Swift's blog

C++ Tricks

By Swift, 9 months ago,

HOT UPDATE: Added tricks about REGEX, Raw Strings, User-defined Literals. As a whole new section!

WARNING: Many of these things belong to C++11 so use C++11 in order to test anything here :)

I just write a short version for this article, because it's now in the main page. I recommend you to click on "Read more »" and read more :) Here is a short trick for the short version:

I see lots of programmers write code like this one:

```
pair<int, int> p;
vector<int> v;
// ...
p = make_pair(3, 4);
v.push_back(4); v.push_back(5);
```

while you can just do this:

```
pair<int, int> p;
vector<int> v;
// ...
p = {3, 4};
v = {4, 5};
```

1. Assign value by a pair of {} to a container

I see lots of programmers write code like this one:

```
pair<int, int> p;
// ...
p = make_pair(3, 4);
```

while you can just do this:

```
pair<int, int> p;
// ...
p = {3, 4};
```

even a more complex `pair`

```
pair<int, pair<char, long long> > p;
// ...
p = {3, {'a', 8ll}};
```

What about `vector`, `deque`, `set` and other containers?

```
vector<int> v;
v = {1, 2, 5, 2};
for (auto i: v)
    cout << i << ' ';
cout << '\n';
// prints "1 2 5 2"
```

```
deque<vector<pair<int, int>>> d;
d = {{{3, 4}, {5, 6}}, {{1, 2}, {3, 4}}};
for (auto i: d) {
    for (auto j: i)
        cout << j.first << ' ' << j.second << '\n';
    cout << "-\n";
}
```

→ Pay attention

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Codeforces Round #327 (Div. 1)
6 days

Before contest
Codeforces Round #327 (Div. 2)
6 days

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4	rng_58	2941
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```
// prints "3 4
//         5 6
//         -
//         1 2
//         3 4
//         -"


set<int> s;
s = {4, 6, 2, 7, 4};
for (auto i: s)
    cout << i << ' ';
cout << '\n';
// prints "2 4 6 7"


list<int> l;
l = {5, 6, 9, 1};
for (auto i: l)
    cout << i << ' ';
cout << '\n';
// prints "5 6 9 1"


array<int, 4> a;
a = {5, 8, 9, 2};
for (auto i: a)
    cout << i << ' ';
cout << '\n';
// prints "5 8 9 2"


tuple<int, int, char> t;
t = {3, 4, 'f'};
cout << get<2>(t) << '\n';
```

Note that it doesn't work for `stack` and `queue`.

2. Name of argument in macros

You can use '#' sign to get exact name of an argument passed to a macro:

```
#define what_is(x) cerr << #x << " is " << x << endl;
// ...
int a_variable = 376;
what_is(a_variable);
// prints "a_variable is 376"
what_is(a_variable * 2 + 1)
// prints "a_variable * 2 + 1 is 753"
```

3. Get rid of those includes!

Simply use

```
#include <bits/stdc++.h>
```

This library includes many of libraries we do need in contest like `algorithm`, `iostream`, `vector` and many more. Believe me you don't need to include anything else!

4. Hidden function (not really hidden but not used often)

one)

```
__gcd(value1, value2)
```

You don't need to code Euclidean Algorithm for a gcd function, from now on we can use. This function returns gcd of two numbers.

e.g. __gcd(18, 27) = 9.

two)

```
__builtin_ffs(x)
```

This function returns 1 + least significant 1-bit of x. If x == 0, returns 0. Here x is `int`, this function with suffix 'l' gets a `long` argument and with suffix 'll' gets a `long long` argument.

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Swistakk → Marathon24 qualifications

Detailed →

e.g. __builtin_ffs(10) = 2 because 10 is '...10 **1** 0' in base 2 and first 1-bit from right is at index 1 (0-based) and function returns 1 + index.

three)

```
__builtin_clz(x)
```

This function returns number of leading 0-bits of x which starts from most significant bit position. x is `unsigned int` and like previous function this function with suffix 'l' gets a `unsigned long` argument and with suffix 'll' gets a `unsigned long long` argument. If x == 0, returns an undefined value.

e.g. __builtin_clz(16) = 27 because 16 is ' **...** 10000'. Number of bits in a `unsigned int` is 32. so function returns 32 — 5 = 27.

four)

```
__builtin_ctz(x)
```

This function returns number of trailing 0-bits of x which starts from least significant bit position. x is `unsigned int` and like previous function this function with suffix 'l' gets a `unsigned long` argument and with suffix 'll' gets a `unsigned long long` argument. If x == 0, returns an undefined value.

e.g. __builtin_ctz(16) = 4 because 16 is '...1 **0000** '. Number of trailing 0-bits is 4.

five)

```
__builtin_popcount(x)
```

This function returns number of 1-bits of x. x is `unsigned int` and like previous function this function with suffix 'l' gets a `unsigned long` argument and with suffix 'll' gets a `unsigned long long` argument. If x == 0, returns an undefined value.

e.g. __builtin_popcount(14) = 3 because 14 is '... **111** 0' and has three 1-bits.

Note: There are other `__builtin` functions too, but they are not as useful as these ones.

Note: Other functions are not unknown to bring them here but if you are interested to work with them, I suggest this website.

5. Variadic Functions and Macros

We can have a variadic function. I want to write a sum function which gets a number of ints, and returns sum of them. Look at the code below:

```
int sum() { return 0; }

template<typename... Args>
int sum(int a, Args... args) { return a + sum(args...); }

int main() { cout << sum(5, 7, 2, 2) + sum(3, 4); /* prints "23" */ }
```

In the code above I used a template. sum(5, 7, 2, 2) becomes 5 + sum(7, 2, 2) then sum(7, 2, 2), itself, becomes 7 + sum(2, 2) and so on... I also declare another sum function which gets 0 arguments and returns 0.

I can even define a any-type sum function:

