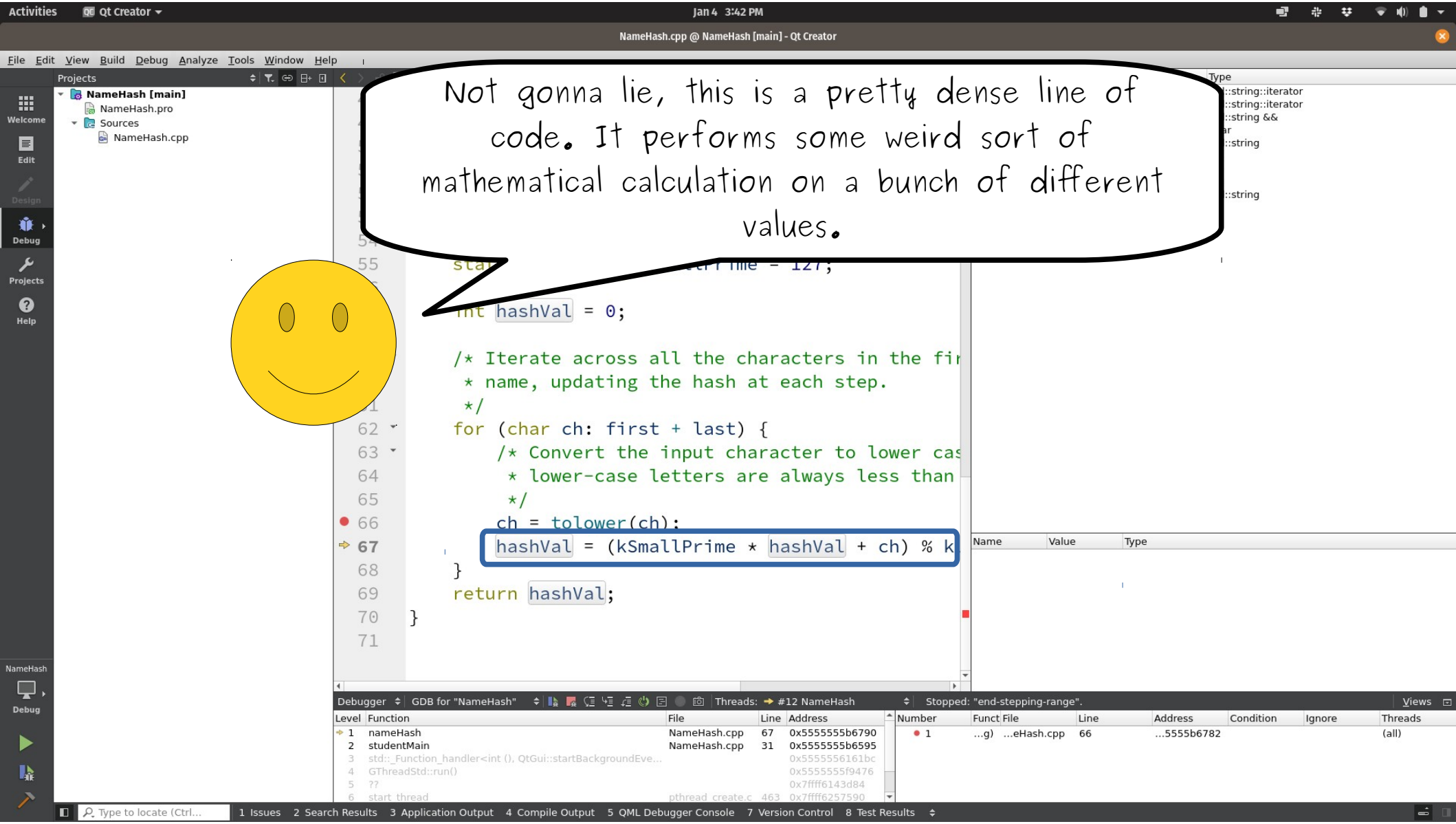
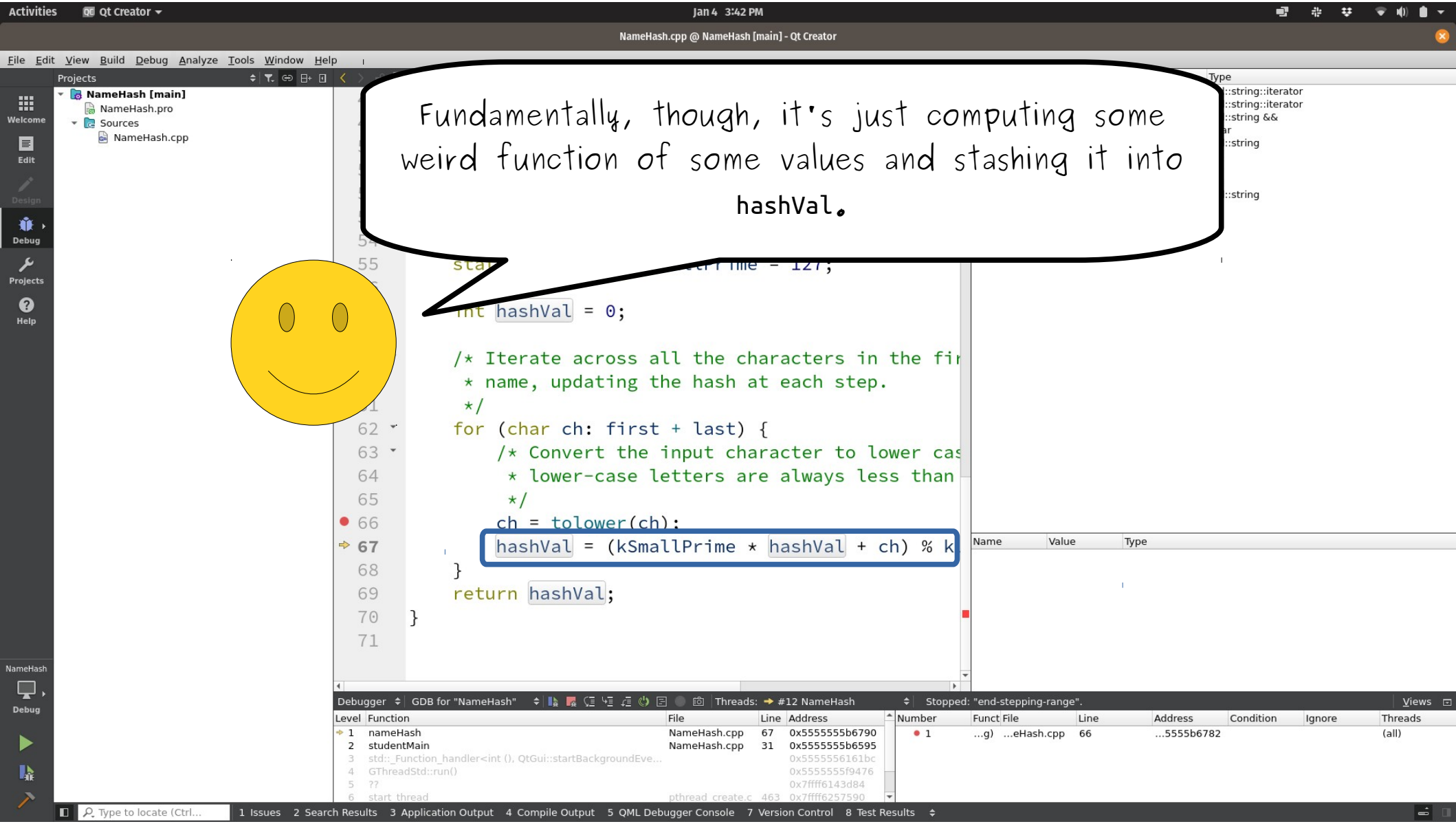
static const int kSmallPrime = 127;
int hashVal = 0;
/* Iterate across all the characters in the fir
* name, updating the hash at each step.
*/
for (char ch: first + last) {
/* Convert the input character to lower cas
* lower-case letters are always less than
*/
ch = tolower(ch);
hashVal = (kSmallPrime * hashVal + ch) % kL
}
return hashVal;
}
Value
Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "Ada Lovelace" std::string &&
ch 'a' 97 0x61 char
first "Ada std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Name
Value
Type
Debugger
GDB for "NameHash"
Threads: #12 NameHash
Stopped: "end-stepping-range".
Views
Level Function File Line Address
1 nameHash NameHash.cpp 67 0x5555555b6790
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
1 Issues
2 Search Results
3 Application Output
4 Compile Output
5 QML Debugger Console
7 Version Control
8 Test Results

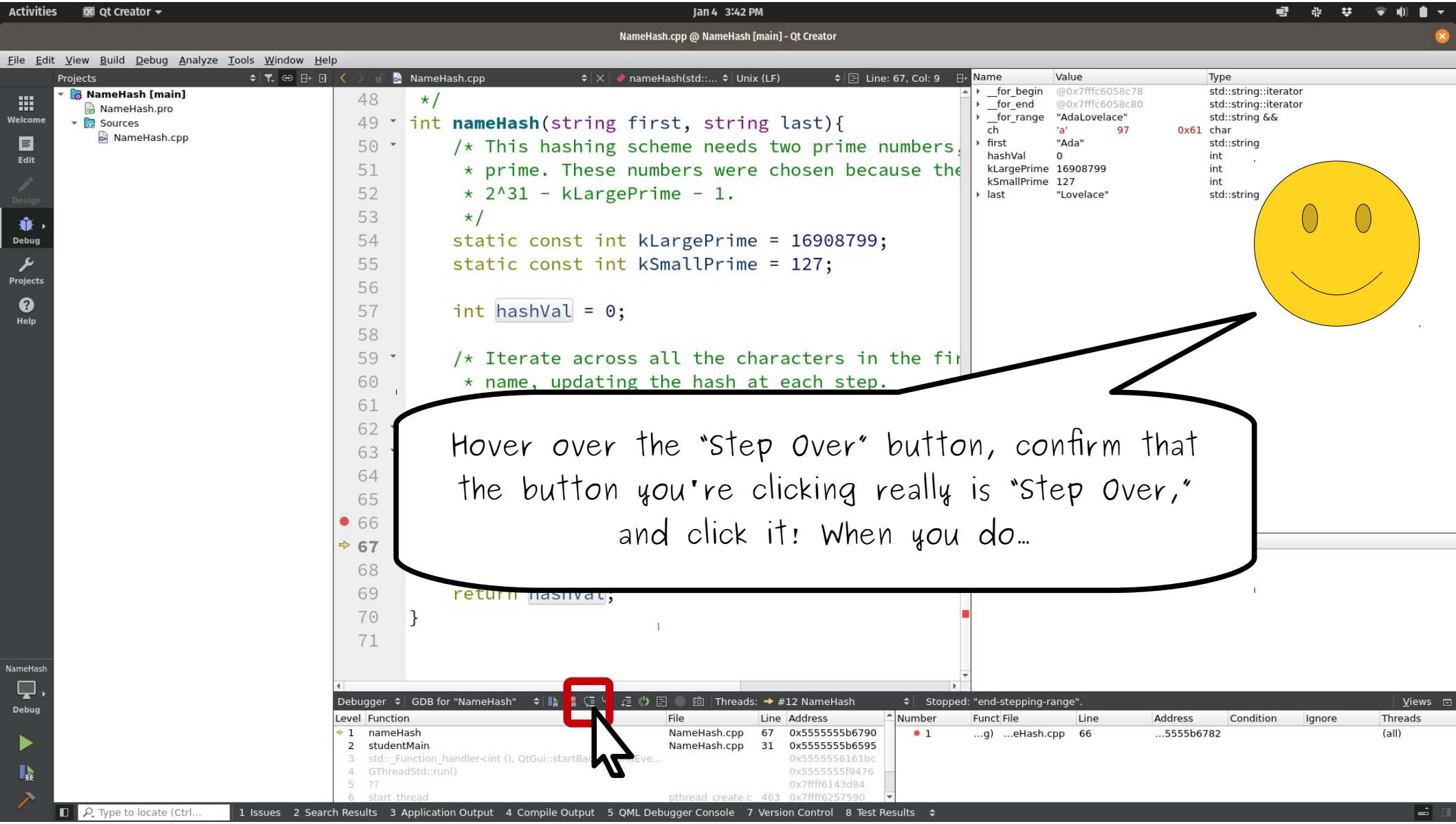

This indicates that the value here has changed since the previous step. This is a really useful way to keep track of what's changing as you run the program.
Activities
Qt Creator
File Edit View Build Debu
Projects
NameHash [main]
Welcome
Edit
Debug
Projects
Help
NameHash
Debug
int nameHash(string first, string last){
/* This hashing scheme needs two prime numbers,
* prime. These numbers were chosen because the
* 2^31 - kLargePrime - 1.
*/
static const int kLargePrime = 16908799;
static const int kSmallPrime = 127;
int hashVal = 0;
/* Iterate across all the characters in the fir
* name, updating the hash at each step.
*/
for (char ch: first + last) {
/* Convert the input character to lower cas
* lower-case letters are always less than
*/
ch = tolower(ch);
hashVal = (kSmallPrime * hashVal + ch) % kL
}
return hashVal;
}
Value
Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "Ada Lovelace" std::string &&
ch 'a' 97 0x61 char
first "Ada std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Name
Value
Type
Debugger
GDB for "NameHash"
Threads: #12 NameHash
Stopped: "end-stepping-range".
Views
Level Function File Line Address
1 nameHash NameHash.cpp 67 0x5555555b6790
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
1 Issues
2 Search Results
3 Application Output
4 Compile Output
5 QML Debugger Console
7 Version Control
8 Test Results

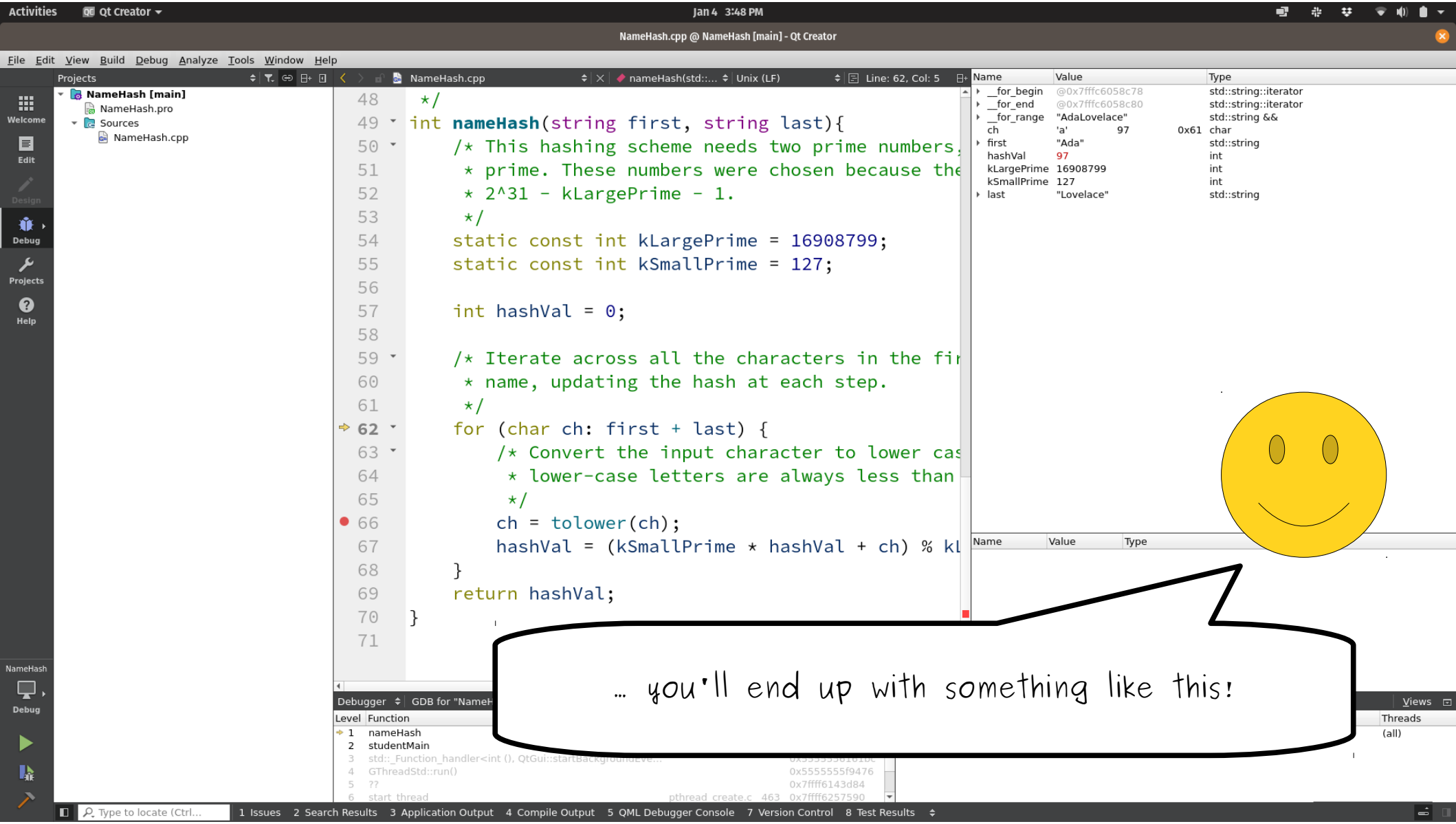

Activities
Qt Creator
Jan 4 3:42 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
Now, let's take a look at line 67, where we are right now.
55 int hashVal = 0;
/* Iterate across all the characters in the fi
* name, updating the hash at each step.
*/
62 for (char ch: first + last) {
63 /* Convert the input character to lower cas
* lower-case letters are always less than
*/
66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % kl
68 }
69 return hashVal;
70 }
71
Type
::string::iterator
::string::iterator
::string &&
::string
::string
Name Value Type
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped: "end-stepping-range". Views
Level Function File Line Address
1 nameHash NameHash.cpp 67 0x5555555b6790
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
NameHash
Debug
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results

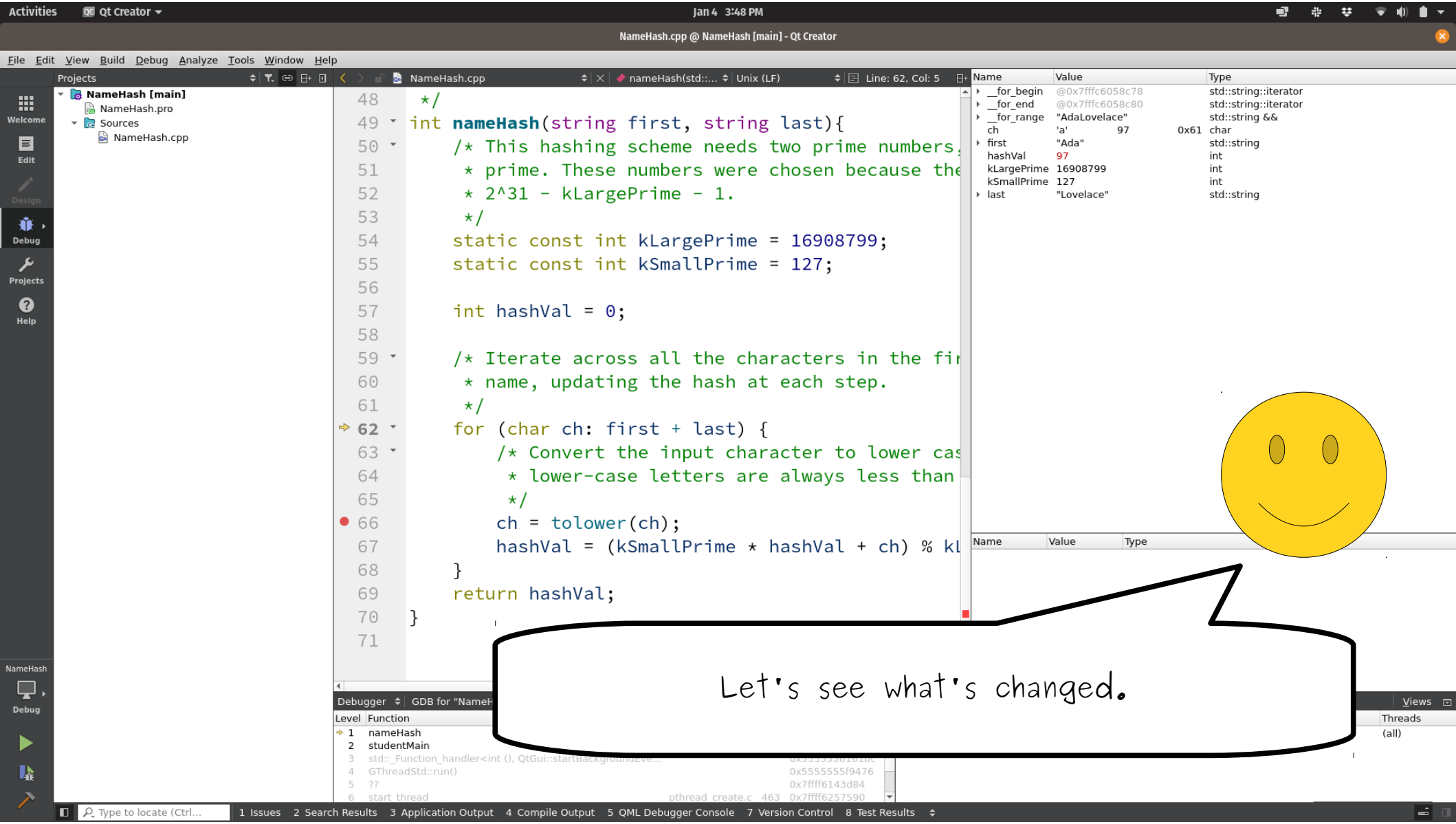

Not gonna lie, this is a pretty dense line of code. It performs some weird sort of mathematical calculation on a bunch of different values.
Activities
Qt Creator
Jan 4 3:42 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
int hashVal = 0;
/* Iterate across all the characters in the fi
* name, updating the hash at each step.
*/
for (char ch: first + last) {
/* Convert the input character to lower cas
* lower-case letters are always less than
*/
ch = tolower(ch);
hashVal = (kSmallPrime * hashVal + ch) % k
}
return hashVal;
}
Type
::string::iterator
::string::iterator
::string &&
::string
::string
Name Value Type
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped: "end-stepping-range". Views
Level Function File Line Address
1 nameHash NameHash.cpp 67 0x5555555b6790
2 studentMain NameHash.cpp 31 0x5555555b6595
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Activities
Qt Creator
Jan 4 3:42 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
Fundamentally, though, it's just computing some weird function of some values and stashing it into hashVal.
int hashVal = 0;
/* Iterate across all the characters in the fi
* name, updating the hash at each step.
*/
for (char ch: first + last) {
/* Convert the input character to lower cas
* lower-case letters are always less than
*/
ch = tolower(ch);
hashVal = (kSmallPrime * hashVal + ch) % k
}
return hashVal;
}
Name Value Type
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped: "end-stepping-range". Views
Level Function File Line Address
1 nameHash NameHash.cpp 67 0x5555555b6790
2 studentMain NameHash.cpp 31 0x5555555b6595
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Activities
Qt Creator
Jan 4 3:42 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
Let's go run that line of code and see what happens!
55 int hashVal = 0;
62 /* Iterate across all the characters in the fi
63 * name, updating the hash at each step.
64 */
65 for (char ch: first + last) {
66 /* Convert the input character to lower cas
67 * lower-case letters are always less than
68 */
69 ch = tolower(ch);
70 hashVal = (kSmallPrime * hashVal + ch) % k
71 }
72 return hashVal;
73 }
Type
::string::iterator
::string::iterator
::string &&
::string
::string
Name Value Type
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped: "end-stepping-range". Views
Level Function File Line Address
1 nameHash NameHash.cpp 67 0x5555555b6790
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
NameHash
Debug
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Activities
Qt Creator
Jan 4 3:42 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 67, Col: 9
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int hashVal = 0;
58
59 /* Iterate across all the characters in the fir
60 * name, updating the hash at each step.
61
62
63
64
65
66
67
68
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'a' 97 0x61 char
first "Ada" std::string
hashVal 0 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Hover over the "Step Over" button, confirm that the button you're clicking really is "Step Over," and click it! When you do...
Debugger GDB for "NameHash"
Threads: #12 NameHash
Stopped: "end-stepping-range".
Views
Level Function File Line Address
1 nameHash NameHash.cpp 67 0x5555555b6790
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBa...nEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
NameHash
Debug
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Activities
Qt Creator
Jan 4 3:48 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 62, Col: 5
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int hashVal = 0;
58
59 /* Iterate across all the characters in the fir
60 * name, updating the hash at each step.
61 */
62 for (char ch: first + last) {
63 /* Convert the input character to lower cas
64 * lower-case letters are always less than
65 */
66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % kL
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'a' 97 0x61 char
first "Ada" std::string
hashVal 97 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Name Value Type
Debugger GDB for "NameH
Level Function
1 nameHash
2 studentMain
3 std::_Function_handler<int (), QtGui::startBackgroundEve...
4 GThreadStd::run()
5 ??
6 start_thread pthread_create.c 463
0x5555555f9476
0x7ffff6143d84
0x7ffff6257590
Views
Threads
(all)
... you'll end up with something like this!
Type to locate (Ctrl...
1 Issues
2 Search Results
3 Application Output
4 Compile Output
5 QML Debugger Console
7 Version Control
8 Test Results


