Tuples

Tuples extend the principles of a pair to a broader perspective. Find out more in this lesson.

WE'LL COVER THE FOLLOWING

You can create tuples of arbitrary length and types with std::tuple. The class template needs the header `<tuple>`. `std::tuple` is a generalization of `std::pair`. You can convert between tuples with two elements and pairs. The tuple has, like his younger brother `std::pair`, a default, a copy, and a move constructor. You can swap tuples with the function `std::swap`.

The i-th element of a tuple t can be referenced by the function template `std::get`: `std::get<i-1>(t)`. By `std::get<type>(t)` you can directly refer to the element of the type `type`.

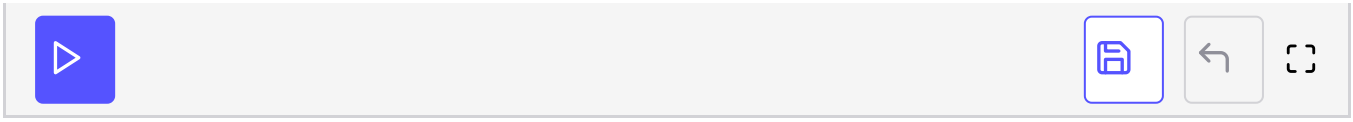
Tuples support the comparison operators `==`, `!=`, `<`, `>`, `<=` and `>=`. If you compare two tuples, the elements of the tuples will be compared lexicographically. The comparison starts at index 0.

std::make_tuple

The helper function std::make_tuple is quite convenient for the creation of tuples. You don't have to provide the types. The compiler automatically deduces them.

```
// tuple.cpp
#include <iostream>
#include <tuple>
using std::get;

int main(){
  std::tuple<std::string, int, float> tup1("first", 3, 4.17f);
  auto tup2= std::make_tuple("second", 4, 1.1);
```

```
  std::cout << get<0>(tup1) << ", " << get<1>(tup1) << ", "
            << get<2>(tup1) << std::endl; // first, 3, 4.17

  std::cout << get<0>(tup2) << ", " << get<1>(tup2) << ", "
            << get<2>(tup2) << std::endl; // second, 4, 1.1

  std::cout << (tup1 < tup2) << std::endl; // true

  get<0>(tup2)= "Second";

  std::cout << get<0>(tup2) << "," << get<1>(tup2) << ","
            << get<2>(tup2) << std::endl;  // Second, 4, 1.1

  std::cout << (tup1 < tup2) << std::endl; // false

  auto pair= std::make_pair(1, true);
  std::tuple<int, bool> tup= pair;

  return 0;
}
```



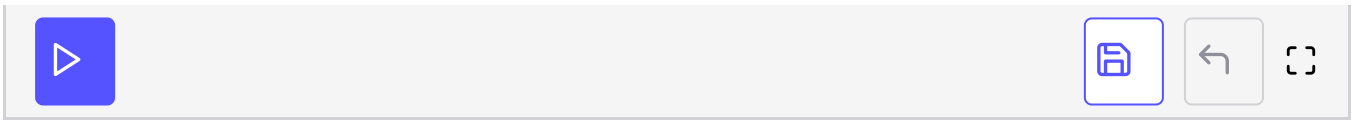
The helper function `std::make_tuple`

std::tie and std::ignore

std::tie enables you to create tuples, whose elements reference variables. With std::ignore you can explicitly ignore elements of the tuple.

```
// tupleTie.cpp
#include <iostream>
#include <tuple>
using namespace std;

int main(){
  int first= 1;
  int second= 2;
  int third= 3;
  int fourth= 4;

  cout << first << " " << second << " "
       << third << " " << fourth << endl;          // 1 2 3 4

  auto tup= tie(first, second, third, fourth)      // bind the tuple
        = std::make_tuple(101, 102, 103, 104);   // create the tuple
                                                   // and assign it
  cout << get<0>(tup) << " " << get<1>(tup) << " " << get<2>(tup)
       << " " << get<3>(tup) << endl;              // 101 102 103 104

  cout << first << " " << second << " " << third << " "
       << fourth << endl;                          // 101 102 103 104

  first= 201;
  get<1>(tup)= 202;
```

```
  cout << get<0>(tup) << " " << get<1>(tup) << " " << get<2>(tup)
       << " " << get<3>(tup) << endl;              // 201 202 103 104

  cout << first << " " << second << " " << third << " "
       << fourth << endl;                          // 201 202 103 104

  int a, b;
  tie(std::ignore, a, std::ignore, b)= tup;
  cout << a << " " << b << endl;                   // 202 104

  return 0;
}
```



The helper functions `std::tie` and `std::ignore`

Now, let’s move on to reference wrappers.