```
int sum() { return 0; }

template<typename T, typename... Args>
T sum(T a, Args... args) { return a + sum(args...); }

int main() { cout << sum(5, 7, 2, 2) + sum(3.14, 4.89); /* prints "24.03" */ }
```

Here, I just changed `int` to `T` and added `typename T` to my template.

In C++14 you can also use `auto sum(T a, Args... args)` in order to get sum of mixed types. (Thanks to **slycelote** and **Corei13**)

We can also use variadic macros:

```
#define a_macro(args...) sum(args...)

int sum() { return 0; }

template<typename T, typename... Args>
auto sum(T a, Args... args) { return a + sum(args...); }

int main() { cout << a_macro(5, 7, 2, 2) + a_macro(3.14, 4.89); /* prints "24.03" */ }
```

Using these 2, we can have a great debugging function: (thanks to **Igorjan94**)

```
#include <bits/stdc++.h>
```

```
using namespace std;

#define error(args...) { vector<string> _v = split(#args, ','); err(_v.begin(), args); }

vector<string> split(const string& s, char c) {
	vector<string> v;
	stringstream ss(s);
	string x;
	while (getline(ss, x, c))
		v.emplace_back(x);
	return move(v);
}

void err(vector<string>::iterator it) {}
template<typename T, typename... Args>
void err(vector<string>::iterator it, T a, Args... args) {
	cerr << it -> substr((*it)[0] == ' ', it -> length()) << " = " << a << '\n';
	err(++it, args...);
}

int main() {
	int a = 4, b = 8, c = 9;
	error(a, b, c);
}
```

Output:

```
a = 4
b = 8
c = 9
```

This function helps a lot in debugging.

6. Here is C++0x in CF, why still C++?

Variadic functions also belong to C++11 or C++0x, In this section I want to show you some great features of C++11.

one) Range-based For-loop

Here is a piece of an old code:

```
set<int> s = {8, 2, 3, 1};
for (set<int>::iterator it = s.begin(); it != s.end(); ++it)
    cout << *it << ' ';
// prints "1 2 3 8"
```

Trust me, that's a lot of code for that, just use this:

```
set<int> s = {8, 2, 3, 1};
for (auto it: s)
    cout << it << ' ';
// prints "1 2 3 8"
```

We can also change the values just change `auto` with `auto &`:

```
vector<int> v = {8, 2, 3, 1};
for (auto &it: v)
    it *= 2;
for (auto it: v)
    cout << it << ' ';
// prints "16 4 6 2"
```

two) The Power of `auto`

You don't need to name the type you want to use, C++11 can infer it for you. If you need to loop over iterators of a set<pair<int, pair<int, int> > > from begin to end, you need to type `set<pair<int, pair<int, int> > >::iterator` for me it's so suffering! just use auto it = s.begin()

also x.begin() and x.end() now are accessible using begin(x) and end(x).

There are more things. I think I said useful features. Maybe I add somethings else to post. If you know anything useful please share with Codeforces community :)

From **Ximera**'s comment:

this code:

```
for(i = 1; i <= n; i++) {
    for(j = 1; j <= m; j++)
        cout << a[i][j] << " ";
    cout << "\n";
}
```

is equivalent to this:

```
for(i = 1; i <= n; i++)
    for(j = 1; j <= m; j++)
        cout << a[i][j] << " \n"[j == m];
```

And here is the reason: `" \n"` is a `char*` , `" \n"[0]` is `' '` and `" \n"[1]` is `'\n'` .

From **technetium28**'s comment:

Usage of `tie` and `emplace_back` :

```
#define mt make_tuple
#define eb emplace_back
typedef tuple<int,int,int> State; // operator< defined

int main(){
  int a,b,c;
  tie(a,b,c) = mt(1,2,3); // assign
  tie(a,b) = mt(b,a); // swap(a,b)

  vector<pair<int,int>> v;
  v.eb(a,b); // shorter and faster than pb(mp(a,b))

  // Dijkstra
  priority_queue<State> q;
  q.emplace(0,src,-1);
  while(q.size()){
    int dist, node, prev;
    tie(dist, ode, prev) = q.top(); q.pop();
    dist = -dist;
    // ~~ find next state ~~
    q.emplace(-new_dist, new_node, node);
  }
}
```

And that's why `emplace_back` faster: `emplace_back` is faster than `push_back` 'cause it just construct value at the end of vector but `push_back` construct it somewhere else and then move it to the vector.

Also in the code above you can see how `tie(args...)` works. You can also use `ignore` keyword in `tie` to ignore a value:

```
tuple<int, int, int, char> t (3, 4, 5, 'g');
int a, b;
tie(b, ignore, a, ignore) = t;
cout << a << ' ' << b << '\n';
```

Output: `5 3`

I use this macro and I love it:

```
#define rep(i, begin, end) for (__typeof(end) i = (begin) - ((begin) > (end)); i != (end)
- ((begin) > (end)); i += 1 - 2 * ((begin) > (end)))
```

First of all, you don't need to name the type you want to use. Second of all it goes forwards and backwards based on (begin > end) condition. e.g. `rep(i, 1, 10)` is 1, 2, ..., 8, 9 and `rep(i, 10, 1)` is 9, 8, ..., 2, 1

It works well with different types e.g.

```
vector<int> v = {4, 5, 6, 4, 8};
rep(it, end(v), begin(v))
    cout << *it << ' ';
// prints "8 4 6 5 4"
```

Also there is another great feature of C++11, lambda functions!

Lambdas are like other languages' closure. It defines like this:

```
[capture list](parameters) -> return value { body }
```

one) Capture List: simple! We don't need it here, so just put `[]`

two) parameters: simple! e.g. int x, string s

three) return value: simple again! e.g. pair<int, int> which can be omitted most of the times (thanks to **Jacob**) four) body: contains function bodies, and returns return value.

e.g.