Activities
Qt Creator
Jan 4 3:48 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 62, Col: 5
48 */
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50 /* This hashing scheme needs two prime numbers,
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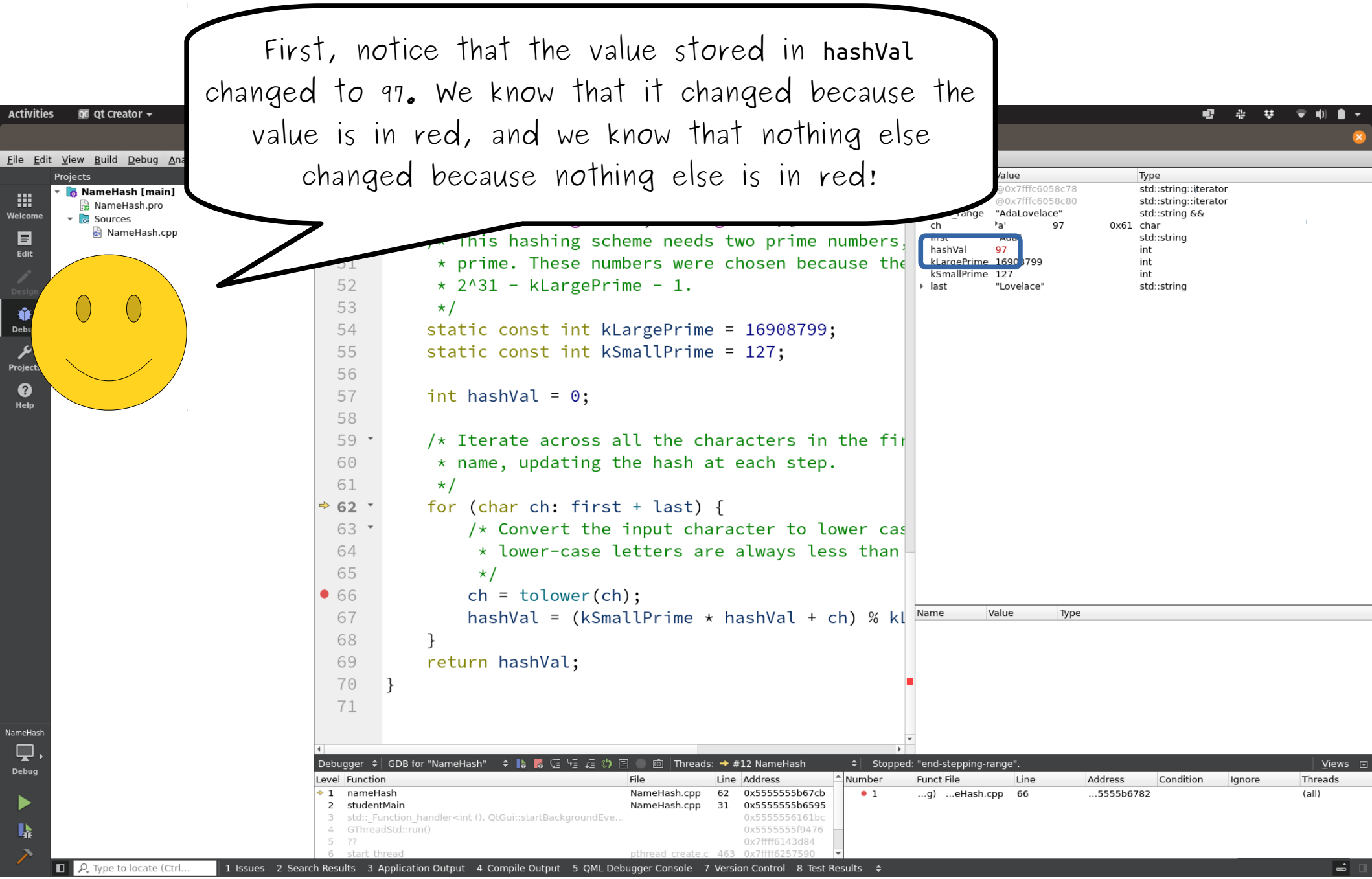
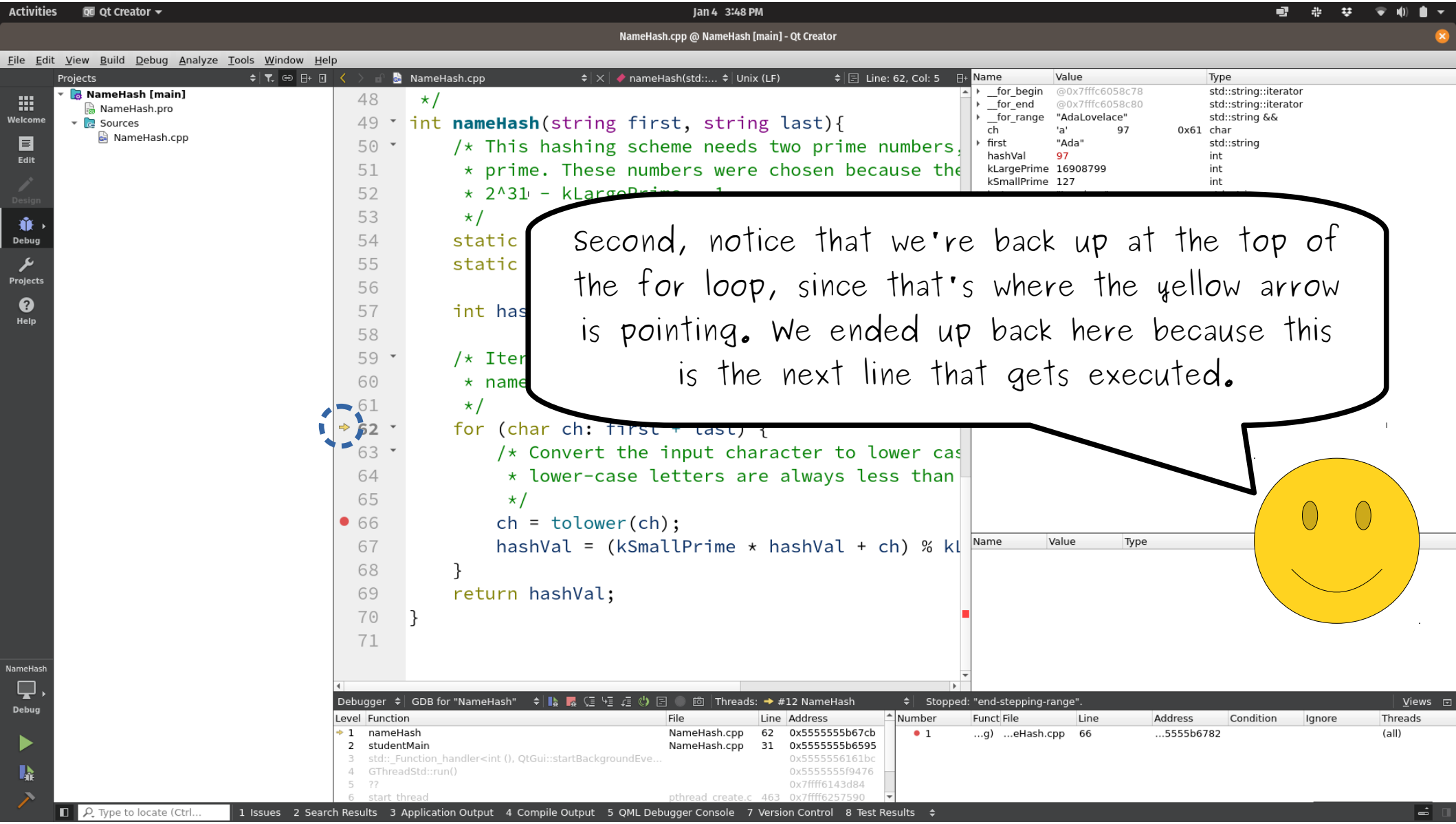
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int hashVal = 0;
58
59 /* Iterate across all the characters in the fir
60 * name, updating the hash at each step.
61 */
62 for (char ch: first + last) {
63 /* Convert the input character to lower cas
64 * lower-case letters are always less than
65 */
66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % kL
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'a' 97 0x61 char
first "Ada" std::string
hashVal 97 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Name Value Type
Let's see what's changed.
Debugger GDB for "NameH
Level Function
1 nameHash
2 studentMain
3 std::_Function_handler<int (), QtGui::startBackgroundEve...
4 GThreadStd::run()
5 ??
6 start_thread pthread_create.c 463
0x5555555f9476
0x7ffff6143d84
0x7ffff6257590
Views
Threads
(all)
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


First, notice that the value stored in hashVal changed to 97. We know that it changed because the value is in red, and we know that nothing else changed because nothing else is in red!
Activities
Qt Creator
File Edit View Build Debug
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Debug
Projects
Help
NameHash
Debug
/* This hashing scheme needs two prime numbers,
* prime. These numbers were chosen because the
* 2^31 - kLargePrime - 1.
*/
static const int kLargePrime = 16908799;
static const int kSmallPrime = 127;
int hashVal = 0;
/* Iterate across all the characters in the fir
* name, updating the hash at each step.
*/
for (char ch: first + last) {
/* Convert the input character to lower cas
* lower-case letters are always less than
*/
ch = tolower(ch);
hashVal = (kSmallPrime * hashVal + ch) % kL
}
return hashVal;
}
Value Type
@0x7fffc6058c78 std::string::iterator
@0x7fffc6058c80 std::string::iterator
"AdaLovelace" std::string &&
ch 'a' 97 0x61 char
std::string
hashVal 97 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Name Value Type
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped: "end-stepping-range". Views
Level Function File Line Address
1 nameHash NameHash.cpp 62 0x5555555b67cb
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Activities
Qt Creator
Jan 4 3:48 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 62, Col: 5
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1
53 */
54 static
55 static
56
57 int has
58
59 /* Iter
60 * name
61 */
62 for (char ch: first + last) {
63 /* Convert the input character to lower cas
64 * lower-case letters are always less than
65 */
66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % kL
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'a' 97 0x61 char
first "Ada" std::string
hashVal 97 int
kLargePrime 16908799 int
kSmallPrime 127 int
Second, notice that we're back up at the top of the for loop, since that's where the yellow arrow is pointing. We ended up back here because this is the next line that gets executed.
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped: "end-stepping-range". Views
Level Function File Line Address
1 nameHash NameHash.cpp 62 0x5555555b67cb
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results

Activities Qt Creator Jan 4 3:48 PM

NameHash.cpp @ NameHash [main] - Qt Creator

File Edit View Build Debug Analyze Tools Window Help

Projects

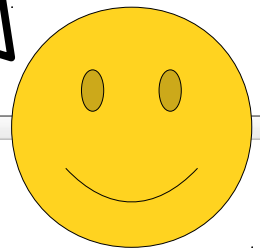
- NameHash [main]
  - NameHash.pro
  - Sources
    - NameHash.cpp

NameHash.cpp | nameHash(std::... | Unix (LF) | Line: 62, Col: 5

```
48   */
49  int nameHash(string first, string last){
50      /* This hashing scheme needs two prime numbers,
51       * prime. These numbers were chosen because the
52       * 2^31 - kLargePrime - 1.
53       */
54      static const int kLargePrime = 16908799;
55      static const int kSmallPrime = 127;
56
57      int has
58
59      /* Iter
60       * name
61       */
62      for (char ch: first + last) {
63          /* Convert the input character to lower cas
64           * lower-case letters are always less than
65           */
66          ch = tolower(ch);
67          hashVal = (kSmallPrime * hashVal + ch) % kL
68      }
69      return hashVal;
70  }
71
```

Name	Value	Type
__for_begin	@0x7fffc6058c78	std::string::iterator
__for_end	@0x7fffc6058c80	std::string::iterator
__for_range	"AdaLovelace"	std::string &&
ch	'a' 97 0x61	char
first	"Ada"	std::string
hashVal	97	int
kLargePrime	16908799	int
kSmallPrime	127	int
last	"Lovelace"	std::string

We just single-stepped through a single iteration of that loop! Pretty cool!

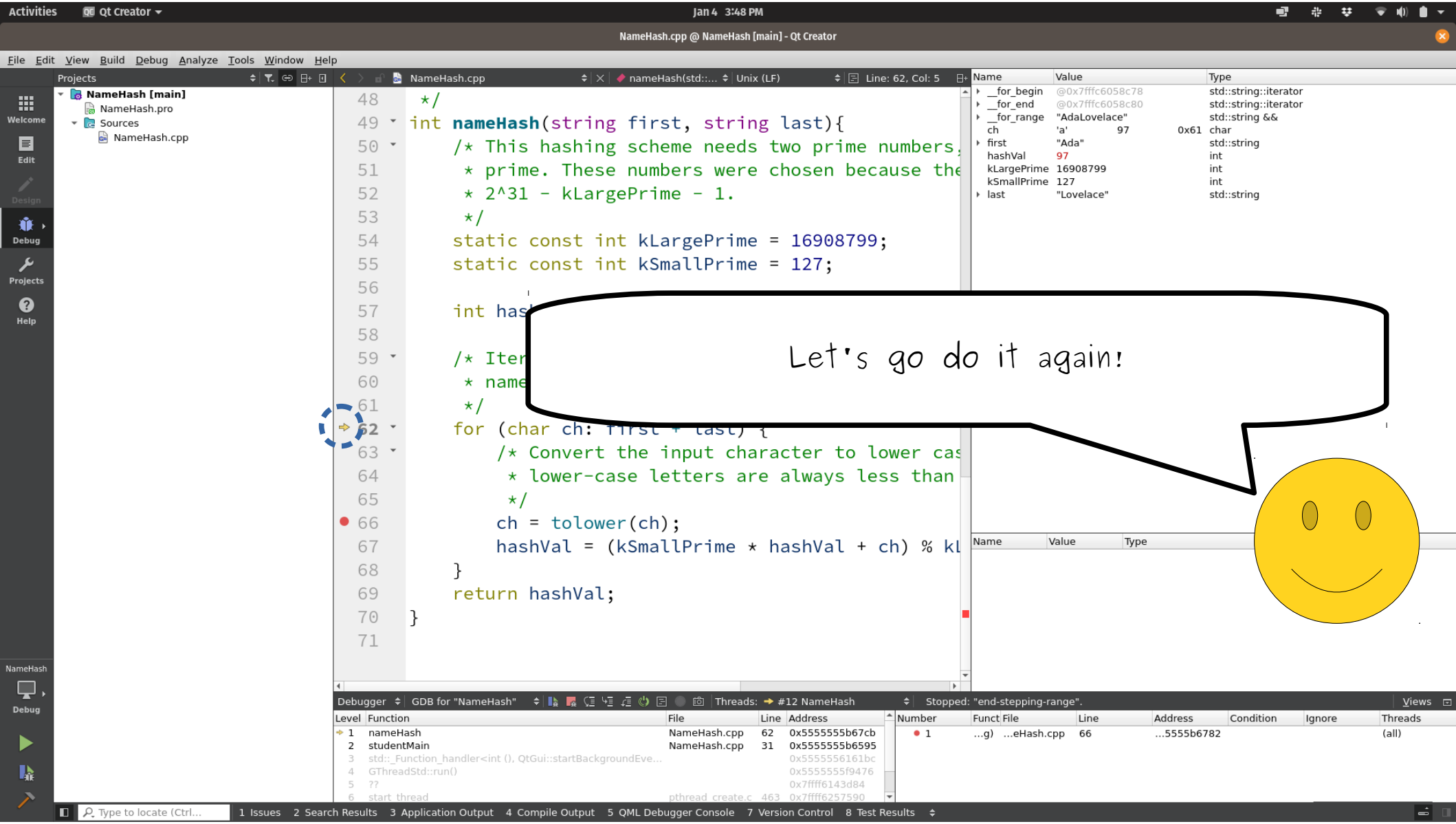


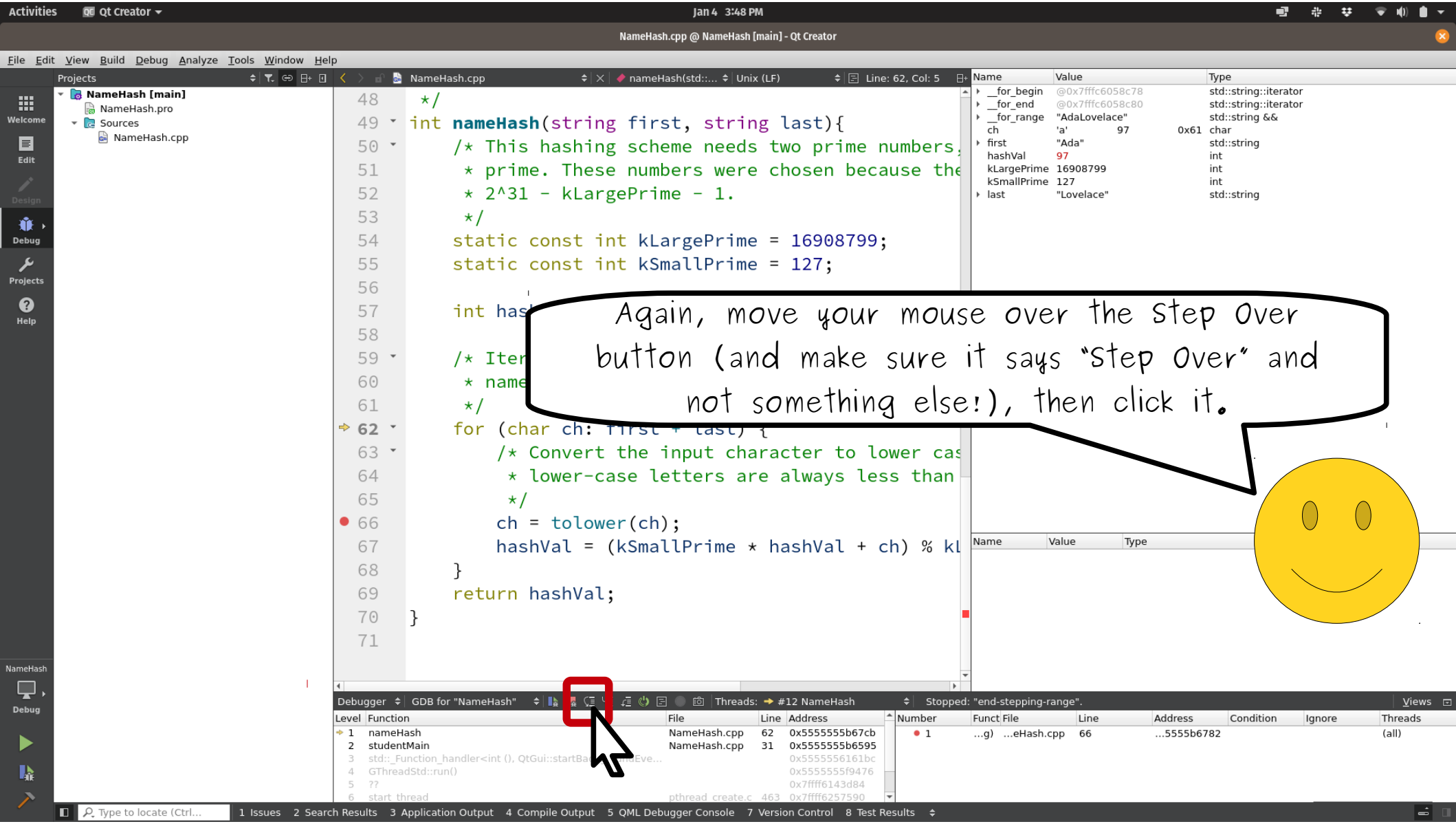
Debugger | GDB for "NameHash" | Threads: #12 NameHash | Stopped: "end-stepping-range". | Views

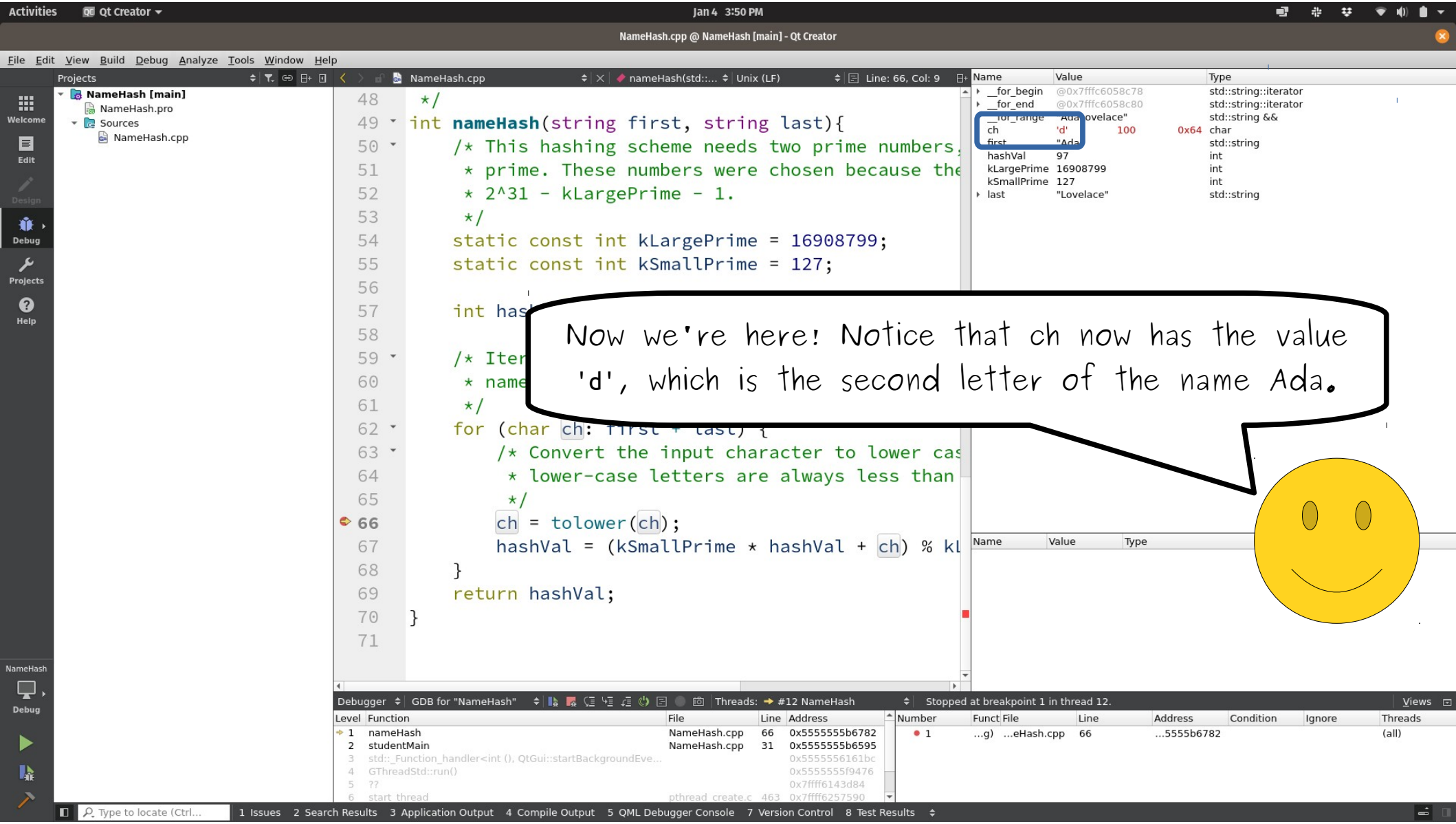
Level	Function	File	Line	Address
1	nameHash	NameHash.cpp	62	0x5555555b67cb
2	studentMain	NameHash.cpp	31	0x5555555b6595
3	std::_Function_handler<int (), QtGui::startBackgroundEve...			0x5555556161bc
4	GThreadStd::run()			0x5555555f9476
5	??			0x7ffff6143d84
6	start_thread	pthread_create.c	463	0x7ffff6257590

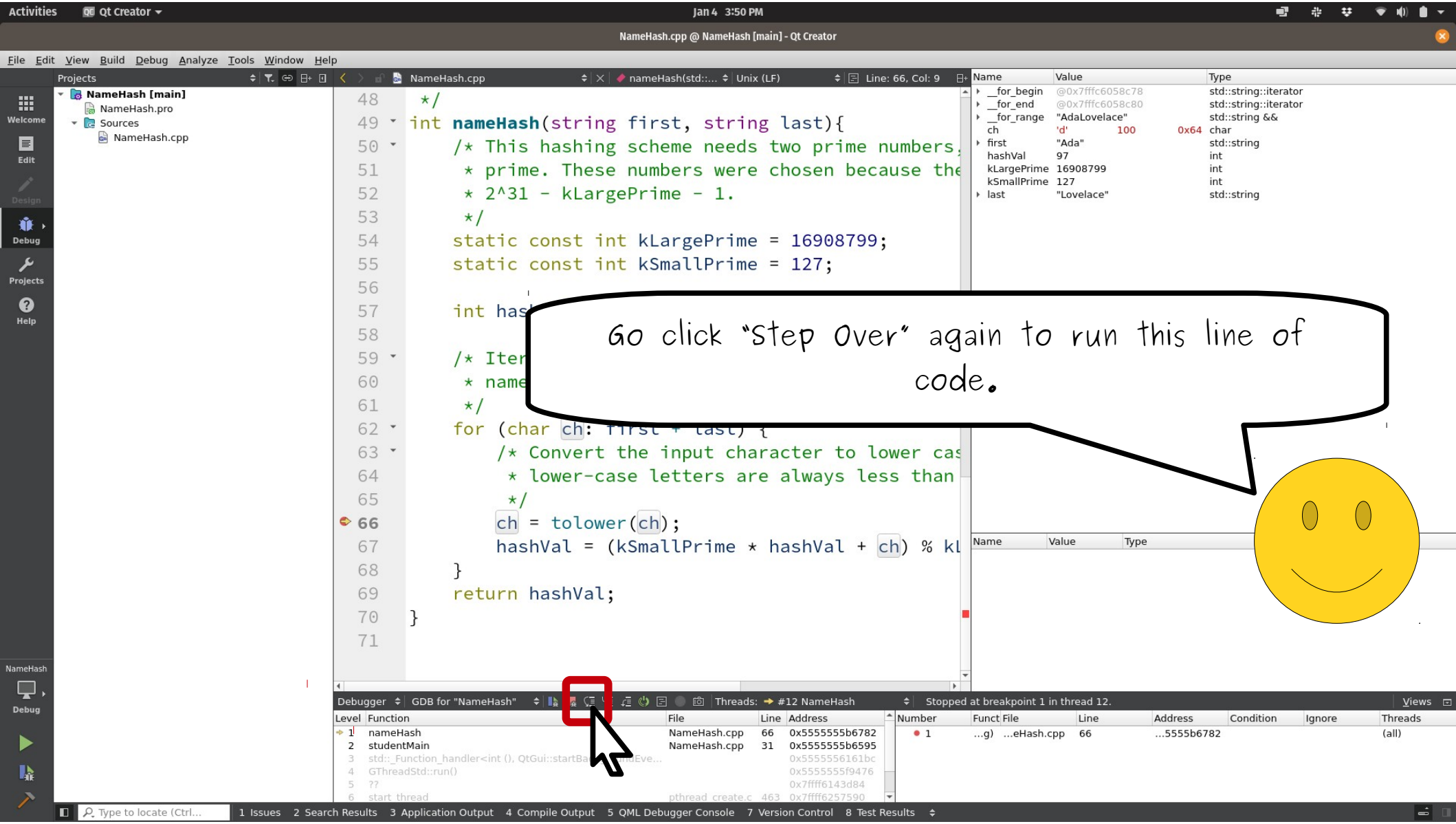
Number	Funct	File	Line	Address	Condition	Ignore	Threads
1	...g)	...eHash.cpp	66	...5555b6782			(all)

Type to locate (Ctrl... | 1 Issues | 2 Search Results | 3 Application Output | 4 Compile Output | 5 QML Debugger Console | 7 Version Control | 8 Test Results


Activities
Qt Creator
Jan 4 3:48 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 62, Col: 5
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int has
58
59 /* Iter
60 * name
61 */
62 for (char ch: first + last) {
63 /* Convert the input character to lower cas
64 * lower-case letters are always less than
65 */
66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % kL
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'a' 97 0x61 char
first "Ada" std::string
hashVal 97 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Let's go do it again!
Name Value Type
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped: "end-stepping-range". Views
Level Function File Line Address
1 nameHash NameHash.cpp 62 0x5555555b67cb
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Activities
Qt Creator
Jan 4 3:48 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 62, Col: 5
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int has
58
59 /* Iter
60 * name
61 */
62 for (char ch: first + last) {
63 /* Convert the input character to lower cas
64 * lower-case letters are always less than
65 */
66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % kL
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'a' 97 0x61 char
first "Ada" std::string
hashVal 97 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Again, move your mouse over the Step Over button (and make sure it says "Step Over" and not something else!), then click it.
Name Value Type
Debugger GDB for "NameHash"
Threads: #12 NameHash
Stopped: "end-stepping-range".
Views
Level Function File Line Address
1 nameHash NameHash.cpp 62 0x5555555b67cb
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBa...uEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Activities
Qt Creator
Jan 4 3:50 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 66, Col: 9
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int has
58
59 /* Iter
60 * name
61 */
62 for (char ch: first + last) {
63 /* Convert the input character to lower cas
64 * lower-case letters are always less than
65 */
66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % kL
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "Ada Lovelace" std::string &&
ch 'd' 100 0x64 char
first "Ada" std::string
hashVal 97 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Now we're here! Notice that ch now has the value 'd', which is the second letter of the name Ada.
Name Value Type
Debugger
GDB for "NameHash"
Threads: #12 NameHash
Stopped at breakpoint 1 in thread 12.
Views
Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
1 Issues
2 Search Results
3 Application Output
4 Compile Output
5 QML Debugger Console
7 Version Control
8 Test Results


Activities
Qt Creator
Jan 4 3:50 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
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NameHash [main]
NameHash.pro
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NameHash.cpp
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NameHash
Debug
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 66, Col: 9
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int has
58
59 /* Iter
60 * name
61 */
62 for (char ch: first + last) {
63 /* Convert the input character to lower cas
64 * lower-case letters are always less than
65 */
66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % kL
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'd' 100 0x64 char
first "Ada" std::string
hashVal 97 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Name Value Type
Go click "Step Over" again to run this line of code.
Debugger
GDB for "NameHash"
Threads: #12 NameHash
Stopped at breakpoint 1 in thread 12.
Views
Level Function File Line Address
1 nameHash NameHash.cpp 66 0x5555555b6782
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBa...nuEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
1 Issues
2 Search Results
3 Application Output
4 Compile Output
5 QML Debugger Console
7 Version Control
8 Test Results

Activities Qt Creator Jan 4 3:52 PM

NameHash.cpp @ NameHash [main] - Qt Creator

File Edit View Build Debug Analyze Tools Window Help

Projects

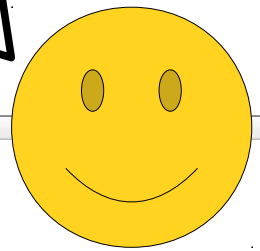
- NameHash [main]
  - NameHash.pro
  - Sources
    - NameHash.cpp

NameHash.cpp | nameHash(std::... | Unix (LF) | Line: 67, Col: 9

```
48   */
49  int nameHash(string first, string last){
50      /* This hashing scheme needs two prime numbers,
51       * prime. These numbers were chosen because the
52       * 2^31 - kLargePrime - 1.
53       */
54      static const int kLargePrime = 16908799;
55      static const
56
57      int has
58
59      /* Iter
60       * name
61       */
62      for (char ch: first + last) {
63          /* Convert the input character to lower cas
64           * lower-case letters are always less than
65           */
66          ch = tolower(ch);
67          hashVal = (kSmallPrime * hashVal + ch) % kL
68      }
69      return hashVal;
70  }
71
```

Name	Value			Type
__for_begin	@0x7fffc6058c78			std::string::iterator
__for_end	@0x7fffc6058c80			std::string::iterator
__for_range	"AdaLovelace"			std::string &&
ch	'd'	100	0x64	char
first	"Ada"			std::string
hashVal	97			int
kLargePrime	16908799			int
kSmallPrime	127			int
last	"Lovelace"			std::string

You should be here now. Notice that none of the values changed. That makes sense, since all we did was convert a lower-case 'd' to a lower-case 'd'.



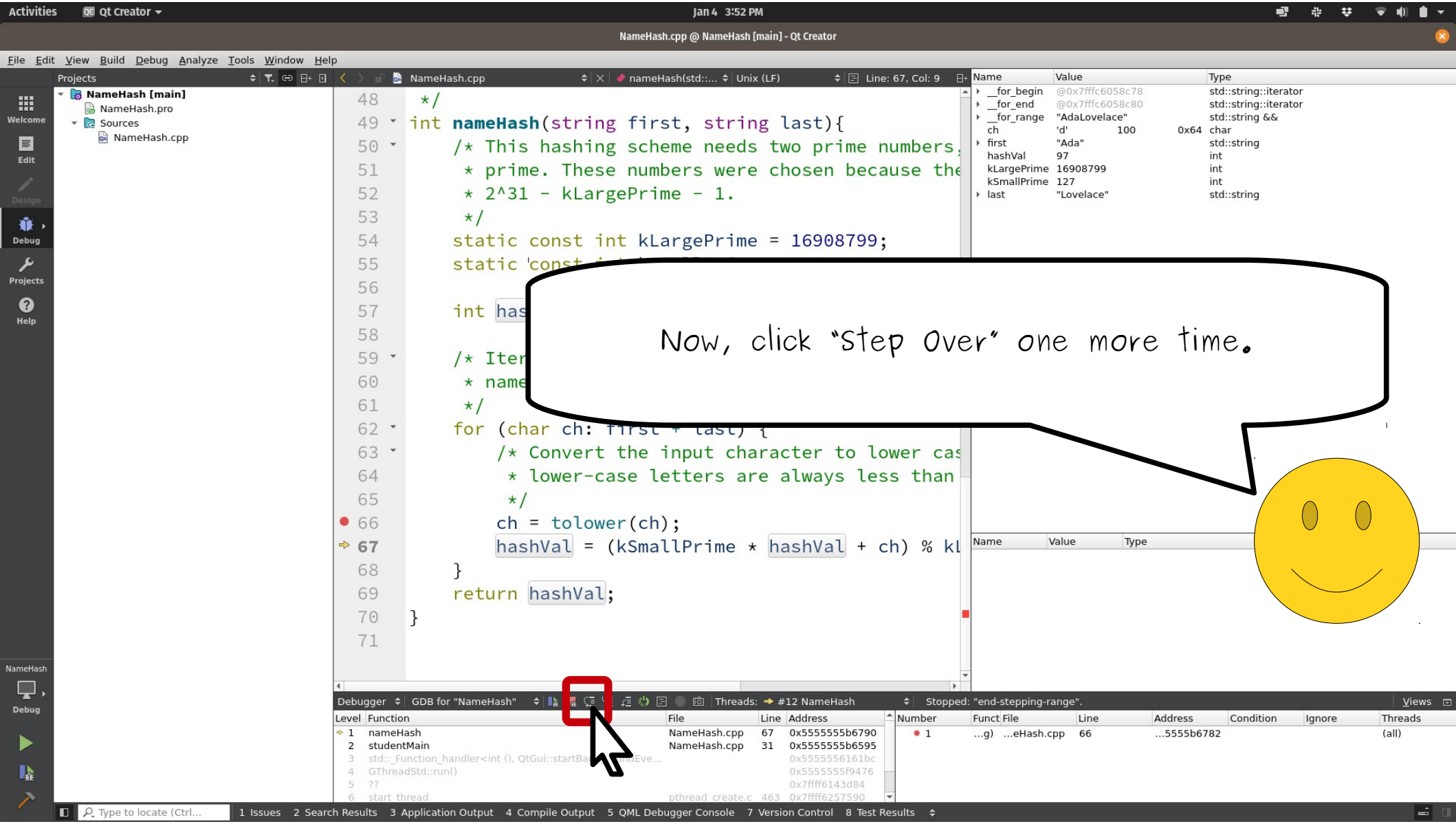
Name	Value	Type

Debugger | GDB for "NameHash" | Threads: #12 NameHash | Stopped: "end-stepping-range". | Views

Level	Function	File	Line	Address
1	nameHash	NameHash.cpp	67	0x5555555b6790
2	studentMain	NameHash.cpp	31	0x5555555b6595
3	std::_Function_handler<int (), QtGui::startBackgroundEve...			0x5555556161bc
4	GThreadStd::run()			0x5555555f9476
5	??			0x7ffff6143d84
6	start_thread	pthread_create.c	463	0x7ffff6257590

Number	Funct	File	Line	Address	Condition	Ignore	Threads
1	...g)	...eHash.cpp	66	...5555b6782			(all)

Type to locate (Ctrl... | 1 Issues | 2 Search Results | 3 Application Output | 4 Compile Output | 5 QML Debugger Console | 7 Version Control | 8 Test Results