```
auto f = [] (int a, int b) -> int { return a + b; };
cout << f(1, 2); // prints "3"
```

You can use lambdas in `for_each`, `sort` and many more STL functions:

```
vector<int> v = {3, 1, 2, 1, 8};
sort(begin(v), end(v), [] (int a, int b) { return a > b; });
for (auto i: v) cout << i << ' ';
```

Output:

```
8 3 2 1 1
```

From **Igorjan94**'s comment:

Usage of `move`:

When you work with STL containers like `vector`, you can use `move` function to just move container, not to copy it all.

```
vector<int> v = {1, 2, 3, 4};
vector<int> w = move(v);

cout << "v: ";
for (auto i: v)
    cout << i << ' ';

cout << "\nw: ";
for (auto i: w)
    cout << i << ' ';
```

Output:

```
v:
w: 1 2 3 4
```

As you can see `v` moved to `w` and not copied.

7. C++0x Strings

one) Raw Strings (From **IvayloS**'s comment)

You can have UTF-8 strings, Raw strings and more. Here I want to show raw strings. We define a raw string as below:

```
string s = R"(Hello, World!)"; // Stored: "Hello, World!"
```

A raw string skips all escape characters like `\n` or `\"`. e.g.

```
string str = "Hello\tWorld\n";
string r_str = R"(Hello\tWorld\n)";
cout << str << r_str;
```

Output:

```
Hello   World
Hello\tWorld\n
```

You can also have multiple line raw string:

```
string r_str =
R"(Dear Programmers,
I'm using C++11
Regards, Swift!)";
cout << r_str;
```

Output:

```
Dear Programmer,
I'm using C++11
Regards, Swift!
```

two) Regular Expressions (regex)

Regular expressions are useful tools in programming, we can define a regular expression by `regex` e.g. `regex r = "[a-z]+";`. We will use raw string for them because sometimes they have `\` and other characters. Look at the example:

```
regex email_pattern(R"(^[a-zA-Z0-9_.+-]+@[a-zA-Z0-9-]+\.[a-zA-Z0-9-.]+$)"); // This email
pattern is not totally correct! It's correct for most emails.

string
valid_email("swift@codeforces.com"),
invalid_email("hello world");

if (regex_match(valid_email, email_pattern))
    cout << valid_email << " is valid\n";
else
    cout << valid_email << " is invalid\n";

if (regex_match(invalid_email, email_pattern))
    cout << invalid_email << " is valid\n";
else
    cout << invalid_email << " is invalid\n";
```

Output:

```
swift@codeforces.com is valid
hello world is invalid
```

Note: You can learn Regex in this website.

three) User-defined literals

You already know literals from C++ like: `0xA`, `1000ll`, `3.14f` and so on...

Now you can have your own custom literals! Sounds great :) So let's see an example:

```
long long operator "" _m(unsigned long long literal) {
        return literal;
}

long double operator "" _cm(unsigned long long literal) {
        return literal / 100.0;
}

long long operator "" _km(unsigned long long literal) {
        return literal * 1000;
}

int main() {
        // See results in meter:
        cout << 250_m << " meters \n"; // Prints 250 meters
        cout << 12_km << " meters \n"; // Prints 12000 meters
        cout << 421_cm << " meters \n"; // Prints 4.21 meters
}
```

Note that a literal should start with an underscore (`_`). We declare a new literal by this pattern:

```
[returnType] operator "" _[name]([parameters]) { [body] }
```

note that parameters only can be one of these:

`(const char *)`

`(unsigned long long int)`

`(long double)`

`(char)`

`(wchar_t)`

`(char16_t)`

`(char32_t)`

`(const char *, size_t)`

`(const wchar_t *, size_t)`

`(const char16_t *, size_t)`

`(const char32_t *, size_t)`

Literals also can used with templates.

To be continued :)

c++, c++0x, tricks

+970 | Swift | 9 months ago | 127

Comments (127)

Write comment?

ConfusedGuy
9 months ago, # | +7

Its awesome. Thanks Swift :)

→ Reply

slycelote
9 months ago, # | +7

Your `sum` function returns an incorrect result for `sum(1, 1.5)`. To fix, declare the return type as `auto`.

→ Reply

Swift
9 months ago, # ^ | ← Rev. 2 +5

My sum function designed to sum numbers from one type. I mean integers, doubles, ... not mix of these types. BTW, How should I use auto in that function?

I mean you can't have a `auto` return type for any function as far as I know.

→ Reply

slycelote
9 months ago, # ^ | +6

http://ideone.com/6l4Wc7

→ Reply

Swift
9 months ago, # ^ | +5

Interesting! my Xcode can't compile that code. I'll edit blog post.

Thank you.

→ Reply

EeOneGuy
9 months ago, # ^ | +5

Why not? http://pastie.org/9817864

→ Reply

Swift
9 months ago, # ^ | ← Rev. 2 +5

Your code has `decltype` (actually because of `->`). Xcode won't compile code without it. However IDEONE compiles it. So I edited my post.

→ Reply

nic11
9 months ago, # ^ | +5

Isn't `decltype` C++14?

→ Reply

Swift
9 months ago, # ^ | +5

I suppose not.

→ Reply

Determinism
9 months ago, # | ← Rev. 2 +5

It's better to use auto& in range-based loop when the object is not primitive (e.g pair, vector). UPD: I realized that you mention it at the end, but there are some code written poorly because of that in the first part.

→ Reply

Swistakk

9 months ago, # | +18

"these things are belong to C++11" — https://www.youtube.com/watch?v=8fvTxv46ano :)

→ Reply

Swift

9 months ago, # ^ | 0

LMAO =))

→ Reply

Swistakk

9 months ago, # | +4

mukel already has written nice "C++11 for dummies" tutorial http://codeforces.com/blog/entry/10124 . I think it's a good idea to provide that link directly in entry.

→ Reply

Swift

9 months ago, # ^ | 0

Excellent tutorial, I'll add it at top of blog.

→ Reply

IWillBeRed

9 months ago, # | +10

Could you give link to compiler that you use? Because I get CE on my GNU 4.7.1:)

→ Reply

Swift

9 months ago, # ^ | ← Rev. 2 +5

In CF, use `GNU C++0x 4` instead of `GNU C++ 4.7` .

Get latest GCC, and from your terminal/cmd use one of these flags `-std=gnu++11` or `-std=c++11` You can download it for your computer: Windows —

→ Reply

shashanktandon

9 months ago, # | 0

Thanks for such a nice explanation...

→ Reply

fushar

9 months ago, # | +5

Anyone knows how to include <bits/stdc++.h> on OS X? I am already using gcc but it cannot found that header...

→ Reply

Swift

9 months ago, # ^ | 0

1. Go to: `/Applications/Xcode.app/Contents/Developer/Toolchains/XcodeDefault.xctoolchain/usr/include/c++/v1`
2. Create a folder named `bits`
3. Add a file into that named `stdc++.h`
4. Edit it and include libraries

→ Reply

J4T8Z9

9 months ago, # ^ | 0

yeah, that works, I did the same :)

→ Reply

9 months ago, # ^ | 0

What is the content of the file (stdc++.h)?

→ Reply

fushar

Swift

9 months ago, # ^ | 0

Here: https://gist.github.com/eduarc/6022859

→ Reply

fushar

9 months ago, # ^ | 0

Ah, forgot to say. Thank you! It worked :)

→ Reply

josemanuel101

9 months ago, # ^ | ← Rev. 2 0

Thanks for sharing! Works like a breeze. For those who don't have Xcode, but have the command line developer tools installed, go to: `/Library/Developer/CommandLineTools/usr/include/c++/v1` in step one.

→ Reply

Corei13

9 months ago, # | +4

The second sum function (with `auto`) is `C++14` standard, not `C++11` . `C++11` doesn't allow function without a return type.

→ Reply

Swift

9 months ago, # ^ | 0

Thanks for sharing your knowledge to us! That's why Xcode couldn't compile that. Now I tested it with C++14 and everything is OK. So let's make it clear in blog.

→ Reply

Corei13

9 months ago, # ^ | +32

And it is still possible to write sum (or other) functions for mixed type using `std::common_type`