Activities
Qt Creator
Jan 4 3:52 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
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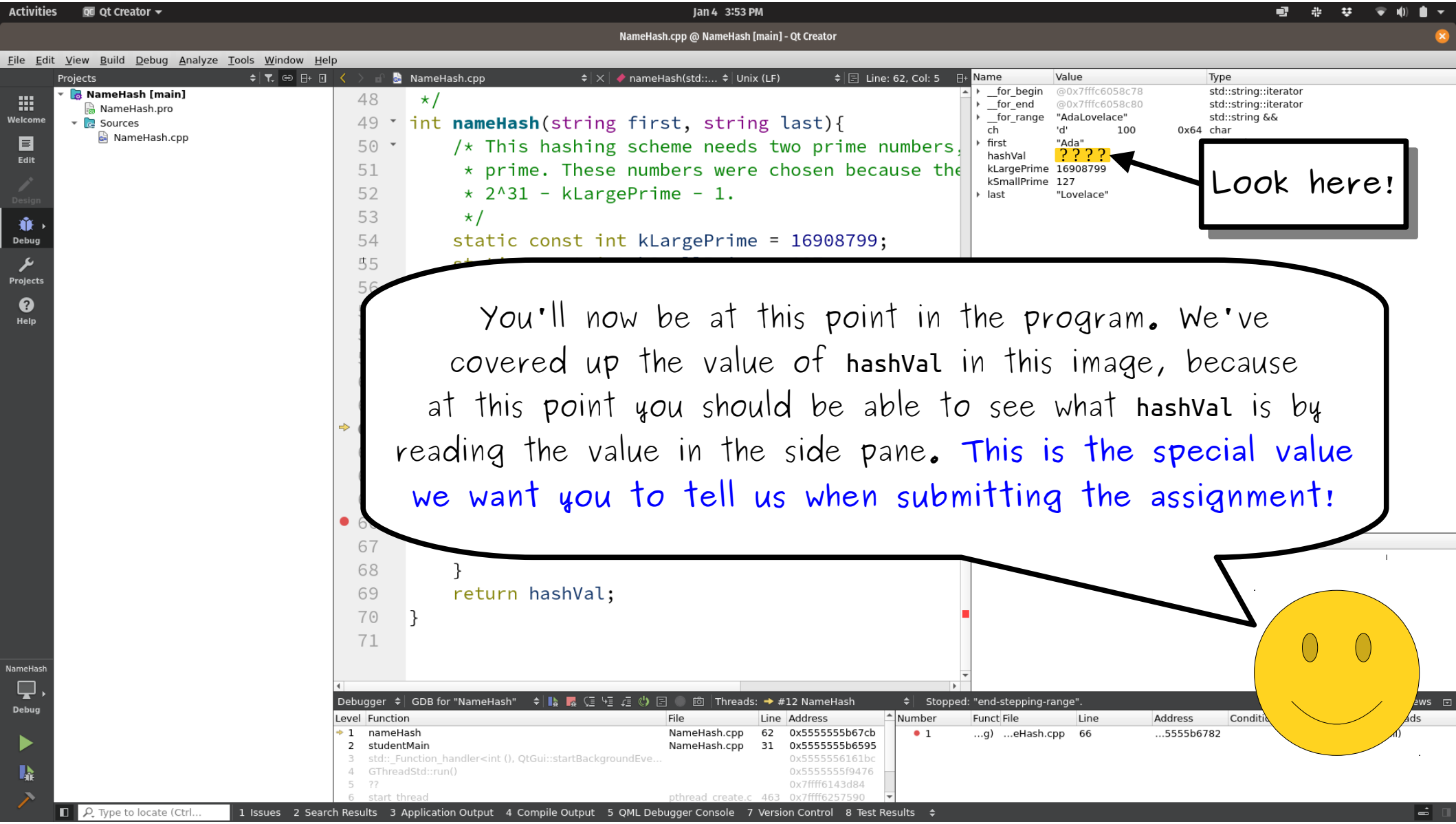
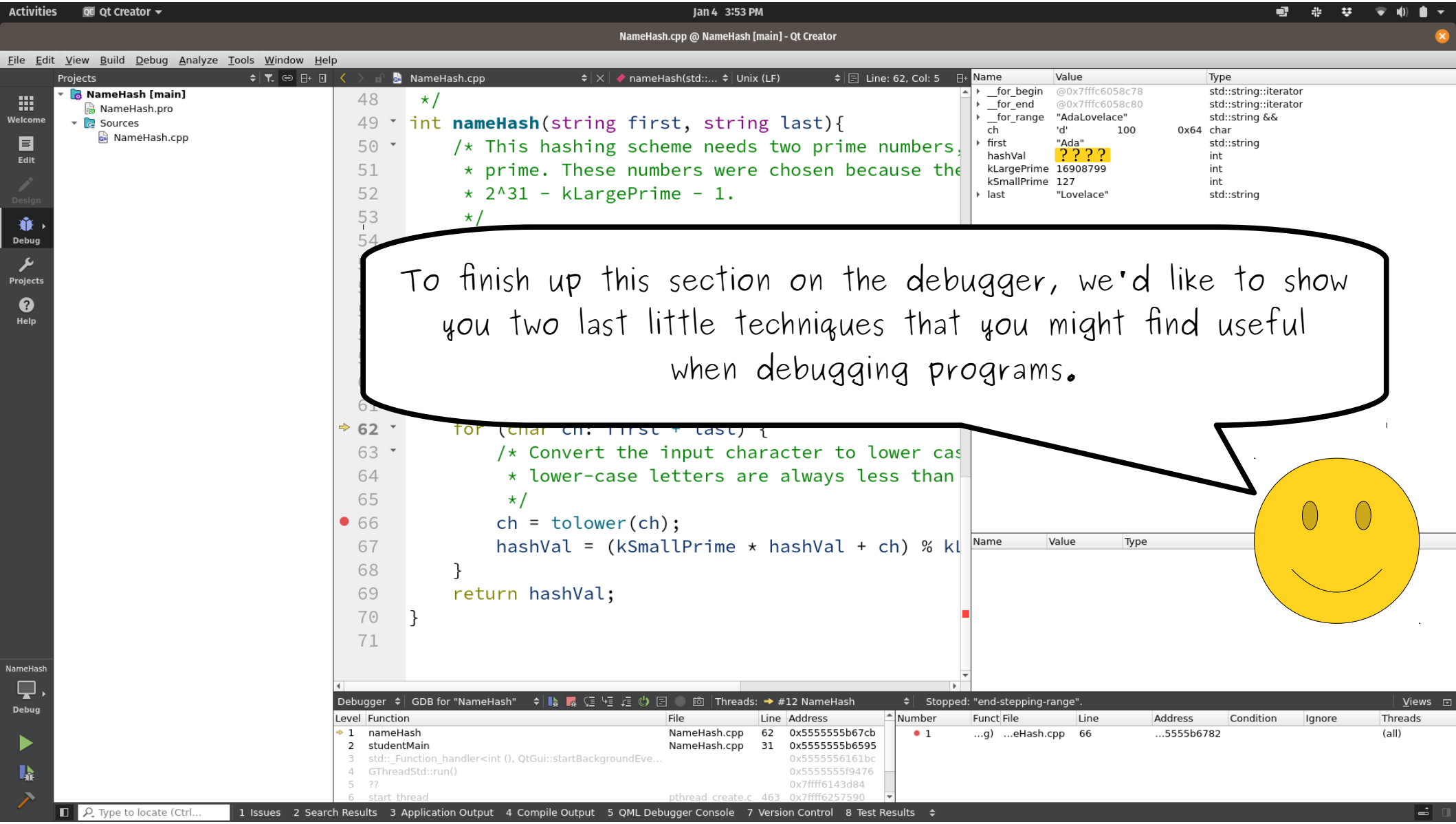
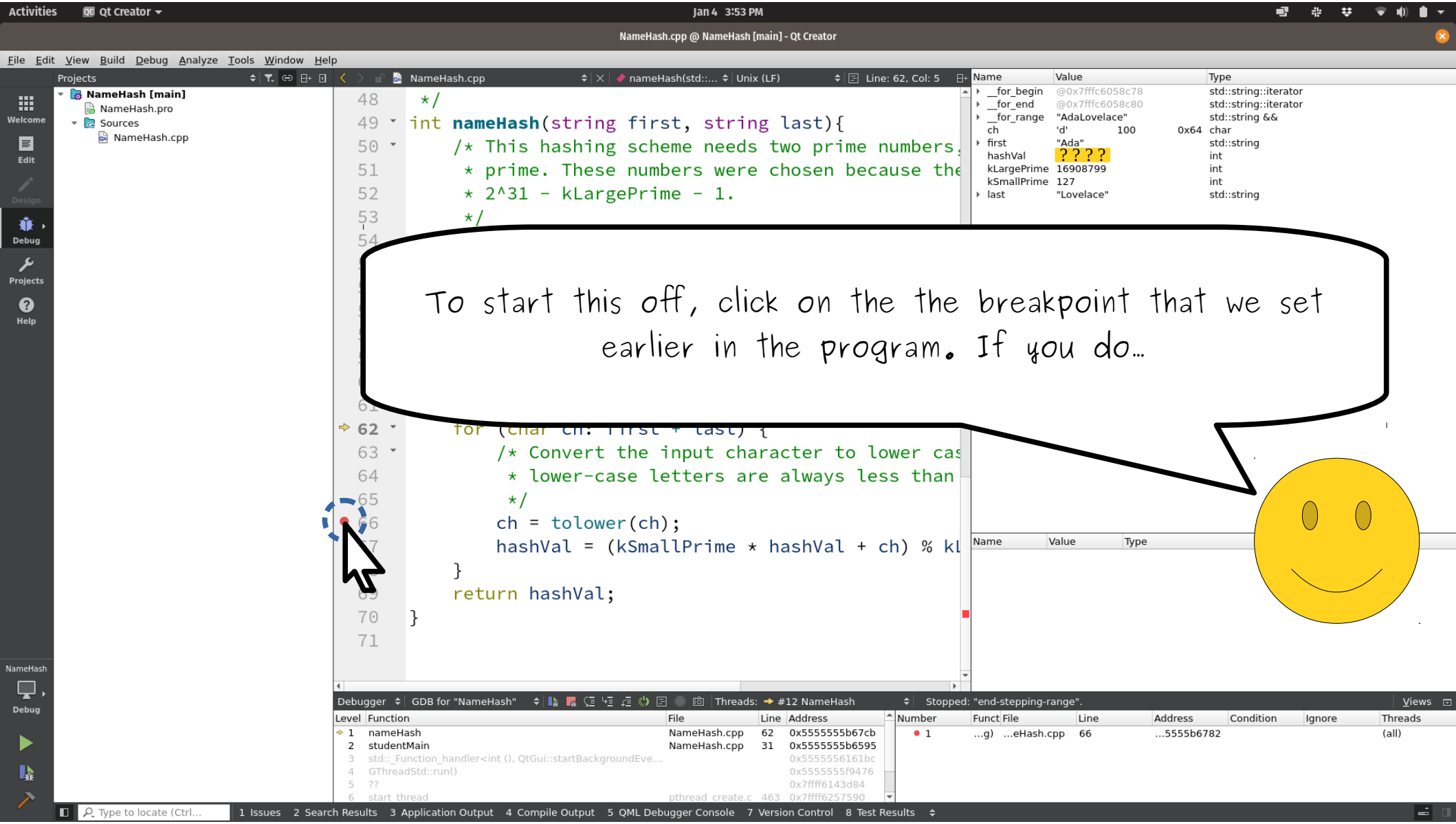
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
nameHash(std::... Unix (LF) Line: 67, Col: 9
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const
56
57 int has
58
59 /* Iter
60 * name
61 */
62 for (char ch: first + last) {
63 /* Convert the input character to lower cas
64 * lower-case letters are always less than
65 */
66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % kL
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'd' 100 0x64 char
first "Ada" std::string
hashVal 97 int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
Now, click "Step Over" one more time.
Name Value Type
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped: "end-stepping-range". Views
Level Function File Line Address
1 nameHash NameHash.cpp 67 0x5555555b6790
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBa...EventLoo... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Activities
Qt Creator
Jan 4 3:53 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash.cpp
nameHash(std::... Unix (LF) Line: 62, Col: 5
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
67
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'd' 100 0x64 char
first "Ada"
hashVal ????
kLargePrime 16908799
kSmallPrime 127
last "Lovelace"
Look here!
You'll now be at this point in the program. We've covered up the value of hashVal in this image, because at this point you should be able to see what hashVal is by reading the value in the side pane. This is the special value we want you to tell us when submitting the assignment!
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped: "end-stepping-range".
Level Function File Line Address
1 nameHash NameHash.cpp 62 0x5555555b67cb
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address
1 ...g) ...eHash.cpp 66 ...5555b6782
NameHash
Debug
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Activities
Qt Creator
Jan 4 3:53 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 62, Col: 5
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
62 for (char ch: first + last) {
63 /* Convert the input character to lower cas
64 * lower-case letters are always less than
65 */
66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % kL
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'd' 100 0x64 char
first "Ada" std::string
hashVal ???? int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
To finish up this section on the debugger, we'd like to show you two last little techniques that you might find useful when debugging programs.
Name Value Type
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped: "end-stepping-range". Views
Level Function File Line Address
1 nameHash NameHash.cpp 62 0x5555555b67cb
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Activities
Qt Creator
Jan 4 3:53 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 62, Col: 5
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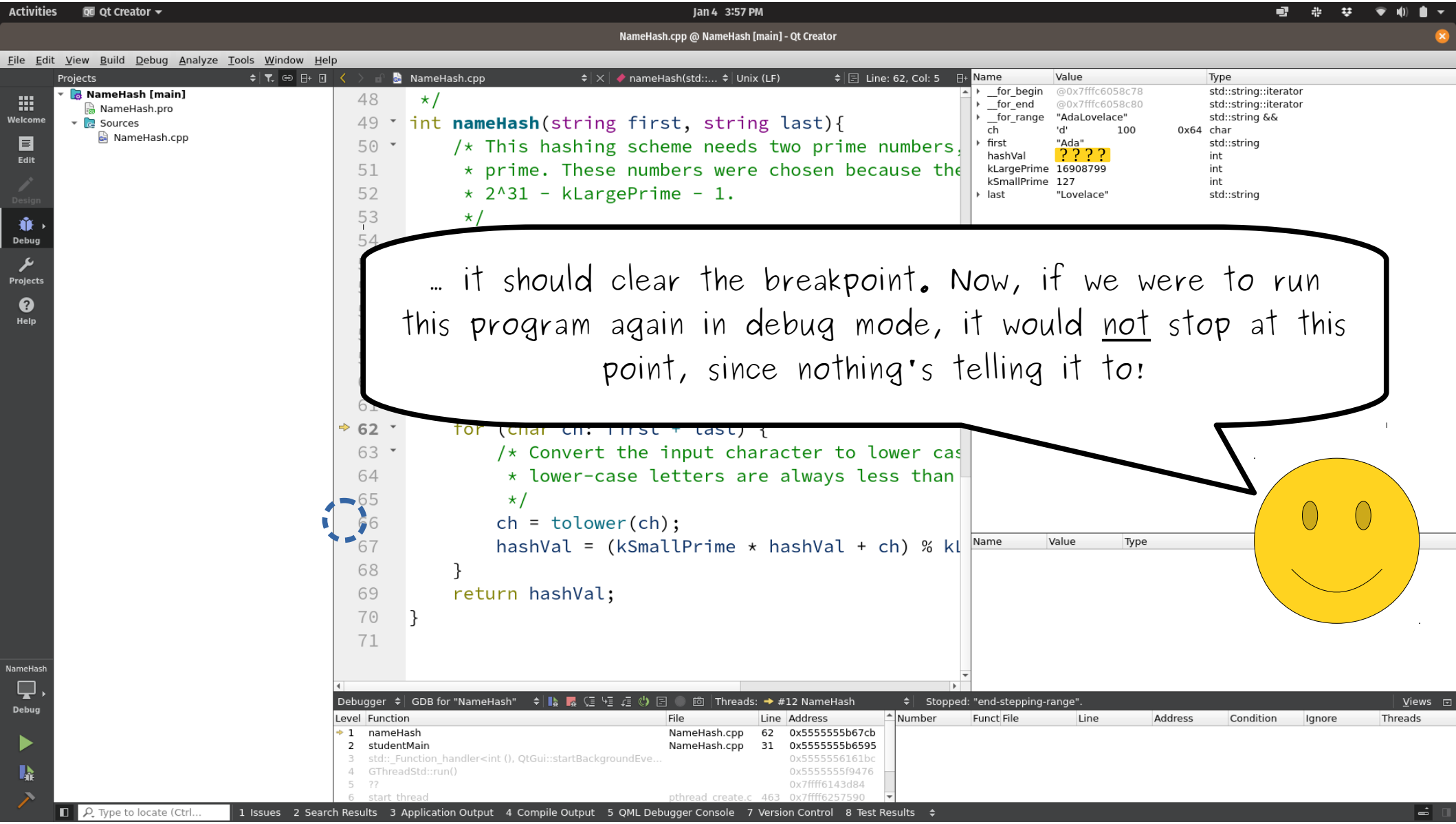
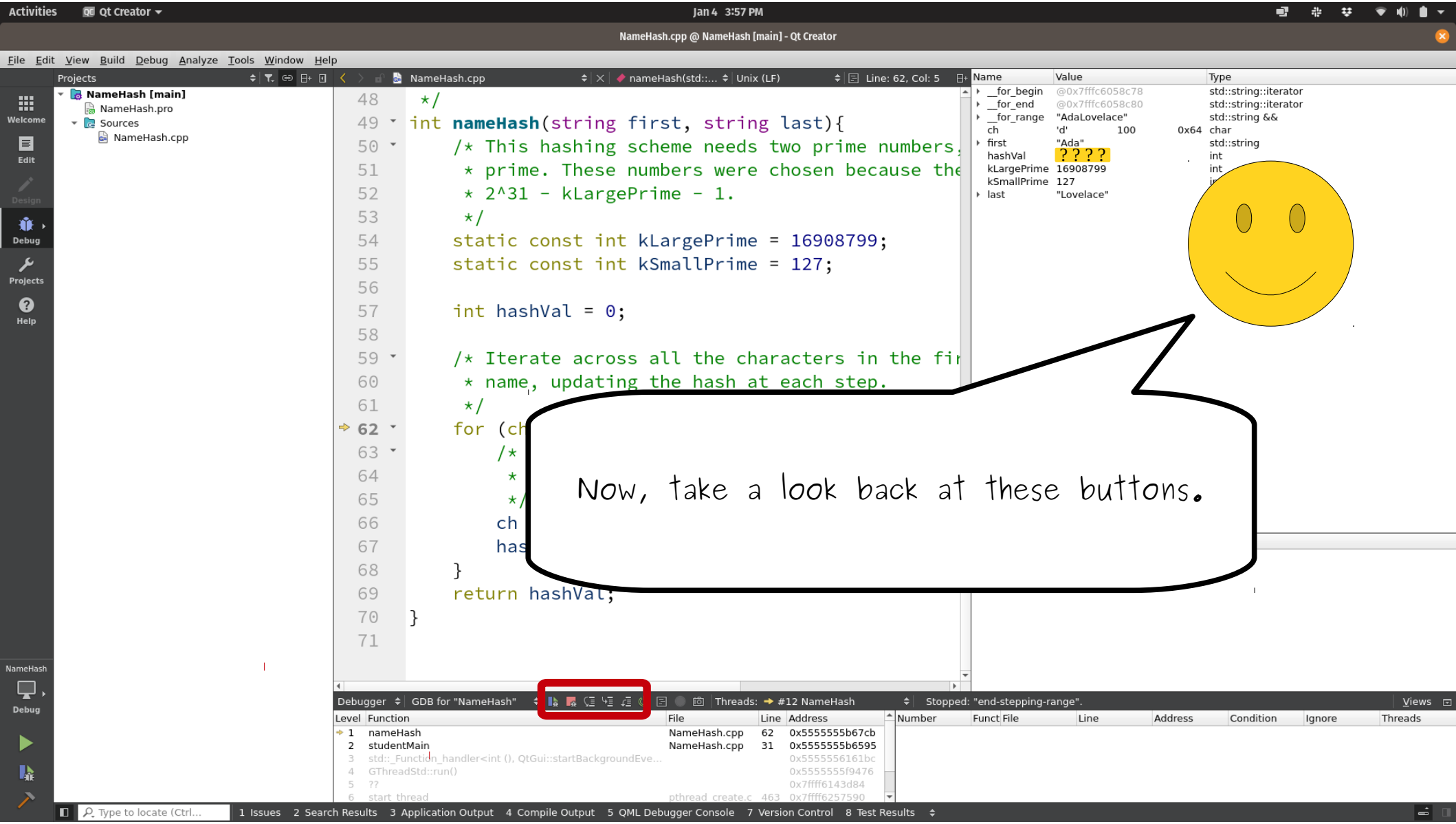
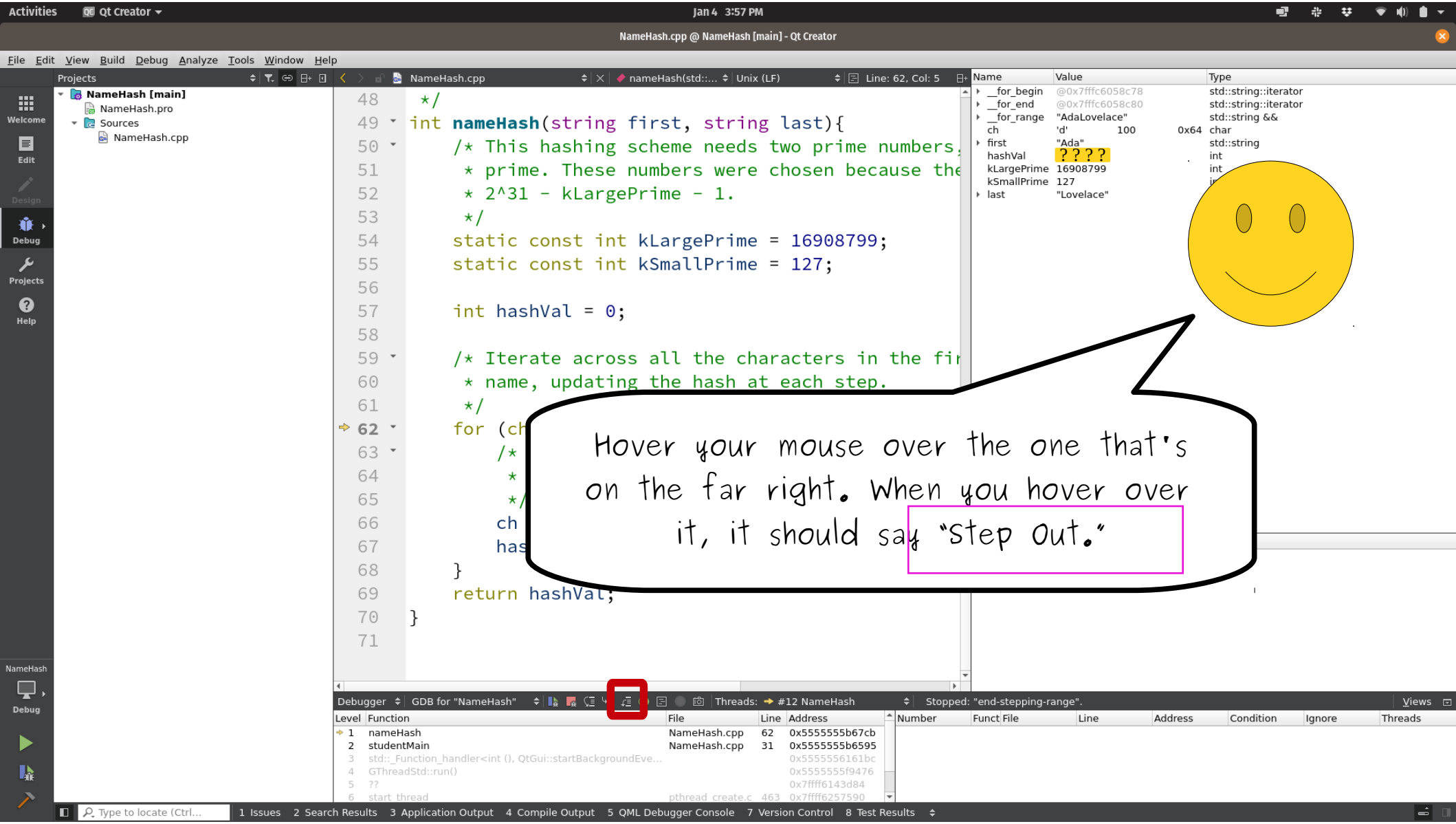
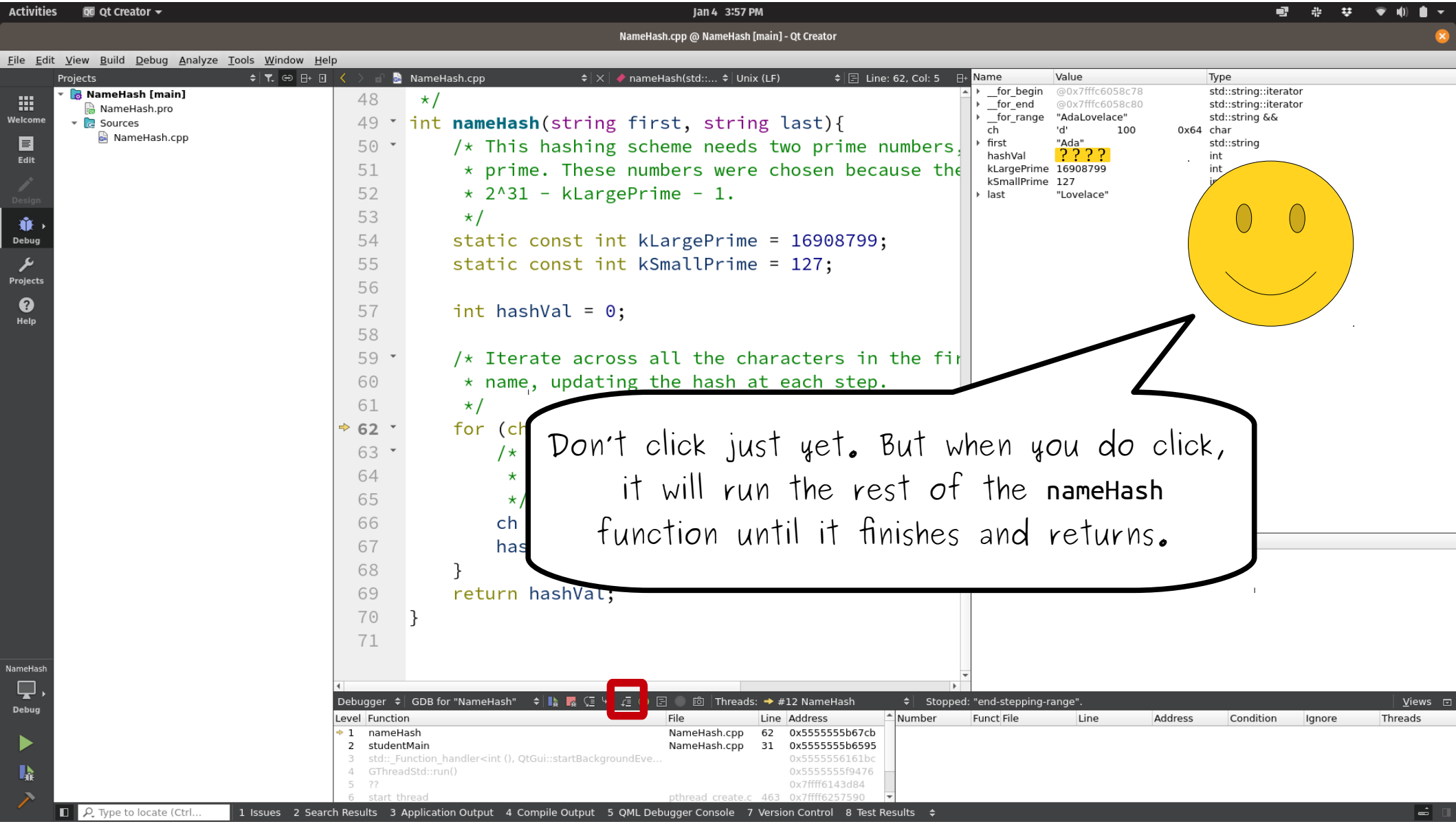
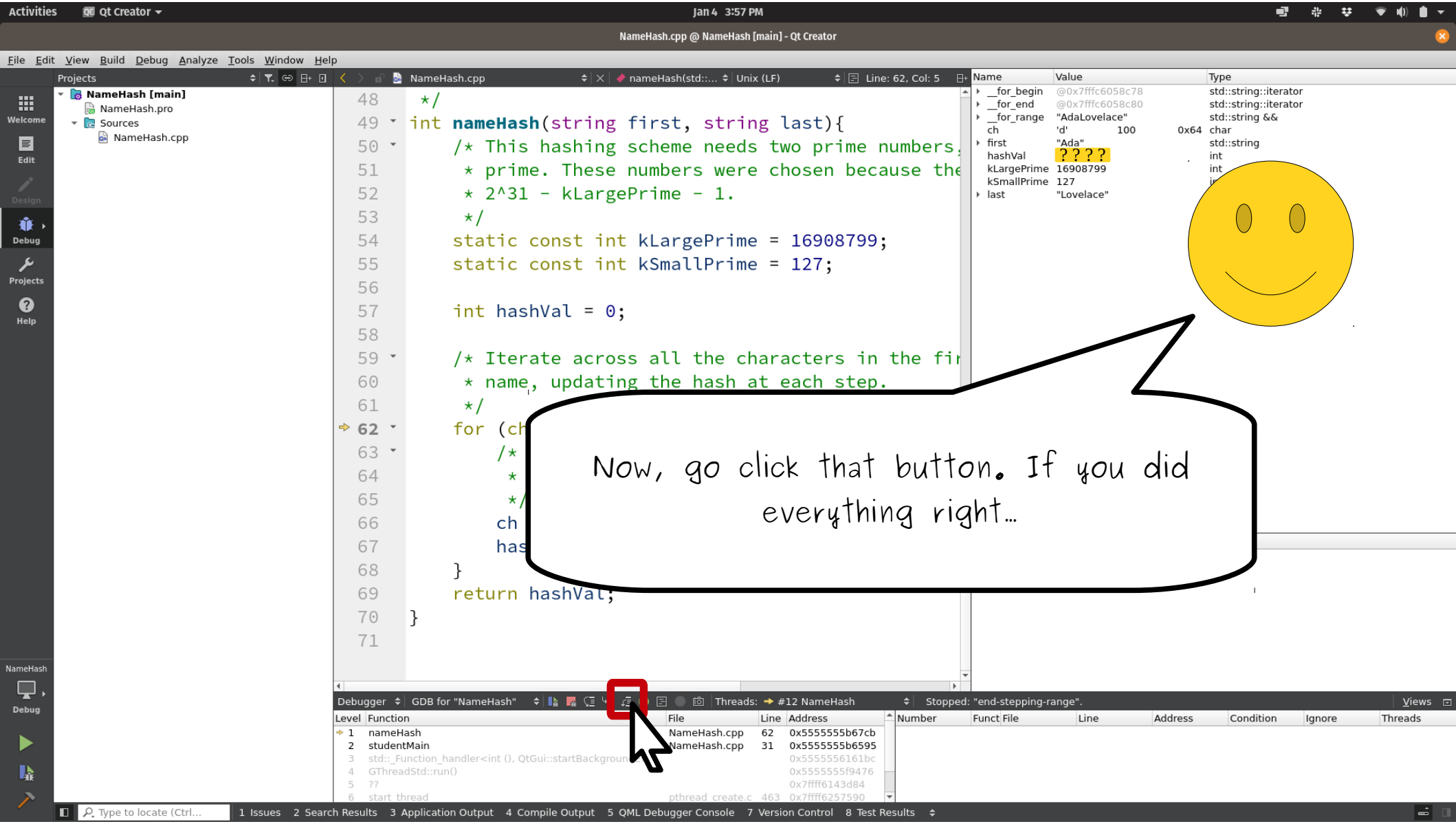
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
62 for (char ch: first + last) {
63 /* Convert the input character to lower cas
64 * lower-case letters are always less than
65 */
66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % kL
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'd' 100 0x64 char
first "Ada" std::string
hashVal ???? int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
To start this off, click on the the breakpoint that we set earlier in the program. If you do...
Debugger GDB for "NameHash"
Threads: #12 NameHash
Stopped: "end-stepping-range".
Views
Level Function File Line Address
1 nameHash NameHash.cpp 62 0x5555555b67cb
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
1 ...g) ...eHash.cpp 66 ...5555b6782 (all)
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results

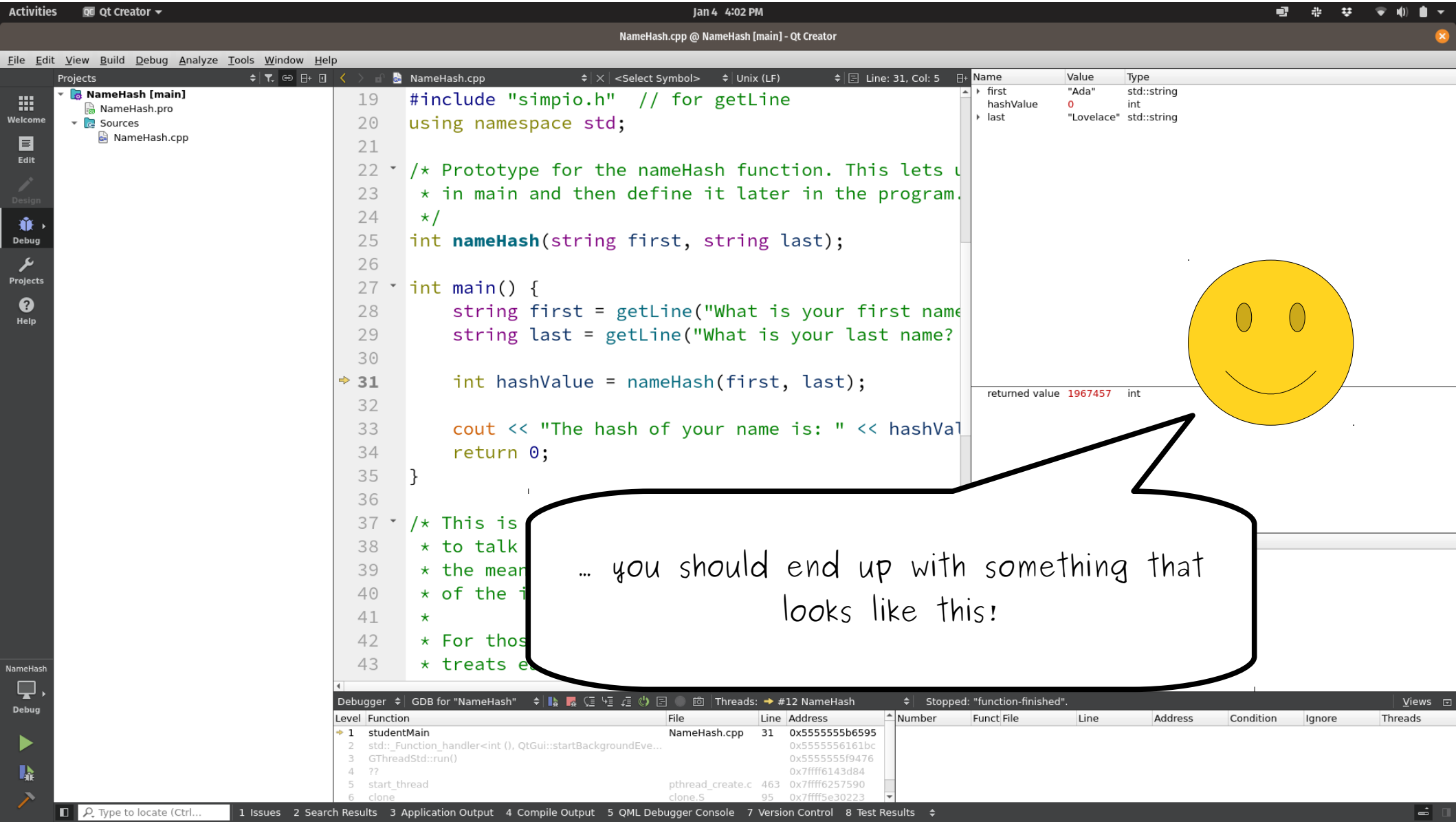

Activities
Qt Creator
Jan 4 3:57 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 62, Col: 5
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
62 for (char ch: first + last) {
63 /* Convert the input character to lower cas
64 * lower-case letters are always less than
65 */
66 ch = tolower(ch);
67 hashVal = (kSmallPrime * hashVal + ch) % kL
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'd' 100 0x64 char
first "Ada" std::string
hashVal ???? int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace" std::string
… it should clear the breakpoint. Now, if we were to run this program again in debug mode, it would not stop at this point, since nothing's telling it to!
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped: "end-stepping-range". Views
Level Function File Line Address
1 nameHash NameHash.cpp 62 0x5555555b67cb
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results

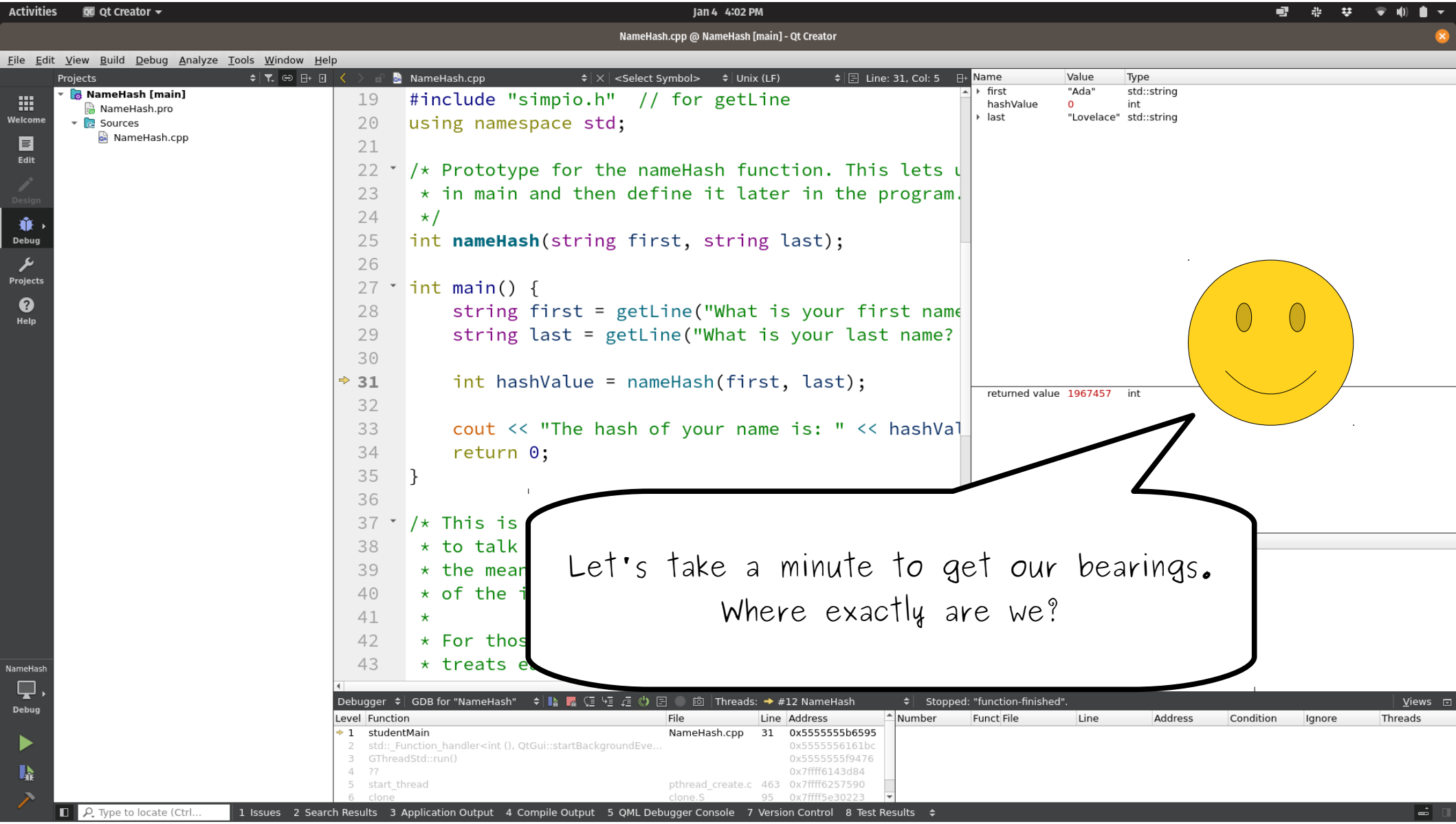

Activities
Qt Creator
Jan 4 3:57 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 62, Col: 5
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int hashVal = 0;
58
59 /* Iterate across all the characters in the fir
60 * name, updating the hash at each step.
61 */
62 for (ch
63 /*
64 *
65 */
66 ch
67 has
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'd' 100 0x64 char
first "Ada" std::string
hashVal ???? int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace"
Now, take a look back at these buttons.
Debugger GDB for "NameHash"
Threads: #12 NameHash
Stopped: "end-stepping-range".
Views
Level Function File Line Address
1 nameHash NameHash.cpp 62 0x5555555b67cb
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results

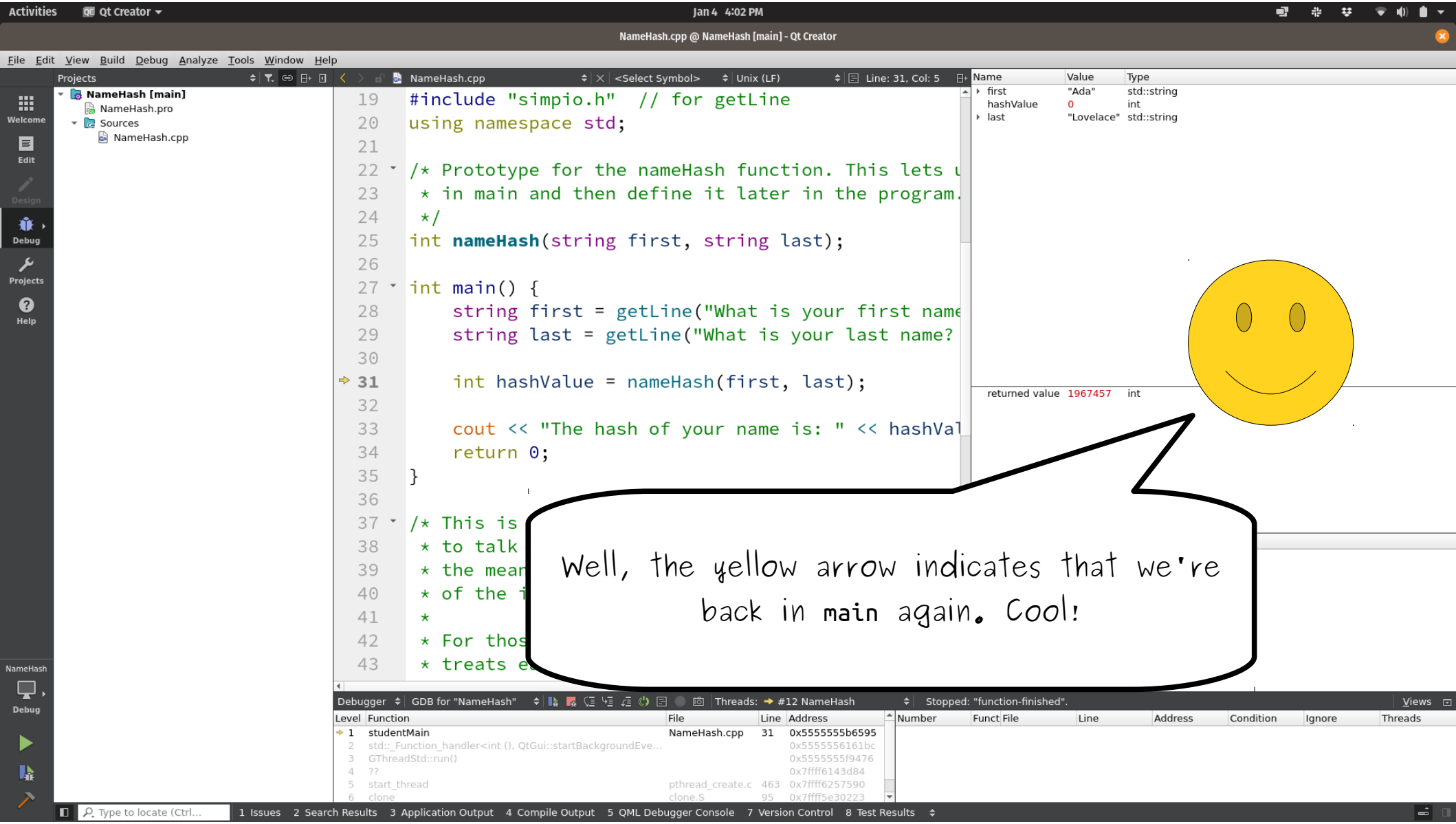

Activities
Qt Creator
Jan 4 3:57 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 62, Col: 5
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int hashVal = 0;
58
59 /* Iterate across all the characters in the fir
60 * name, updating the hash at each step.
61 */
62 for (ch
63 /*
64 *
65 */
66 ch
67 has
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'd' 100 0x64 char
first "Ada" std::string
hashVal ???? int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace"
Hover your mouse over the one that's on the far right. When you hover over it, it should say "Step Out."
Debugger GDB for "NameHash"
Threads: #12 NameHash
Stopped: "end-stepping-range".
Views
Level Function File Line Address
1 nameHash NameHash.cpp 62 0x5555555b67cb
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results

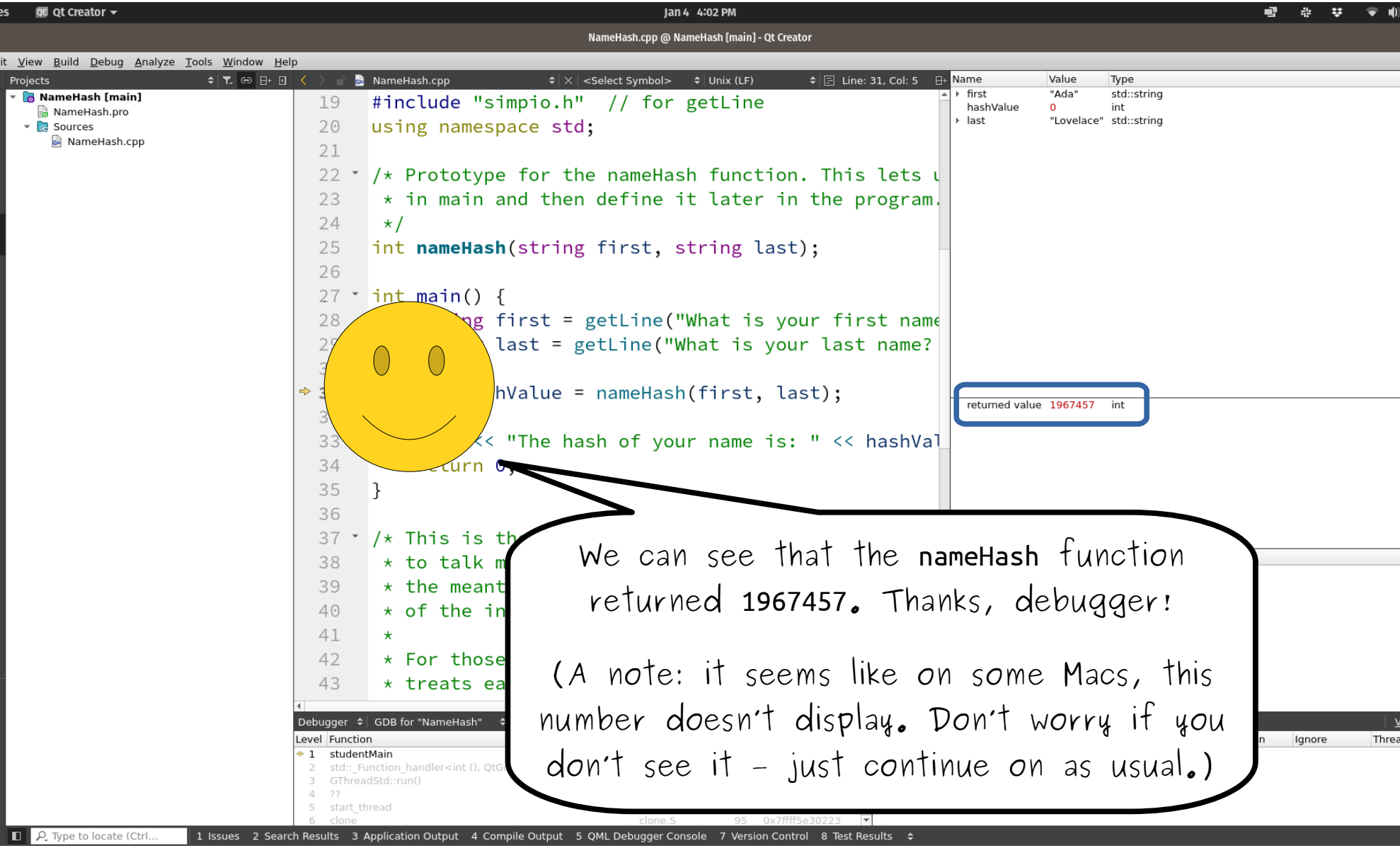

Activities
Qt Creator
Jan 4 3:57 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 62, Col: 5
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int hashVal = 0;
58
59 /* Iterate across all the characters in the fir
60 * name, updating the hash at each step.
61 */
62 for (ch
63 /*
64 *
65 */
66 ch
67 has
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'd' 100 0x64 char
first "Ada" std::string
hashVal ???? int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace"
Don't click just yet. But when you do click, it will run the rest of the nameHash function until it finishes and returns.
Debugger GDB for "NameHash"
Threads: #12 NameHash
Stopped: "end-stepping-range".
Views
Level Function File Line Address
1 nameHash NameHash.cpp 62 0x5555555b67cb
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results