```
template <typename A, typename B>
auto sum(A a, B b) -> typename common_type<A, B>::type {
    return static_cast<typename common_type<A, B>::type>(a) +
static_cast<typename common_type<A, B>::type>(b);
}

template <typename A, typename B, typename... Args>
auto sum(A a, B b, Args... args) -> typename common_type <A,
B, Args...>::type {
    return sum(sum(a, b), args...);
}

int main() {
    cout << sum(5, 7, 2, 2) + sum(3.14, 4.89) << endl;      //
24.03
    cout << sum (complex <double>(1, 2), 1.3, 2) << endl;   //
(4.3,2)
}
```

→ Reply

Swift

9 months ago, # ^ | +65

→ Reply

Baklazan

9 months ago, # | +3

As for `__gcd()` , it may be a little tricky at some compilers.

→ Reply

na2a

9 months ago, # | ← Rev. 2 +30

The best thing is that you can write like this (C++11 vs C++) :D

```
vector<pair<int, int>> v;
```

instead of this

```
vector<pair<int, int> > v;
```

→ Reply

Swift

9 months ago, # ^ | 0

Yep. I also do this in my post: `deque<vector<pair<int, int>>> d;`

→ Reply

Ximera

9 months ago, # | ← Rev. 2 +31

May be you can tell something more about this

```
for(i = 1; i <= n; i++) {
    for(j = 1; j <= m; j++)
        cout << a[i][j] << " ";
    cout << "\n";
}

for(i = 1; i <= n; i++)
    for(j = 1; j <= m; j++)
        cout << a[i][j] << " \n"[j == m];
```

→ Reply

Swift

9 months ago, # ^ | ← Rev. 3 +32

Well, Great creativity :)

`" \n"` is a char*, " \n"[0] is ' ' and " \n"[1] is '\n'.

Also this is a correct one too:

```
for (int i = 1; i <= n; i++)
                for (int j = 1; j <= m; j++)
                        cout << a[i][j] << (j == m)[" \n"];
```

It's because e.g. a[8] and 8[a] are the same thing both of them are (a + 8)* and (8 + a)*.

→ Reply

GiveMinus

9 months ago, # ^ | -13

→ Reply

The comment is hidden because of too negative feedback, click here to view it

Ximera

9 months ago, # ^ | 0

Actually `" \n"[j == m]` was correct, but that doesn't matter at all now :)

→ Reply

Swift

9 months ago, # ^ | 0

Oops! You're right!

→ Reply

9 months ago, # ^ | +1

For a while, I thought that this is Iverson's bracket :D

saadtaame

For a while, I thought that this is Iverson's bracket :D

→ Reply

technetium28

9 months ago, # | ← Rev. 2 +14

Do you know tie and emplace ?