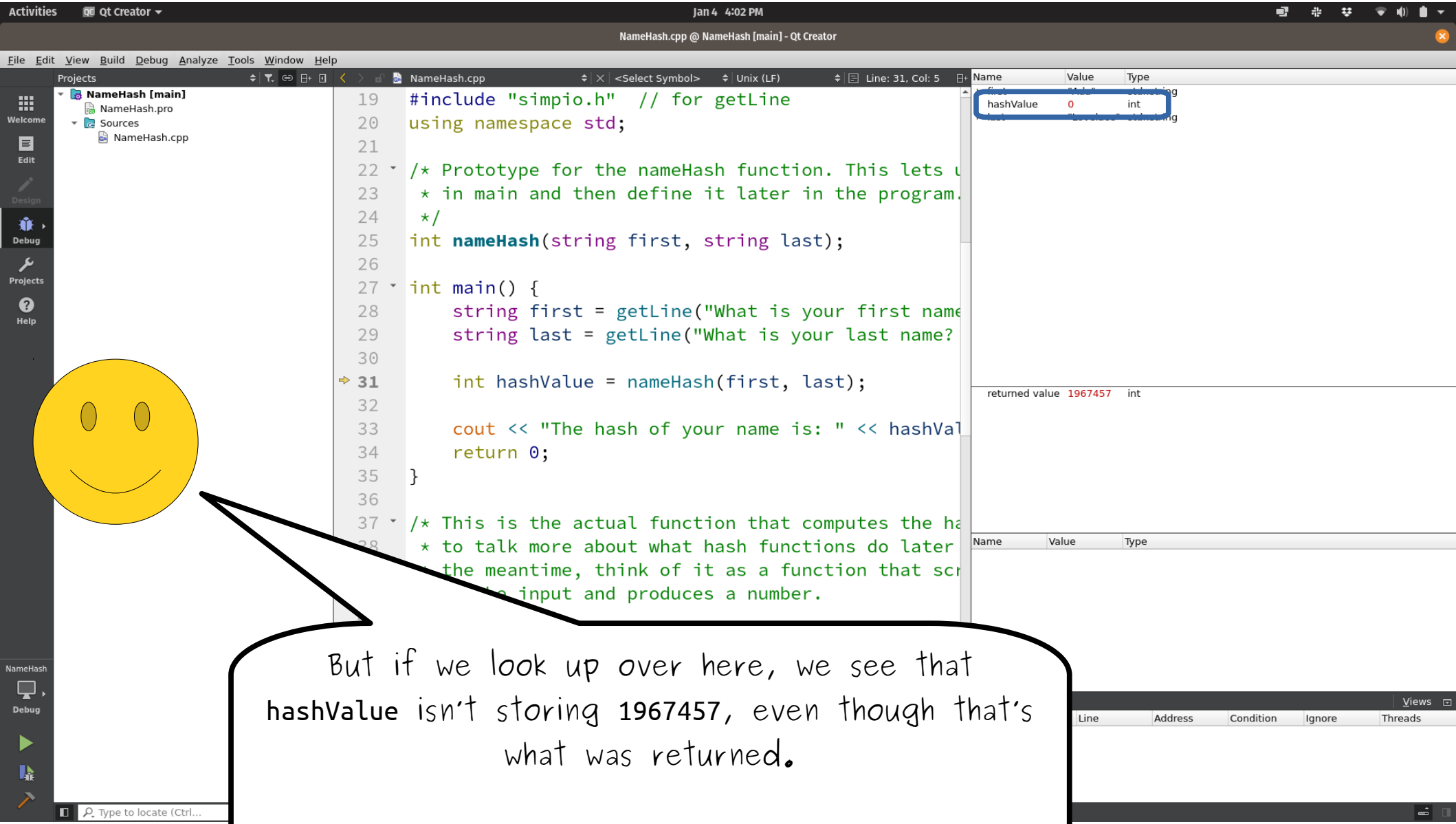

Activities
Qt Creator
Jan 4 3:57 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
nameHash(std::...
Unix (LF)
Line: 62, Col: 5
48 */
49 int nameHash(string first, string last){
50 /* This hashing scheme needs two prime numbers,
51 * prime. These numbers were chosen because the
52 * 2^31 - kLargePrime - 1.
53 */
54 static const int kLargePrime = 16908799;
55 static const int kSmallPrime = 127;
56
57 int hashVal = 0;
58
59 /* Iterate across all the characters in the fir
60 * name, updating the hash at each step.
61 */
62 for (ch
63 /*
64 *
65 */
66 ch
67 has
68 }
69 return hashVal;
70 }
71
Name Value Type
__for_begin @0x7fffc6058c78 std::string::iterator
__for_end @0x7fffc6058c80 std::string::iterator
__for_range "AdaLovelace" std::string &&
ch 'd' 100 0x64 char
first "Ada" std::string
hashVal ???? int
kLargePrime 16908799 int
kSmallPrime 127 int
last "Lovelace"
Now, go click that button. If you did everything right...
Debugger GDB for "NameHash"
Threads: #12 NameHash
Stopped: "end-stepping-range".
Views
Level Function File Line Address
1 nameHash NameHash.cpp 62 0x5555555b67cb
2 studentMain NameHash.cpp 31 0x5555555b6595
3 std::_Function_handler<int (), QtGui::startBackgroun 0x5555556161bc
4 GThreadStd::run() 0x5555555f9476
5 ?? 0x7ffff6143d84
6 start_thread pthread_create.c 463 0x7ffff6257590
Number Funct File Line Address Condition Ignore Threads
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results

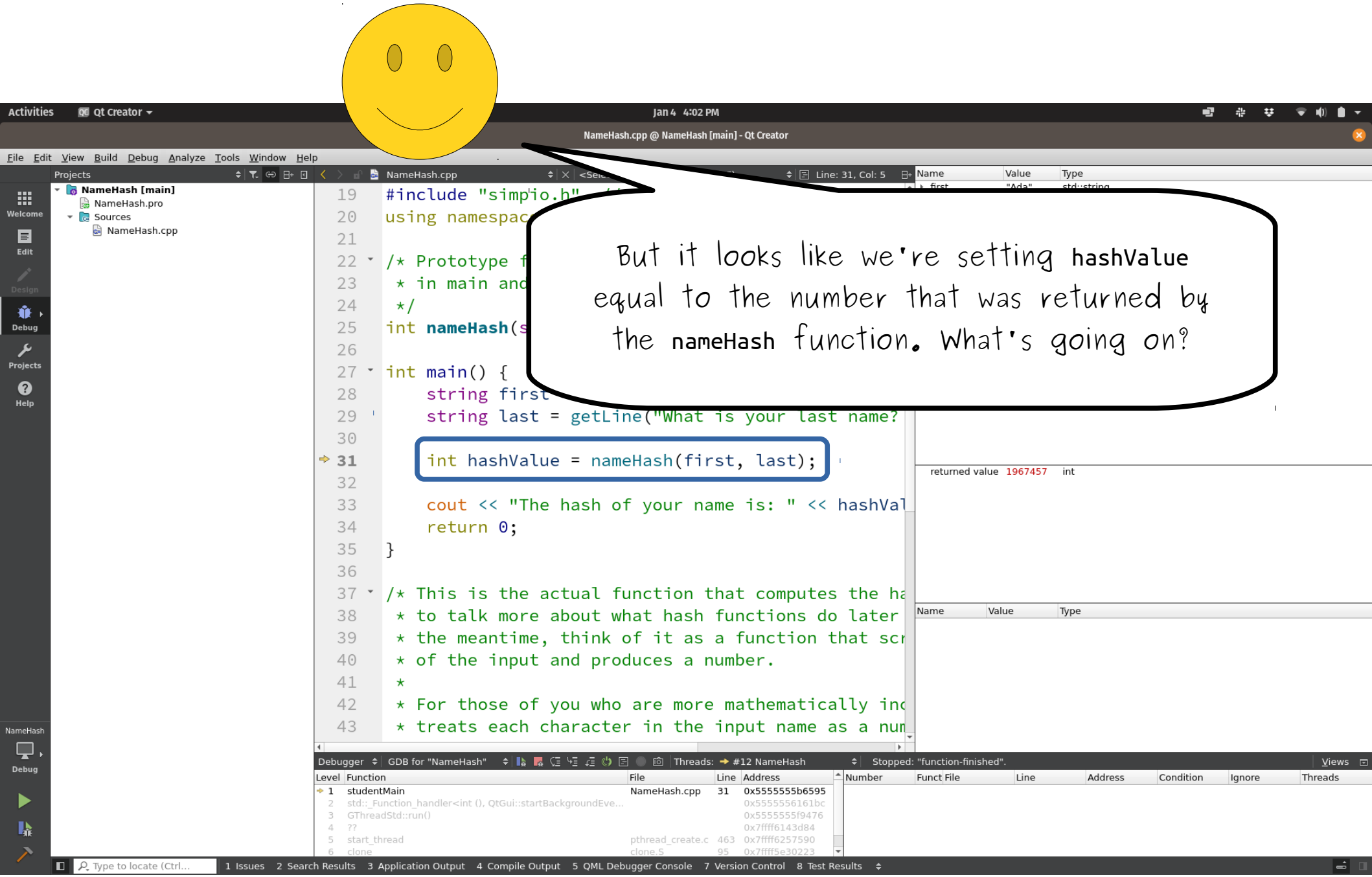

Activities
Qt Creator
Jan 4 4:02 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
<Select Symbol>
Unix (LF)
Line: 31, Col: 5
19 #include "simpio.h" // for getLine
20 using namespace std;
21
22 /* Prototype for the nameHash function. This lets u
23 * in main and then define it later in the program.
24 */
25 int nameHash(string first, string last);
26
27 int main() {
28 string first = getLine("What is your first name
29 string last = getLine("What is your last name?
30
31 int hashValue = nameHash(first, last);
32
33 cout << "The hash of your name is: " << hashVal
34 return 0;
35 }
36
37 /* This is
38 * to talk
39 * the mean
40 * of the i
41 *
42 * For thos
43 * treats e
Name Value Type
first "Ada" std::string
hashValue 0 int
last "Lovelace" std::string
returned value 1967457 int
... you should end up with something that looks like this!
Debugger
GDB for "NameHash"
Threads: #12 NameHash
Stopped: "function-finished".
Views
Level Function File Line Address
1 studentMain NameHash.cpp 31 0x5555555b6595
2 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
3 GThreadStd::run() 0x5555555f9476
4 ?? 0x7ffff6143d84
5 start_thread pthread_create.c 463 0x7ffff6257590
6 clone clone.S 95 0x7ffff5e30223
Number Funct File Line Address Condition Ignore Threads
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results

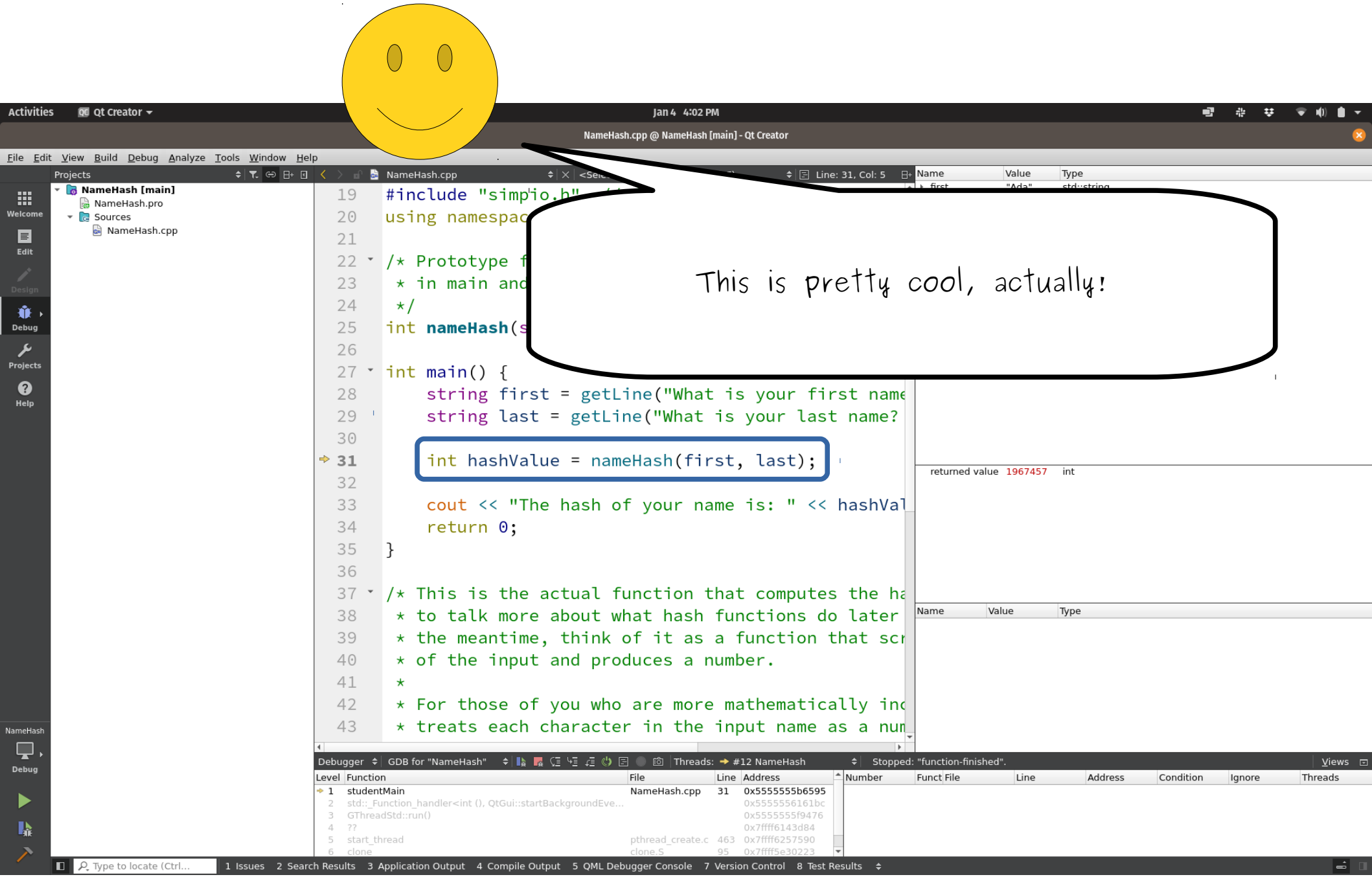

Activities
Qt Creator
Jan 4 4:02 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
<Select Symbol>
Unix (LF)
Line: 31, Col: 5
19 #include "simpio.h" // for getLine
20 using namespace std;
21
22 /* Prototype for the nameHash function. This lets u
23 * in main and then define it later in the program.
24 */
25 int nameHash(string first, string last);
26
27 int main() {
28 string first = getLine("What is your first name
29 string last = getLine("What is your last name?
30
31 int hashValue = nameHash(first, last);
32
33 cout << "The hash of your name is: " << hashVal
34 return 0;
35 }
36
37 /* This is
38 * to talk
39 * the mean
40 * of the
41 *
42 * For thos
43 * treats e
Name Value Type
first "Ada" std::string
hashValue 0 int
last "Lovelace" std::string
returned value 1967457 int
Let's take a minute to get our bearings.
Where exactly are we?
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped: "function-finished". Views
Level Function File Line Address
1 studentMain NameHash.cpp 31 0x5555555b6595
2 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
3 GThreadStd::run() 0x5555555f9476
4 ?? 0x7ffff6143d84
5 start_thread pthread_create.c 463 0x7ffff6257590
6 clone clone.S 95 0x7ffff5e30223
Number Funct File Line Address Condition Ignore Threads
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results

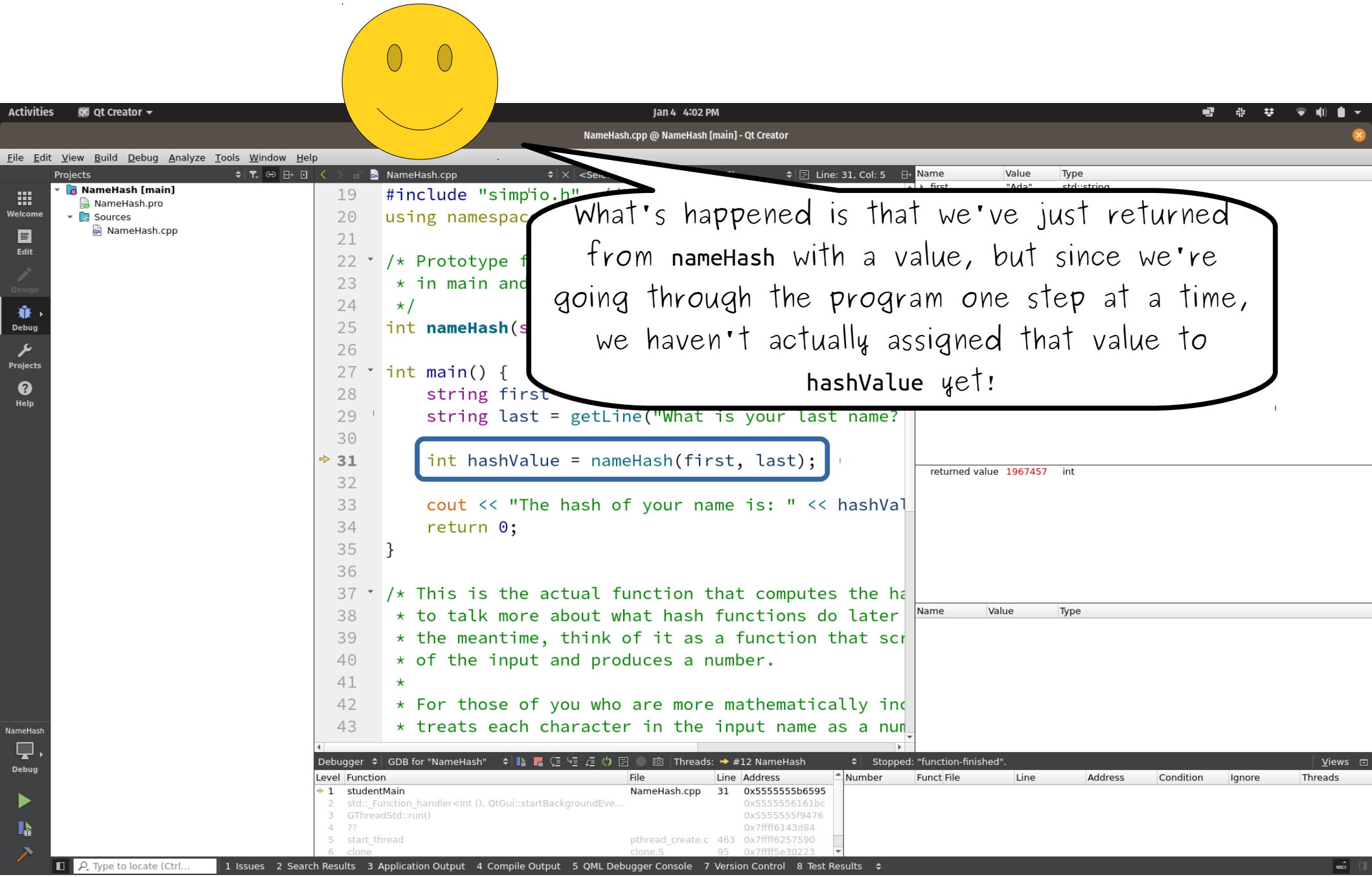

Activities
Qt Creator
Jan 4 4:02 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
<Select Symbol>
Unix (LF)
Line: 31, Col: 5
19 #include "simpio.h" // for getLine
20 using namespace std;
21
22 /* Prototype for the nameHash function. This lets u
23 * in main and then define it later in the program.
24 */
25 int nameHash(string first, string last);
26
27 int main() {
28 string first = getLine("What is your first name
29 string last = getLine("What is your last name?
30
31 int hashValue = nameHash(first, last);
32
33 cout << "The hash of your name is: " << hashVal
34 return 0;
35 }
36
37 /* This is
38 * to talk
39 * the mean
40 * of the
41 *
42 * For thos
43 * treats e
Name Value Type
first "Ada" std::string
hashValue 0 int
last "Lovelace" std::string
returned value 1967457 int
Well, the yellow arrow indicates that we're back in main again. Cool!
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped: "function-finished". Views
Level Function File Line Address
1 studentMain NameHash.cpp 31 0x5555555b6595
2 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
3 GThreadStd::run() 0x5555555f9476
4 ?? 0x7ffff6143d84
5 start_thread pthread_create.c 463 0x7ffff6257590
6 clone clone.S 95 0x7ffff5e30223
Number Funct File Line Address Condition Ignore Threads
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results

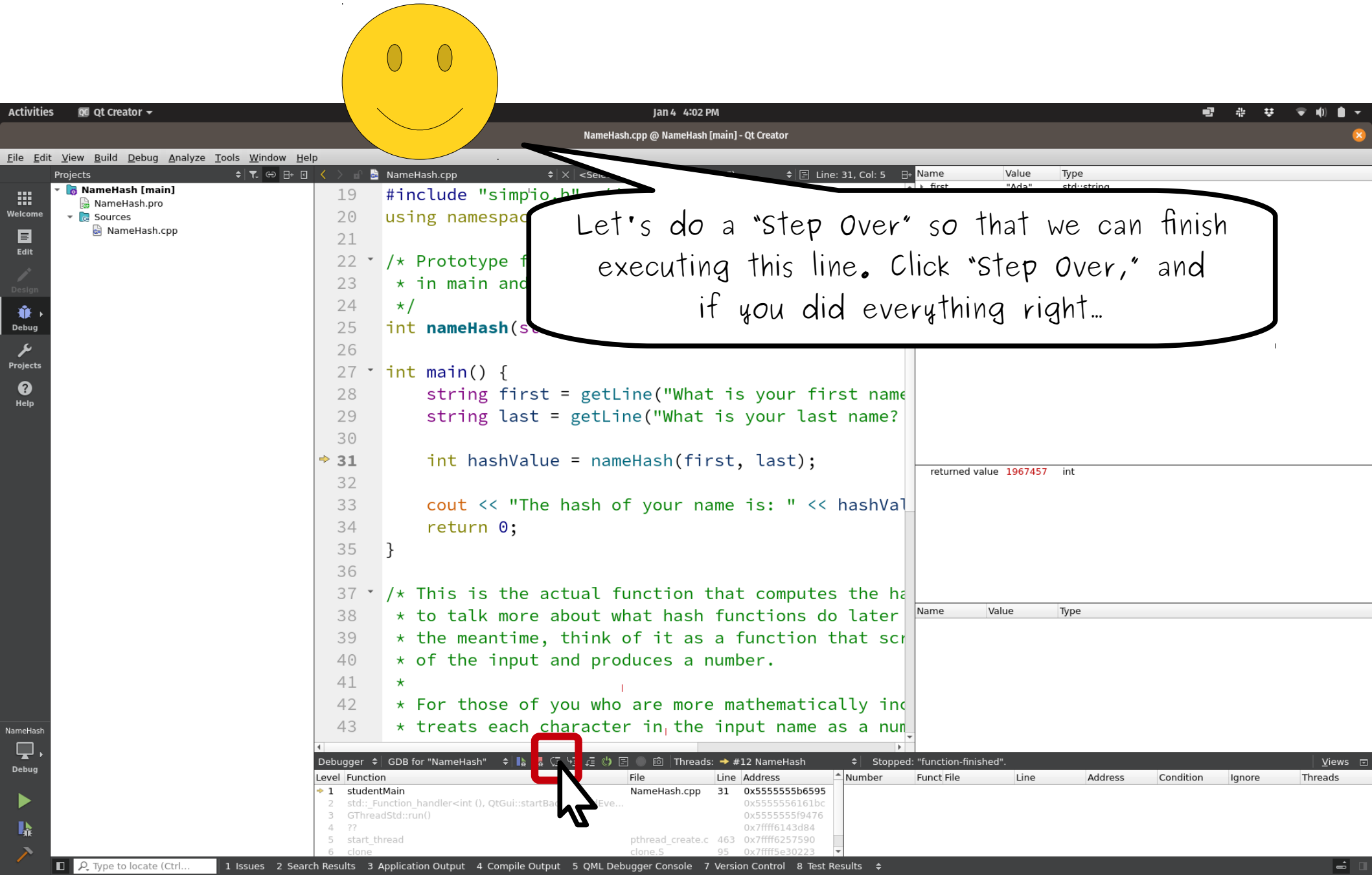

Activities
Qt Creator
Jan 4 4:02 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash.cpp
<Select Symbol>
Unix (LF)
Line: 31, Col: 5
#include "simpio.h" // for getLine
using namespace std;
/* Prototype for the nameHash function. This lets u
* in main and then define it later in the program.
*/
int nameHash(string first, string last);
int main() {
ng first = getLine("What is your first name
last = getLine("What is your last name?
hValue = nameHash(first, last);
<< "The hash of your name is: " << hashVal
turn 0;
}
/* This is th
* to talk m
* the meant
* of the in
*
* For those
* treats ea
Name Value Type
first "Ada" std::string
hashValue 0 int
last "Lovelace" std::string
returned value 1967457 int
We can see that the nameHash function returned 1967457. Thanks, debugger!
(A note: it seems like on some Macs, this number doesn't display. Don't worry if you don't see it - just continue on as usual.)
Debugger
GDB for "NameHash"
Level Function
1 studentMain
Views
Ignore
Threads
NameHash
Debug
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results