```
#define mt make_tuple
#define eb emplace_back
typedef tuple<int,int,int> State; // operator< defined

int main(){
  int a,b,c;
  tie(a,b,c) = mt(1,2,3); // assign
  tie(a,b) = mt(b,a); // swap(a,b)

  vector<pair<int,int>> v;
  v.eb(a,b); // shorter and faster than pb(mp(a,b))

  // Dijkstra
  priority_queue<State> q;
  q.emplace(0,src,-1);
  while(q.size()){
    int dist, node, prev;
    tie(dist, ode, prev) = q.top(); q.pop();
    dist = -dist;
    // ~~ find next state ~~
    q.emplace(-new_dist, new_node, node);
  }
}
```

→ Reply

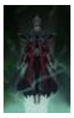
Swift

9 months ago, # ^ | 0

Such a great feature.

`emplace_back` is faster than `push_back` 'cause it just construct value at the end of vector but `push_back` construct it somewhere else and then move it to the vector.

→ Reply


HekpoMaH

9 months ago, # | 0

Can you get the previous element in an, let's say, vector using `auto` ? Here is why `auto` is not the best option for dp-like tasks where you need information from the previous elements.

→ Reply

Swift

9 months ago, # ^ | ← Rev. 3 +4

Use this approach:

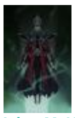
```
vector<int> dp = {4, 5, 6, 4, 8};
for (auto i = ++dp.begin(); i != dp.end(); ++i)
    *i += *(i - 1);
for (auto i: dp)
    cout << i << '\n';
```

Output:

```
4
9
15
19
27
```

Use range-based for-loop only when you want exact element, when you need to access other elements use normal for-loop, but this doesn't mean that you can't use auto in that for-loop.

→ Reply


HekpoMaH

9 months ago, # ^ | 0

Hm, I didn't know it could be done. Still, it is easier with normal for loop.

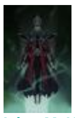
→ Reply

Swift

9 months ago, # ^ | ← Rev. 3 +3

Btw, using `auto` is just for inferring type you are working with. If your type is `int` , it's better to use that ('cause it's just 3 characters) but if your type is `std::vector<std::pair<std::set<int>, bool>>::iterator` so I think using `auto` is a must :)

→ Reply



HekpoMaH

9 months ago, # ^ | 0

XD yeah I agree about this one.

→ Reply

rlac

9 months ago, # | +13

In 2, I use:

```
#define DB(x) cerr << __LINE__ << ": " << #x << " = " << (x) << endl
```

In this way I get the number of the line in which this instruction is executed. It's useful when we have more than one variable with the same name. Also, x needs to be enclosed in parenthesis due to operators precedence.

→ Reply

ammgh

9 months ago, # | 0

would you please tell me about vector ,i don't know anything about that !

→ Reply

yarak

9 months ago, # ^ | ← Rev. 2 0

vector

→ Reply

yzmyyff

9 months ago, # | 0

Its useful! Thanks for sharing.

→ Reply

Determinism

9 months ago, # | ← Rev. 2 +6

You say that "Variadic functions also belong to C++11", but that's not really correct. Even C had variadic functions. New feature in C++11 is variadic templates.

→ Reply

Swift

9 months ago, # ^ | +3

Yeah. You're right. Here I used variadic template so I said it's for C++11.

→ Reply

Baklazan

9 months ago, # | +1

I thing you should consider defining short version of your blog post, now that it is on the main page.

→ Reply

Swift

9 months ago, # ^ | 0

OK. I'll do it.

→ Reply

kien_coi_1997

9 months ago, # | +27

In my country, at this time, we are not allowed to use C++11 in national contest.

→ Reply

I_love_Hoang_Yen

9 months ago, # ^ | 0

Is C++11 being used in IOI? If this is the case, I guess it should not be hard to convince the judge committee to change.

→ Reply

Tensor

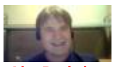
9 months ago, # | 0

if i have a vector < pair<int, pair<int, int> > > a;

could i use emplace_back to insert {1, {2, 3} }? i tries to emplace_back(1, 2, 3); but of course it's an error.

thanks in advance :-)

→ Reply


AlexDmitriev

9 months ago, # ^ | 0

You could emplace_back(1, mp(2,3))

→ Reply

Tensor

9 months ago, # ^ | 0

thank you for replying. i was looking forward for a method like that above something like (1, 2, 3); as i don't like using macros, something that's faster to write.

thanks in advance :)

→ Reply

Swift

9 months ago, # ^ | 0

Don't use `pair<int, pair<int, int>>` ! Code less and use `tuple<int, int, int>` :

```
vector<tuple<int, int, int>> v;
v.emplace_back(1, 2, 3);
```

→ Reply

Baklazan

9 months ago, # ^ | +3

Well, actually sometimes `pair<int, pair<int,int> > x;` may make more sense than `tuple<int,int,int> x;` , for instance when `x.second` are coordinates of some point and `x.first` is some property of this point.

→ Reply

Swift

9 months ago, # ^ | ← Rev. 2 +10

When working with tuples, you don't really use get(tuple) you do use tie:

```
tie(point_property, pointx, pointy) = some_tuple;
```

And that makes sense.

→ Reply

AlexDmitriev

9 months ago, # ^ | 0

then you probably have that point as a variable, not as two coordinates.

→ Reply

Baklazan

9 months ago, # ^ | 0

I often use

```
#define X first
#define Y second
#define pii pair<int, int>

pii point;
```

→ Reply

Rubanenko

9 months ago, # ^ | +25

Yeah let's write ugly unreadable code with nested pairs and macros instead of class/struct.

→ Reply

Baklazan

9 months ago, # ^ | +8

I totally agree that classes/structs are more readable. I just wanted to point out that in some cases `tuple<int,int,int>` is less readable (at least for me) than `pair<int, pair<int,int> >` .

→ Reply

AkshajK

9 months ago, # | 0

Thanks for this! I'm sure many of us would also be interested in a Java tricks article! :)

→ Reply

Rubanenko

9 months ago, # ^ | +38

The advantage of Java is that there are no tricks.

→ Reply

Swift

9 months ago, # ^ | ← Rev. 2 0

I can also write an article about **Swift**'s tricks. But no one here, cares about that language :)

→ Reply

Igorjan94

9 months ago, # | ← Rev. 2 +3

your debugging function doesn't work for `#args` with spaces
so, I think it's better to rewrite split to more universal

```
vector<string> split(const string& s, char c) {
    vector<string> v;
    stringstream ss(s);
    string x;
    while (getline(ss, x, c))
        v.eb(x); //emplace_back
    return std::move(v);
}
```

(Note no copying because of move, another cpp trick)
and macro will be:

```
#define err(args...) {\
    vector<string> _v = split(#args, ',');\
    err(_v.begin(), args);\
}
```

→ Reply

Swift

9 months ago, # ^ | 0

It also brings default space before arguments, e.g. `err(a, b)` outputs:

```
a = value1
 b = value2
```

but it's better for arguments like `a + b` so I'll replace it with my code.

→ Reply

Igorjan94

9 months ago, # ^ | ← Rev. 3 0

oh, yep, I forgot I changed your err to

```
void err(vector<string>::iterator it) {}
template<typename T, typename... Args>
void err(vector<string>::iterator it, T a, Args... args) {
        cerr << it->substr((*it)[0] == ' ') << " = " << a <<
'\n';
        err(++it, args...);
}
```

→ Reply

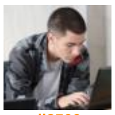
9 months ago, # ^ | 0

if you are interested in it, I also have writeln and readln on variadic templates, which helps to write smth like this:

```
int n; vector<pair<int, pair<int, long long>>> a; long long l;
char c; string s; double d; // just any combination of
fundamental types + vector/pair
readln(n, a, l, c, s, d);
writeln(n, a, l, c, s, d);
```

Igorjan94

you can find it here 9388829(I deleted all spaces for more compact view)
if trailing space is unimportant, half of code can be deleted:)
it can be simply extended on user's types by overloading ostream and istream operators
this template is with cin/cout, and this->9316393 with scanf/printf
yes, looks awful, and for only prewritten use:)
→ Reply


dj3500

9 months ago, # ^ | +6

Actually this use of `std::move` is superfluous. The compiler will move the return value automatically (search for: return value optimization).
→ Reply

Jacob

9 months ago, # | ← Rev. 3 +1

One can omit return type in lambda expression in most cases.

P.S. I have to say, 'tie' looks awesome, I need to start using it.
→ Reply

9 months ago, # | +4

You haven't to specify return type in lambda functions if all return values are the same type.

```
auto f1 = [](int a, int b) {return a < b;}; // ok: return type is bool

auto f2 = [](int a, double b) {
             if (a == 0)
                 return b;
             else
                 return a;}; // error: is return type double or int?

auto f3 = [](int a, double b)->double {
             if (a == 0)
                 return b;
              else
                 return a;}; // ok: return type is double

auto f4 = [](double a, double b) {
             if (a < 0)
                 return a;
             else
                 return pow(a, b);}; // ok: return type is double
```

Kvark161

see more about lambda functions
→ Reply

9 months ago, # | +1

you can even write your own recursive functions inside the main in lambdas, that's really cool and useful for less code.

Tensor

But here instead of using auto you should specify the return type and the parameters type of the lambda expression.

see my submission here
→ Reply

9 months ago, # | 0
Thanks. Useful information.

anthonycherepkov

Thanks. Useful information.
→ Reply

Ehsan.Poursaeed

9 months ago, # | 0

Thank you so much :) I learned a lot :D
→ Reply

CFpolice

9 months ago, # | -16

+669 for vain' blog !why?
→ Reply

Swift

9 months ago, # ^ | 0

You are **GiveMinus**! Both of you have a comment "give a kiss baby :)"

give a kiss baby :)
→ Reply

Xellos

9 months ago, # ^ | +21

+726 for a lot of useful info, that's why.
→ Reply

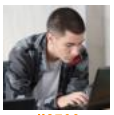
jon-536

9 months ago, # | ← Rev. 20 +9

```
warning: ISO C does not permit named variadic macros [-Wvariadic-macros]
#define error(args...)
                  ^
```

could write:

```
#define error(...) { vector<string> _v = split(#__VA_ARGS__, ','); 
err(_v.begin(), __VA_ARGS__);}
```
→ Reply



dj3500

9 months ago, # | 0

The example which is now given for `move` (define `w = move(v)` and then output contents of `v`) is actually undefined behaviour. What the compiler will actually do in this situation is just swap the contents of the two vectors (`v` with the empty `w`); however, in theory `v` is now "junk" and should not be touched at all (it can not even be a vector with arbitrary contents, but just something referring to some arbitrary place in memory, which might, in theory, no longer correspond to any correct contents of a vector, and it can do basically anything when its methods (such as the range-based for loop) are called).
→ Reply

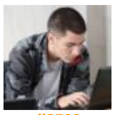
Bukreyev

9 months ago, # ^ | +25

http://cplusplus.com/reference/vector/vector/operator=

"The move assignment (2) moves the elements of x into the container (x is left in an unspecified **but valid state**)."

We'd better call `v.clear()` after `w = move(v)` to bring `v` to a determinate (empty, actually) state. And then we can access it.
→ Reply



dj3500

9 months ago, # ^ | 0

Didn't know that. Thanks for the correction!
→ Reply

9 months ago, # | ← Rev. 2 0

Variadic functions and macros are awesome. Now I've got unique functions for debug, input and output, no more gi2, gi3, ... !!!

sparks

output, no more g12, g13, ...
→ Reply

9 months ago, # | ← Rev. 3 +20

IvayloS

I like the string literals fucntionality. Sometime it can make code much simpler, especially for competitions:

```
#include <iostream>
using namespace std;

int main() {
        string test = R"END(
                let's test a multiline string
                that can have special chars like ''
                or even ""
                and not to forget \
                and no need to escape!
                This rocks !)END";
        cout << test << endl;
        return 0;
}
```

And the result on ideone can be seen here.
→ Reply

Swift

9 months ago, # ^ | 0

I didn't know about this! Thank you. Could you please write a tutorial about this, I'll move it to this post.
→ Reply

IvayloS

9 months ago, # ^ | +5

c++11 also introduces a set of new string literals. Some of them are really useful for professional programming, but not very helpful for competitions(like UTF-8, UTF-16 and UTF-32 literals) and thus they are not that much of an interest(you can read about them in the wiki article that I link to). However one type of string literal is particularly interesting — the raw string literal. To write a raw string literal you need to prefix the opening quotes with R and immediately after the quotes you should write some delimiter, the delimiter can be a string of up to 16 characters and should not contain whitespace or control characters, You should terminate the string with the same delimiter before the closing quote and also the string should be in brackets(after the delimiter). Here is an example usage:

```
int main() {
        string test = R"END(
                let's test a multiline string
                that can have special chars like ''
                or even ""
                and not to forget \
                and no need to escape!
                This rocks !
                )END";
        cout << test << endl;
        return 0;
}
```

And the output can be seen here.

Note that the string can span multiple lines and that you don't need to escape special characters in it. In this case I use END as my delimiter.
→ Reply

9 months ago, # | ← Rev. 4 +17

Following is also useful for GCC. Very fast ASM bit operations:

Note, that **offset** can be >=32, any valid offset will work. However, I didn't know if inline assembly allowed in CF. Should work.

```
/* Read bit and set to zero */
inline bool btr (volatile void * mem, size_t offset) {
        bool result;
        __asm__ (
                "btr %2, %1; setc %0;"
                : "=r" (result), "+m" (* (volatile long *) mem)
                : "=r" (result), "+m" (* (volatile long *) mem)
                : "r" (offset)
                : "cc");
        return result;
}

/* Read bit and set to one */
inline bool bts (volatile void * mem, size_t offset) {
        bool result;
        __asm__ (
                "bts %2, %1; setc %0;"
                : "=r" (result), "+m" (* (volatile long *) mem)
                : "r" (offset)
                : "cc");
        return result;
}

/* Bit value */
inline bool bittest (volatile void * mem, size_t offset) {
        bool result;
        __asm__ (
                "bt %1, %2; setc %0;"
                : "=r" (result)
                : "r" (offset), "m" (* (volatile long *) mem)
                : "cc");
        return result;
}

/* Set bit to one */
inline void bitset1 (volatile void * mem, size_t offset) {
        __asm__ ("bts %1, %0;" : "+m" (* (volatile long *) mem) : "r"
(offset) : "cc");
}

/* Set bit to zero */
inline void bitset0 (volatile void * mem, size_t offset) {
        __asm__ ("btr %1, %0;" : "+m" (* (volatile long *) mem) : "r"
(offset) : "cc");
}
```

MyHandleIsStolen

→ Reply

andreyv

9 months ago, # ^ | 0

Why do you need `volatile` everywhere?

→ Reply

MyHandleIsStolen

9 months ago, # ^ | ← Rev. 2 0

Just to make sure that value is actually changed. It gives information to the compiler that memory is changed indirectly (inside **asm** block), to avoid unexpected optimizations. Modern compilers have aggressive optimizations. If you used some value from memory, compiler probably saved it to intermediate register. Let's imagine, that you then called bitset on that memory and used value again. Compiler may decide: "Ok, he didn't even touched that **mem** variable, I'll use the old value". But it's wrong. You changed it inside **asm** block. Everything inside **asm** — direct instructions to processor, compiler doesn't know what you are doing there.

→ Reply

andreyv

9 months ago, # ^ | +11

Yes, GCC does not know what is inside the asm block. However, GCC does know which variables are used and modified — you specified this yourself in the asm block input/output operands! In particular, `"+m"` should tell GCC that this variable/location in memory is read and modified.

You can see that GCC indeed reloads the value as it should here: http://goo.gl/Jz8SYH. If GCC thought the variable was unmodified, it would do

```
movl    $31, %eax
```

instead (comment out the `btr()` call to see this).

Bottom line: `volatile` is not needed in correct code. The only valid uses for `volatile` I can think of are signal handler flags and hardware registers that are mapped in memory.

hardware registers that are mapped in memory.
→ Reply

MyHandleIsStolen

9 months ago, # ^ | 0

Well, it seems like `volatile` is indeed redundant in this case. Clobber "+m" should take care of all things. I put it there just in case. Because redundant information isn't a problem, but lack of information is. `volatile` also comes in handy in multithreaded programs, when you are messing up with custom synchronization/locking technique. Actually anything that involves shared memory involves volatile somehow. In regular programs volatile rarely used, because everything is already written (like synchronization primitives/threadsafe data structures...) and program uses high-level functions for this.
→ Reply

andreyv

9 months ago, # ^ | +8

I'm sorry for being a nerd, but `volatile` can't be used to implement thread synchronization primitives too. Even `volatile sig_atomic_t` won't do. You are confusing `volatile` with atomic operations, which are two different things.
→ Reply

IvayloS

9 months ago, # | 0

Please note that regex is part of the standard but it is not part of g++(at least prior to 4.9). Have a look here. I'm not 100% sure but I think code with regex will not compile on codeforces.
→ Reply

AlexDmitriev

9 months ago, # ^ | 0

actually, regex's compile fine on g++4.6 or 4.7 (I don't remember) but they just worked incorrectly.
→ Reply

IvayloS

9 months ago, # ^ | 0

As is mentioned in the bug I relate to, some of the functionality is not working as expected and some of not implemented at all. As per the comments in the bug I think this is fixed in 4.9. However I think codeforces uses an earlier version.
→ Reply

Chaze

9 months ago, # | 0

array<int, 4> a; a = {5, 8, 9, 2};

This code fails on c++11 compilation with error error: no match for 'operator=' in 'a' no known conversion for argument 1 from '' to 'const std::array<int, 4ul>&'

Need additional braces a = {{5, 8, 9, 2}};
→ Reply

levonog

9 months ago, # | ← Rev. 3 -19

I use some tricks too, for example:

Input in vector n elements:

`for ( int i = 0 ; i < n ; cin >> vec [ i++ ] );`

Or analog of:

```
for(i = 1; i <= n; i++) {
    for(j = 1; j <= m; j++)
        cout << a[i][j] << " ";
    cout << "\n";
}
```

//

```
for(i = 1; i <= n; i++ , cout << endl)

    for(j = 1; j <= m; j++)
    for(j = 1; j <= m; j++)
        cout << a[i][j] << " ";
```
→ Reply

nic11

9 months ago, # ^ | +14

I would call it not a C++ trick, but a creative way to use for in C++. It's indeed shorter (just a little), but the code is unreadable IMHO.
→ Reply

multisystem

9 months ago, # |

This is really priceless!

Just another two tricks that might help.