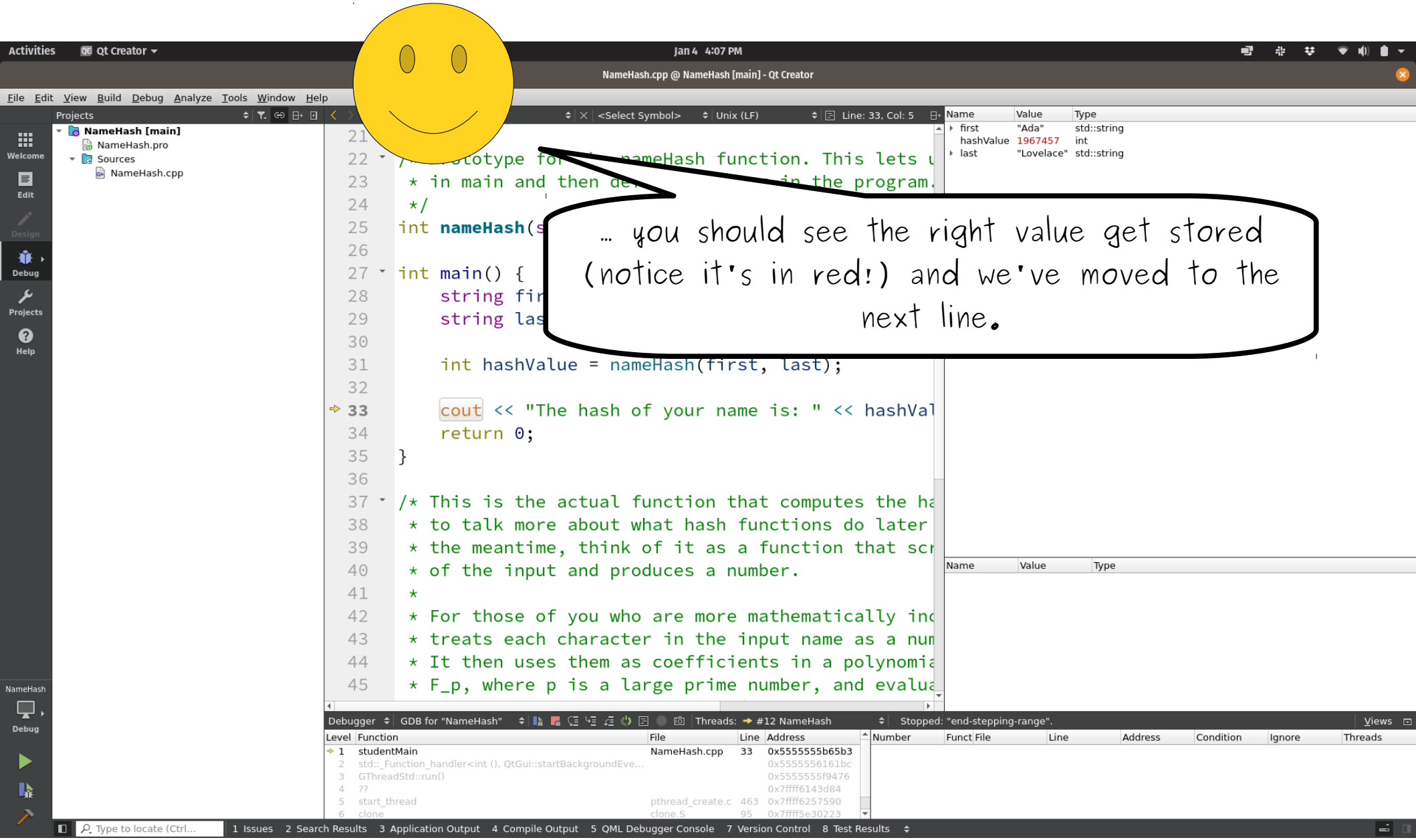

Activities
Qt Creator
Jan 4 4:02 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
NameHash.cpp
<Select Symbol>
Unix (LF)
Line: 31, Col: 5
19 #include "simpio.h" // for getLine
20 using namespace std;
21
22 /* Prototype for the nameHash function. This lets u
23 * in main and then define it later in the program.
24 */
25 int nameHash(string first, string last);
26
27 int main() {
28 string first = getLine("What is your first name
29 string last = getLine("What is your last name?
30
31 int hashValue = nameHash(first, last);
32
33 cout << "The hash of your name is: " << hashVal
34 return 0;
35 }
36
37 /* This is the actual function that computes the ha
* to talk more about what hash functions do later
the meantime, think of it as a function that scr
input and produces a number.
Name Value Type
hashValue 0 int
returned value 1967457 int
Name Value Type
Views
Line Address Condition Ignore Threads
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
Type to locate (Ctrl...
But if we look up over here, we see that hashValue isn't storing 1967457, even though that's what was returned.
(You might see a number other than 0 on your system - that's okay.)

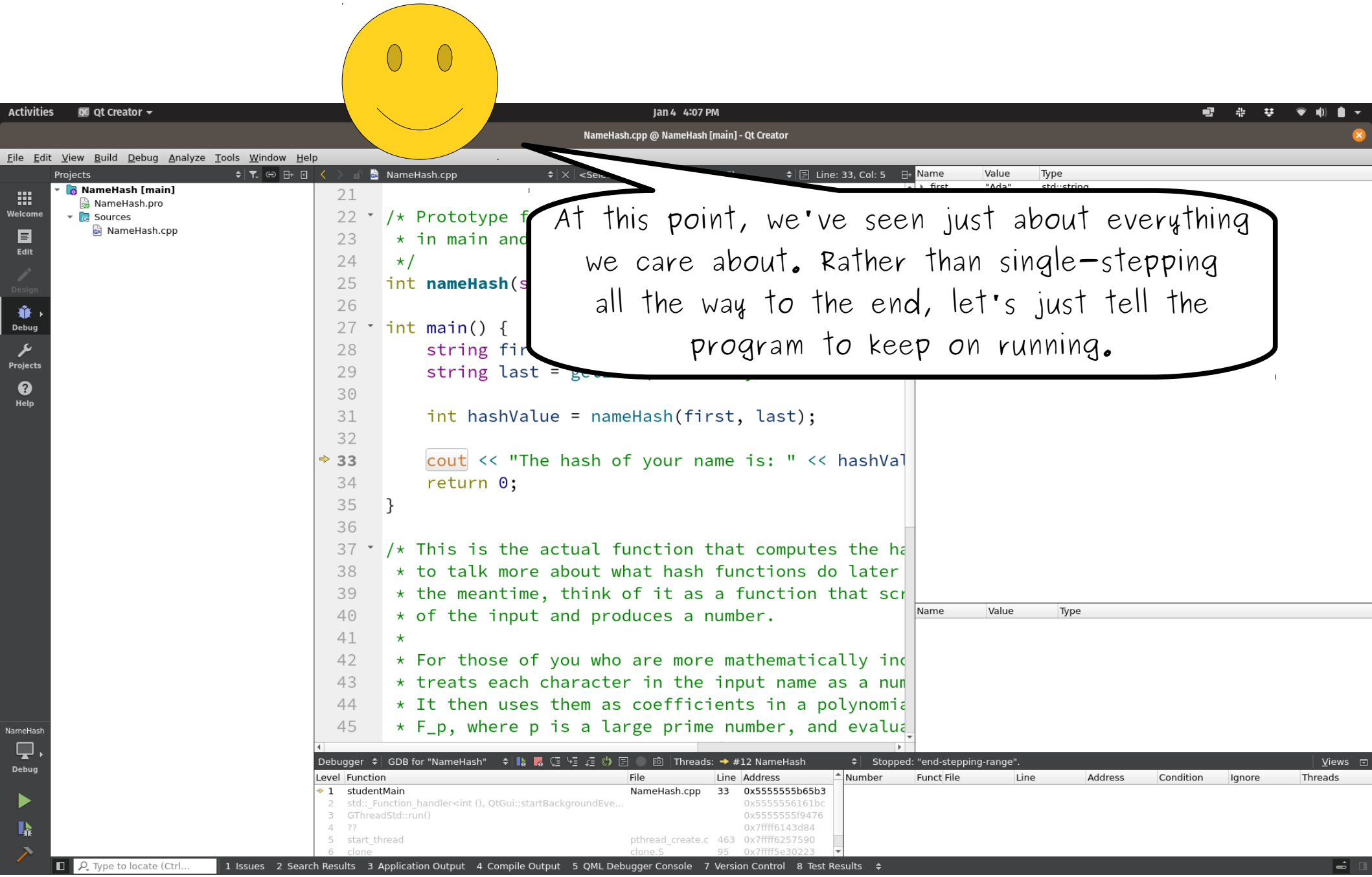

But it looks like we're setting hashValue equal to the number that was returned by the nameHash function. What's going on?
Activities
Qt Creator
Jan 4 4:02 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
Line: 31, Col: 5
19 #include "simpio.h"
20 using namespac
21
22 /* Prototype f
23 * in main and
24 */
25 int nameHash(s
26
27 int main() {
28 string first
29 string last = getLine("What is your last name?
30
31 int hashValue = nameHash(first, last);
32
33 cout << "The hash of your name is: " << hashVal
34 return 0;
35 }
36
37 /* This is the actual function that computes the ha
38 * to talk more about what hash functions do later
39 * the meantime, think of it as a function that scr
40 * of the input and produces a number.
41 *
42 * For those of you who are more mathematically inc
43 * treats each character in the input name as a num
Name Value Type
returned value 1967457 int
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped: "function-finished". Views
Level Function File Line Address
1 studentMain NameHash.cpp 31 0x5555555b6595
2 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
3 GThreadStd::run() 0x5555555f9476
4 ?? 0x7ffff6143d84
5 start_thread pthread_create.c 463 0x7ffff6257590
6 clone clone.S 95 0x7ffff5e30223
Number Funct File Line Address Condition Ignore Threads
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results

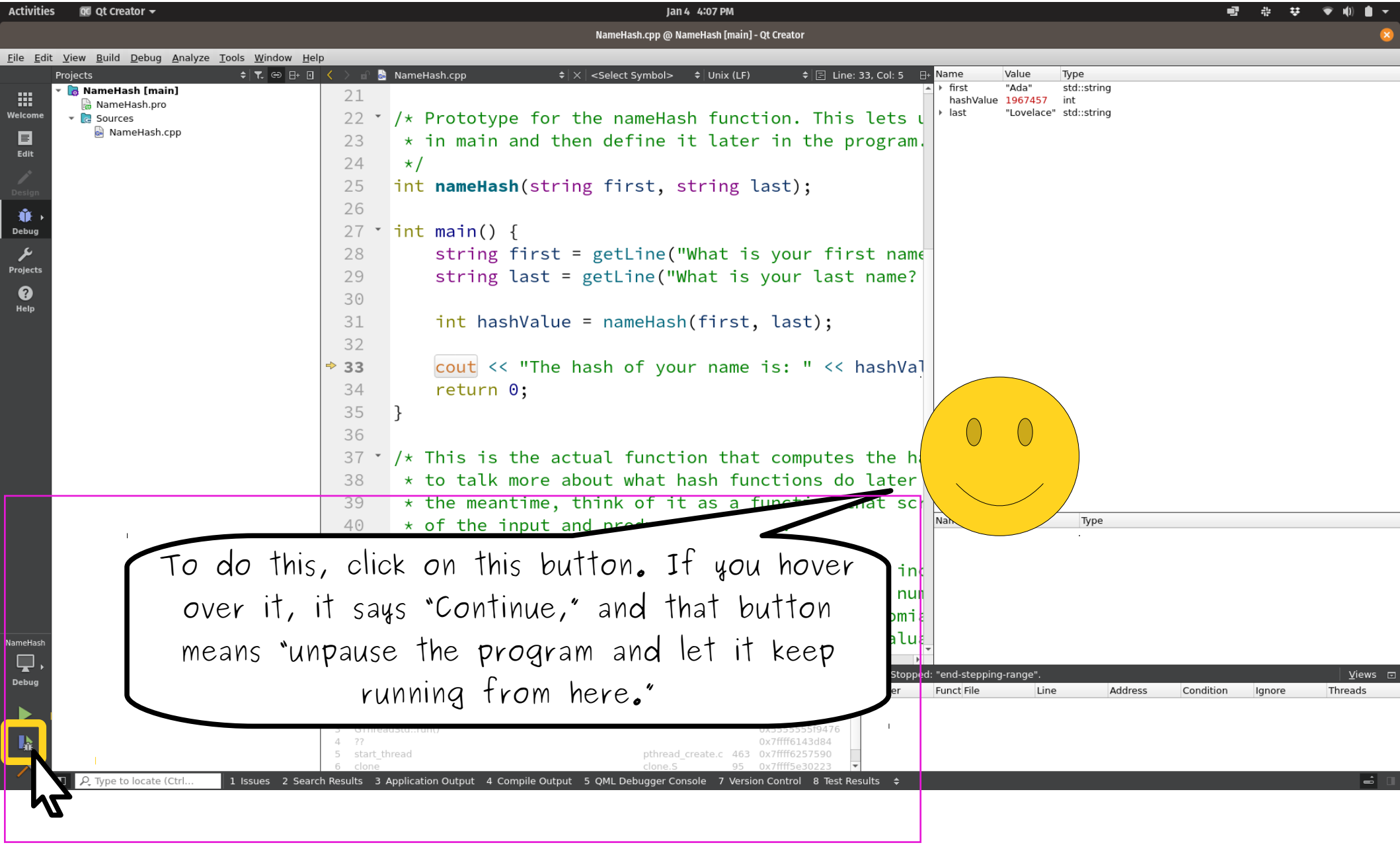

This is pretty cool, actually!

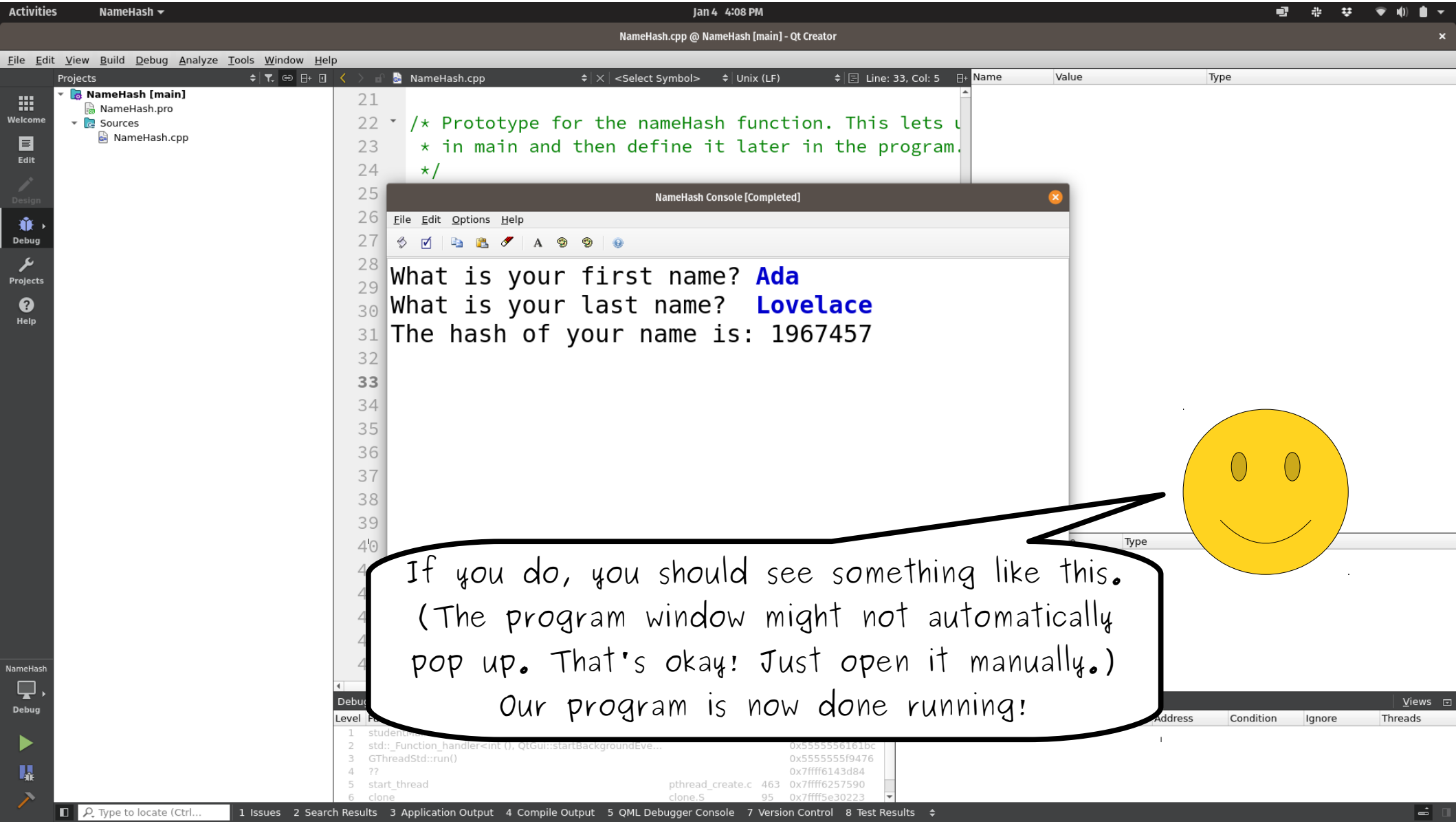

Activities
Qt Creator
Jan 4 4:02 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
Line: 31, Col: 5
19 #include "simpio.h"
20 using namespac
21
22 /* Prototype f
23 * in main and
24 */
25 int nameHash(s
26
27 int main() {
28 string first
29 string last = getLine("What is your last name?
30
31 int hashValue = nameHash(first, last);
32
33 cout << "The hash of your name is: " << hashVal
34 return 0;
35 }
36
37 /* This is the actual function that computes the ha
38 * to talk more about what hash functions do later
39 * the meantime, think of it as a function that scr
40 * of the input and produces a number.
41 *
42 * For those of you who are more mathematically inc
43 * treats each character in the input name as a num
Name Value Type
returned value 1967457 int
Name Value Type
What's happened is that we've just returned from nameHash with a value, but since we're going through the program one step at a time, we haven't actually assigned that value to hashValue yet!
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped: "function-finished". Views
Level Function File Line Address
1 studentMain NameHash.cpp 31 0x5555555b6595
2 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
3 GThreadStd::run() 0x5555555f9476
4 ?? 0x7ffff6143d84
5 start_thread pthread_create.c 463 0x7ffff6257590
6 clone clone.S 95 0x7ffff5e30223
Number Funct File Line Address Condition Ignore Threads
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results


Let's do a "Step Over" so that we can finish executing this line. Click "Step Over," and if you did everything right…

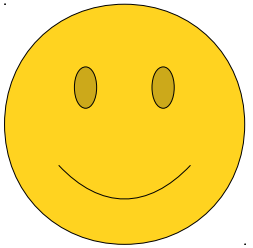

Activities
Qt Creator
Jan 4 4:07 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
<Select Symbol>
Unix (LF)
Line: 33, Col: 5
21
22 /* Prototype for the nameHash function. This lets u
23 * in main and then de in the program.
24 */
25 int nameHash(s
26
27 int main() {
28 string fir
29 string las
30
31 int hashValue = nameHash(first, last);
32
33 cout << "The hash of your name is: " << hashVal
34 return 0;
35 }
36
37 /* This is the actual function that computes the ha
38 * to talk more about what hash functions do later
39 * the meantime, think of it as a function that scr
40 * of the input and produces a number.
41 *
42 * For those of you who are more mathematically inc
43 * treats each character in the input name as a num
44 * It then uses them as coefficients in a polynomia
45 * F_p, where p is a large prime number, and evalua
Name Value Type
first "Ada" std::string
hashValue 1967457 int
last "Lovelace" std::string
Name Value Type
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped: "end-stepping-range". Views
Level Function File Line Address
1 studentMain NameHash.cpp 33 0x5555555b65b3
2 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
3 GThreadStd::run() 0x5555555f9476
4 ?? 0x7ffff6143d84
5 start_thread pthread_create.c 463 0x7ffff6257590
6 clone clone.S 95 0x7ffff5e30223
Number Funct File Line Address Condition Ignore Threads
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results
… you should see the right value get stored (notice it's in red!) and we've moved to the next line.

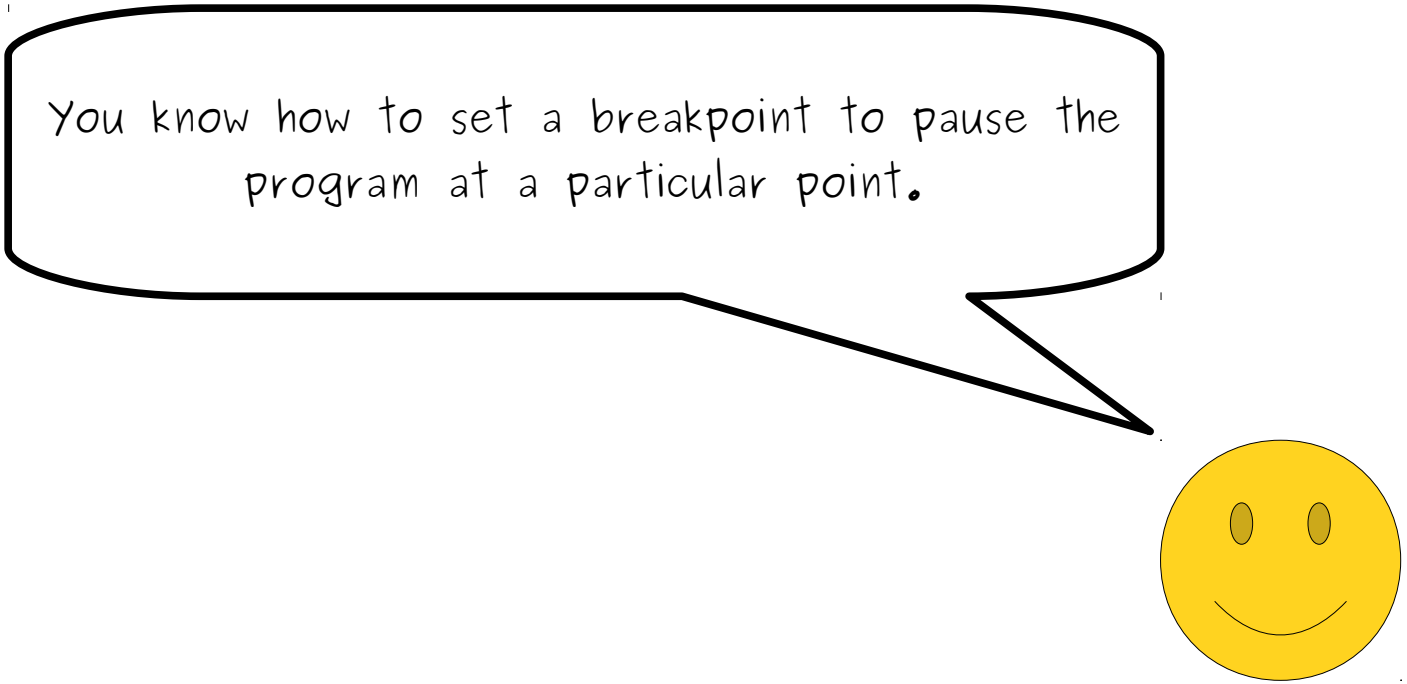

Activities
Qt Creator
Jan 4 4:07 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash
Debug
NameHash.cpp
Line: 33, Col: 5
21
22 /* Prototype f
23 * in main and
24 */
25 int nameHash(s
26
27 int main() {
28 string fir
29 string last = ge
30
31 int hashValue = nameHash(first, last);
32
33 cout << "The hash of your name is: " << hashVal
34 return 0;
35 }
36
37 /* This is the actual function that computes the ha
38 * to talk more about what hash functions do later
39 * the meantime, think of it as a function that scr
40 * of the input and produces a number.
41 *
42 * For those of you who are more mathematically inc
43 * treats each character in the input name as a num
44 * It then uses them as coefficients in a polynomia
45 * F_p, where p is a large prime number, and evalua
Name Value Type
first "Ada" std::string
Name Value Type
Debugger GDB for "NameHash" Threads: #12 NameHash Stopped: "end-stepping-range". Views
Level Function File Line Address
1 studentMain NameHash.cpp 33 0x5555555b65b3
2 std::_Function_handler<int (), QtGui::startBackgroundEve... 0x5555556161bc
3 GThreadStd::run() 0x5555555f9476
4 ?? 0x7ffff6143d84
5 start_thread pthread_create.c 463 0x7ffff6257590
6 clone clone.S 95 0x7ffff5e30223
Number Funct File Line Address Condition Ignore Threads
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results
At this point, we've seen just about everything we care about. Rather than single-stepping all the way to the end, let's just tell the program to keep on running.

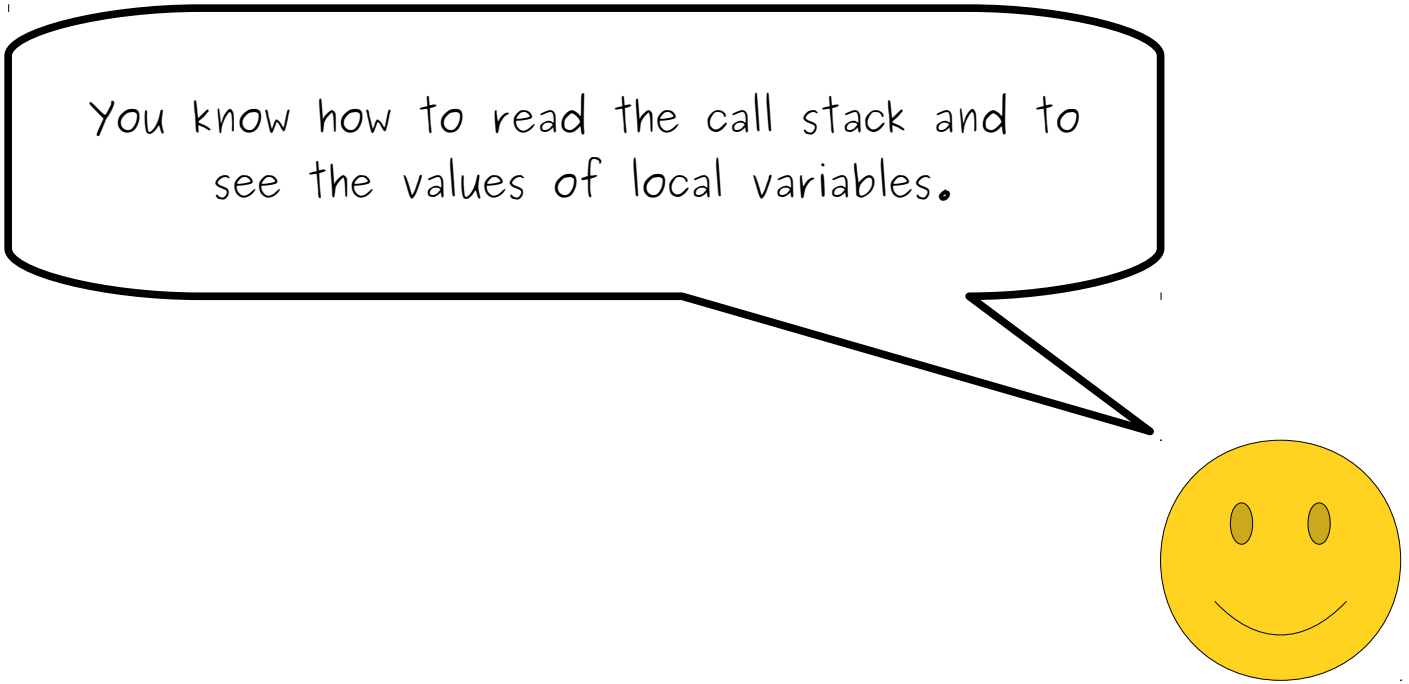

Activities
Qt Creator
Jan 4 4:07 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
Welcome
Edit
Design
Debug
Projects
Help
NameHash.cpp
<Select Symbol>
Unix (LF)
Line: 33, Col: 5
21
22 /* Prototype for the nameHash function. This lets u
23 * in main and then define it later in the program.
24 */
25 int nameHash(string first, string last);
26
27 int main() {
28 string first = getLine("What is your first name
29 string last = getLine("What is your last name?
30
31 int hashValue = nameHash(first, last);
32
33 cout << "The hash of your name is: " << hashVal
34 return 0;
35 }
36
37 /* This is the actual function that computes the h
38 * to talk more about what hash functions do later
39 * the meantime, think of it as a funct
40 * of the input and pred
Name Value Type
first "Ada" std::string
hashValue 1967457 int
last "Lovelace" std::string
Type
To do this, click on this button. If you hover over it, it says "Continue," and that button means "unpause the program and let it keep running from here."
NameHash
Debug
Stopped: "end-stepping-range".
Views
Funct File Line Address Condition Ignore Threads
Type to locate (Ctrl...
1 Issues 2 Search Results 3 Application Output 4 Compile Output 5 QML Debugger Console 7 Version Control 8 Test Results

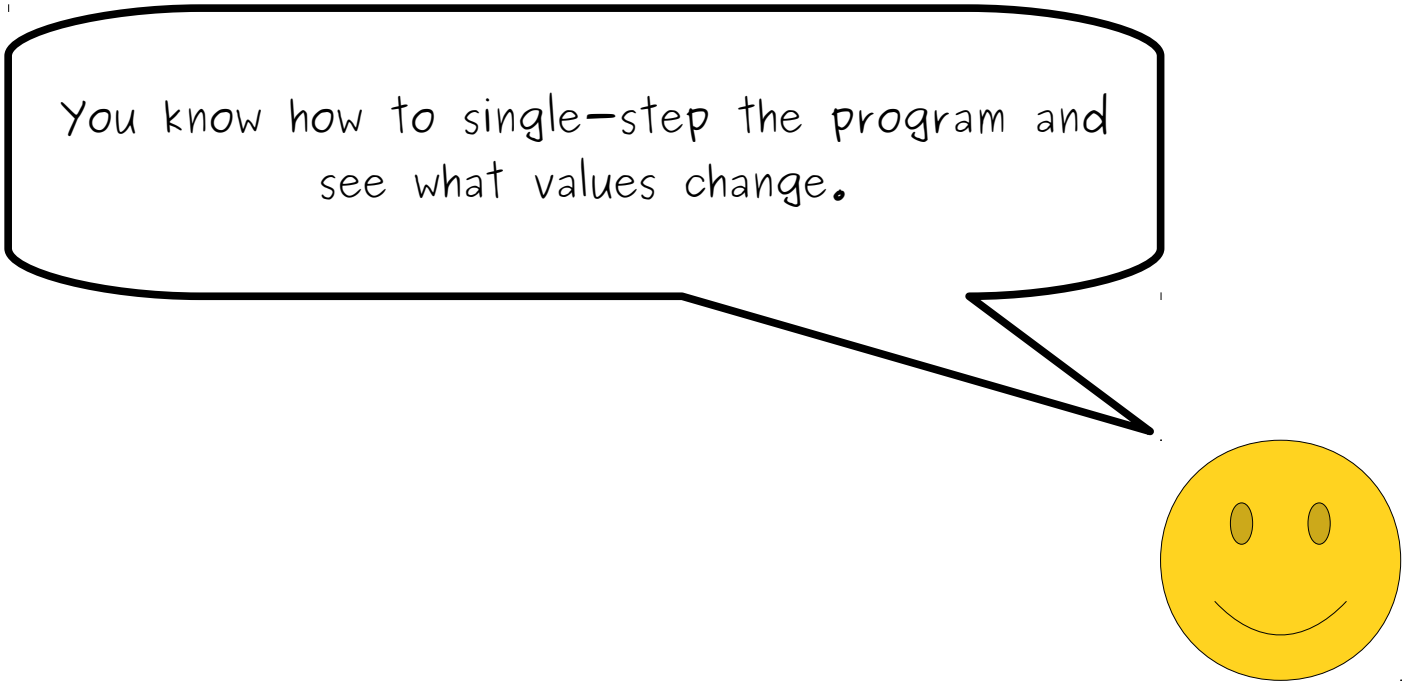

Activities
NameHash
Jan 4 4:08 PM
NameHash.cpp @ NameHash [main] - Qt Creator
File Edit View Build Debug Analyze Tools Window Help
Projects
NameHash [main]
NameHash.pro
Sources
NameHash.cpp
NameHash.cpp
<Select Symbol>
Unix (LF)
Line: 33, Col: 5
Name
Value
Type
/* Prototype for the nameHash function. This lets u
* in main and then define it later in the program.
*/
NameHash Console [Completed]
File Edit Options Help
What is your first name? Ada
What is your last name? Lovelace
The hash of your name is: 1967457
Address
Condition
Ignore
Threads
Views
Type to locate (Ctrl...
1 Issues
2 Search Results
3 Application Output
4 Compile Output
5 QML Debugger Console
7 Version Control
8 Test Results
If you do, you should see something like this.
(The program window might not automatically
pop up. That's okay! Just open it manually.)
Our program is now done running!

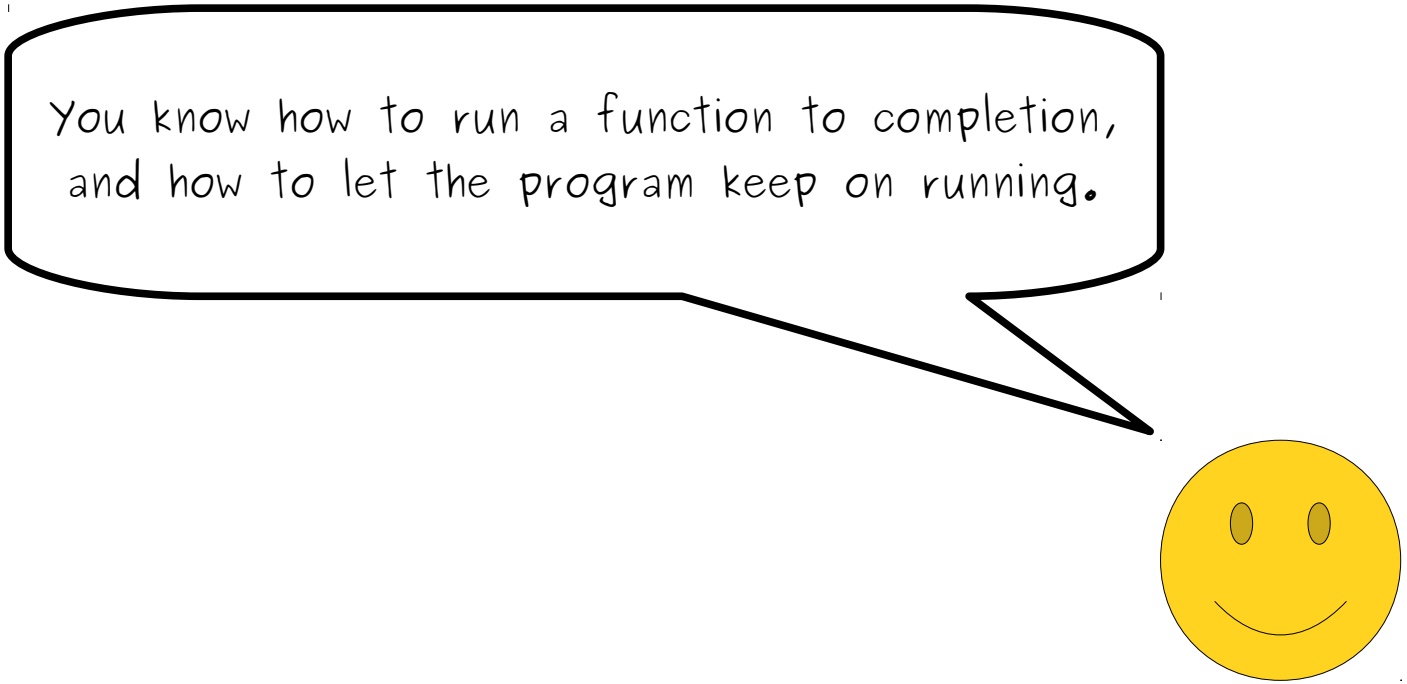
So there you have it! You've now gotten more familiar with the debugger!

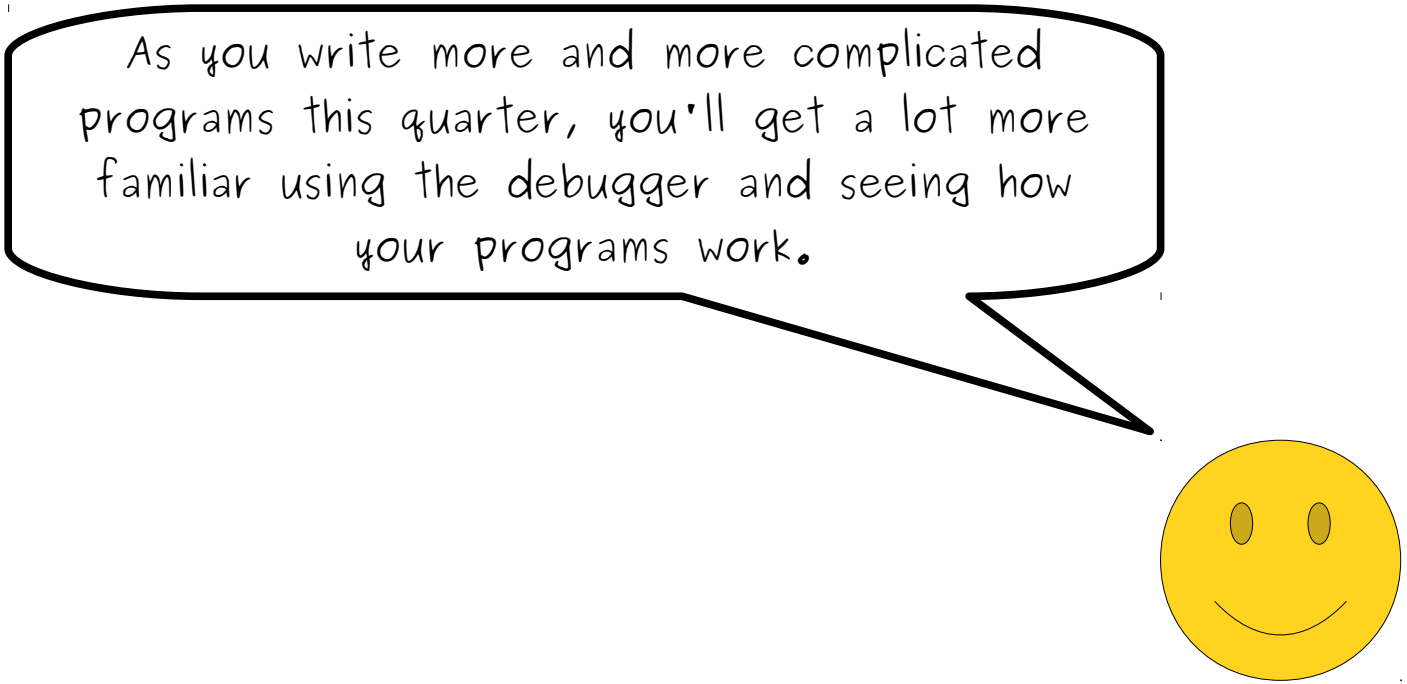


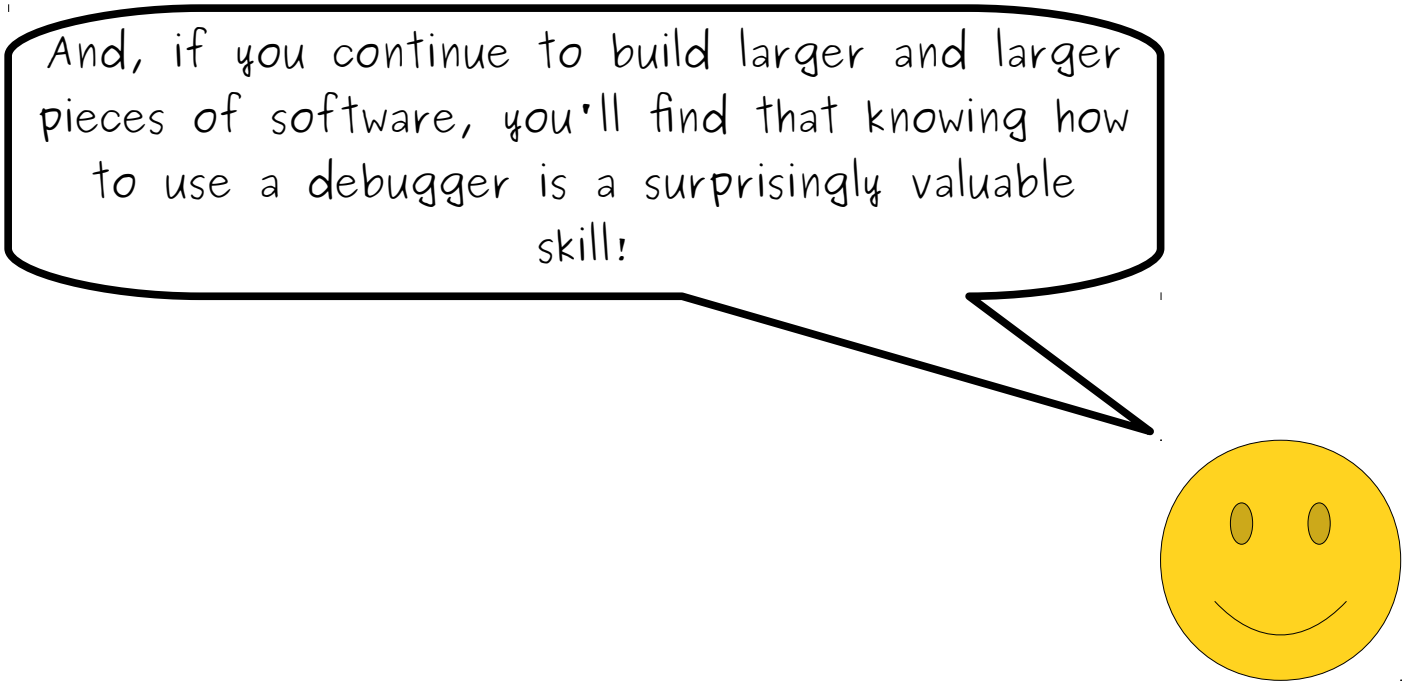

You know how to set a breakpoint to pause the program at a particular point.


You know how to read the call stack and to see the values of local variables.


You know how to single-step the program and see what values change.


You know how to run a function to completion,
and how to let the program keep on running.


As you write more and more complicated programs this quarter, you'll get a lot more familiar using the debugger and seeing how your programs work.


And, if you continue to build larger and larger pieces of software, you'll find that knowing how to use a debugger is a surprisingly valuable skill!


Hope this helps, and welcome to CS106B!