```
std::string to_string( int value ); // Converts a numeric value to std::string.
```

```
int stoi( const std::string& str, std::size_t* pos = 0, int base = 10 ); // Interprets a signed integer value in the strin
```

For more information, review std::to_string and std::stoi.
→ Reply

TERMINATOR_228

9 months ago, # | +1

Thanks, very interesting. Let's do blogs like this often!
→ Reply

xpertcoder

9 months ago, # | ← Rev. 2 0

Can someone tell what I am doing wrong with trick `__builtin_popcount` where it's written `function with suffix 'l' gets a unsigned long argument and with suffix 'll' gets a unsigned long long argument` in this problem

485C - Bits

Solution 9506498 gives WA because of overflow.
→ Reply

sparik

9 months ago, # ^ | +1

`1ll<<i`
→ Reply

xpertcoder

9 months ago, # ^ | 0

Thanks man!! and after that contest I cursed `__builtin_popcount` for making me lose points :P .

I wonder then what is the difference between `__builtin_popcount` and `__builtin_popcountll` as both solution give AC. I thought `__builtin_popcount` should give wrong result if I send long long as an argument.

9506854 --> __builtin_popcountll

and 9506856 __builtin_popcount
→ Reply

Alsh_compiler

9 months ago, # | 0

please show us some tricks in swift language :D :D
→ Reply

hepic1

8 months ago, # | 0

One of the best quick C++/STL tutorials,I have ever read. Congratulations to people who helped for this tut.
→ Reply

8 months ago, # | ← Rev. 2 +11

It is not part of c++11(only one of this), but useful cpp functions

It is not part of c++11(only one of this), but useful cpp functions

```
    vector<int> a(n), b(n), c(n);
    iota(a.begin(), a.end(), 1); //c++11
// a = 1..10
    random_shuffle(a.begin(), a.end());
// a = random permutation of a
    partial_sum(a.begin(), a.end(), b.begin());
// b[i] = sum(a[j], j <= i)
    adjacent_difference(a.begin(), a.end(), c.begin());
// c[i] = a[i] - (i == 0 ? 0 : a[i - 1])
    cout << accumulate(a.begin(), a.end(), 123) << "\n";
// x = 123 + sum(a[i])
    cout << inner_product(a.begin(), a.end(), b.begin(), 234) << "\n";
// x = 234 + sum(a[i] * b[i])
```

Igorjan94

All functions have two iterators as input, some of them have outputIterators and init values. All operators, used in these functions can be user-defined or standard:

```
    cout << accumulate(a.begin(), a.end(), 1, multiplies<int>()) << "\n";
// x = product(a[i])
// foldl in functional languages
    adjacent_difference(a.begin(), a.end(), c.begin(), [](int a, int b)
{return a * b;});
// c[i] = a[i] * (i == 0 ? 1 : a[i - 1])
```

These functions are defined in <numeric>
→ Reply

8 months ago, # | ← Rev. 3 +3

hepic1

Swift ,I think you forgot a semicolon in your perfect tutorial,right here:

"""""" auto f = [] (int a, int b) -> int { return a + b; } ..HERE.. cout << f(1, 2); // prints "3" """"""
→ Reply

8 months ago, # ^ | 0

Swift

Thanks, now corrected.
→ Reply

8 months ago, # | +11

PrinceOfPersia

Using `complex` , `p.real() = x` or `cin >> p.real()` don't work in C++11 but they do in C++98.
→ Reply

8 months ago, # ^ | 0

Swift

You can use `p.real(x)` in C++11. I don't know any way to `cin` real.
→ Reply

8 months ago, # | 0

saadtaame

Here is a trick that might interest you. In C++, a class can inherit from a template instantiation of itself. So you can write `class X: vector<X> {...};` for example. Class X inherits the members of vector and you can use this trick to implement multidimensional arrays, tries, and other useful data structure without using pointers. More here.
→ Reply

8 months ago, # | ← Rev. 2 -11

AKP

C++11 Tricks or Traps?

One should not use this:

```
    vector<int> s(5);
    for(int i=0;i<5;i++) s[i]=(101*i)%37;
    for(int z:s) cout<<s[z]<<' ';
```

instead of this:

```
    vector<int> s(5);
    for(int i=0;i<5;i++) s[i]=(101*i)%37;
```

```
for(int z=0;z<s.size();z++) cout<<s[z]<<' ';
```

or, am I missing something?
→ Reply

8 months ago, # ^ | ← Rev. 2 +8

natsukagami

```
for(int z:s) cout<<s[z]<<' ';
```

should be

```
for(int z:s) cout<< z <<' ';
```

→ Reply

8 months ago, # ^ | 0

AKP

Oh I see, misunderstood that, thanks.
→ Reply

8 months ago, # ^ | 0

Swift

You trapped in your own mistake!
→ Reply

6 months ago, # | 0

Annaqeeb

`for(auto& e: ...)` will cause compile error on `vector<bool>` . use universal reference instead: `for(auto&& e: ...)`
→ Reply

5 months ago, # | 0

yhylord

There is a tiny typo in the section 6, dijkstra's part: `tie(dist, ode, prev) = q.top(); q.pop();`

should be: `tie(dist, node, prev) = q.top(); q.pop();`
→ Reply