- Examples

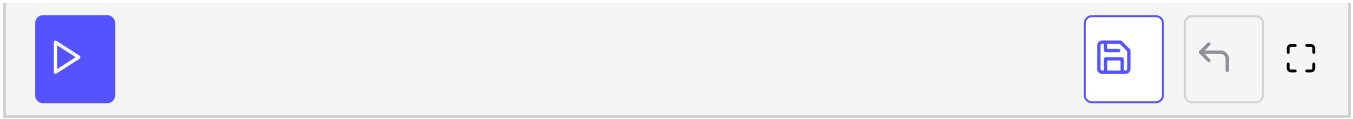
Let's take a look at some examples of function templates in this lesson.

WE'LL COVER THE FOLLOWING

Example 1: Templates in Functions

```
// templateFunctionsTemplates.cpp

#include <iostream>
#include <string>
#include <vector>

template <typename T>
void xchg(T& x, T& y){
  T t = x;
  x =y;
  y =t;
}

template <int N>
int nTimes(int n){
  return N * n;
}

int main(){

  std::cout << std::endl;

  bool t = true;
  bool f = false;
  std::cout << "(t, f):  (" << t << ", " << f << ") "<< std::endl;
  xchg(t, f);
  std::cout << "(t, f):  (" << t << ", " << f << ") "<< std::endl;

  std::cout << std::endl;

  int int2011 = 2011;
```

```
  int int2014 = 2014;
  std::cout << "(int2011, int2014):  (" << int2011 << ", " << int2014 << ") "<< std::endl;
  xchg(int2011, int2014);

  std::cout << "(int2011, int2014):  (" << int2011 << ", " << int2014 << ") "<< std::endl;

  std::cout << std::endl;

  std::string first{"first"};
  std::string second{"second"};
  std::cout << "(first, second):  (" << first << ", " << second << ") "<< std::endl;
  xchg(first, second);
  std::cout << "(first, second):  (" << first << ", " << second << ") "<< std::endl;

  std::cout << std::endl;
  std::vector<int> intVec1{1, 2, 3, 4, 5};
  std::vector<int> intVec2{5, 4, 3, 2, 1};

  std::cout << "vec1: ";
  for (auto v: intVec1)std::cout  << v << " ";
  std::cout << "\nvec2: ";
  for (auto v: intVec2)std::cout << v << " ";
  std::cout << std::endl;
  xchg(intVec1, intVec2);

  std::cout << "vec1: ";
  for (auto v: intVec1)std::cout  << v << " ";
  std::cout << "\nvec2: ";
  for (auto v: intVec2)std::cout << v << " ";
  std::cout << std::endl;


  std::cout << "\n\n";

  std::cout << "nTimes<5>(10): " << nTimes<5>(10) << std::endl;
  std::cout << "nTimes<10>(5): " << nTimes<10>(5) << std::endl;

  std::cout << std::endl;
}
```



Explanation

In the example above, we've declared two function templates: `xchg` and `nTimes` in lines 8 and 15. `xchg` swaps the values passed as arguments. The only non-type we use is `N` in the function template `nTimes`. `nTimes` returns `N` times the number passed as `n`. We have initialized multiple instances to check for functions in lines 31 and 32, lines 39 and 40, and lines 46 and 47.

Example 2: Overloading Function Templates

```
// templateFunctionsTemplatesOverloading.cpp
```

```
#include <iostream>

void xchg(int& x, int& y){   // 1
  int t = x;
  x = y;
  y = t;
}


template <typename T>        // 2
void xchg(T& x, T& y){
  T t = x;
  x = y;
  y = t;
}

template <typename T>         // 3
void xchg(T& x, T& y, T& z){
  xchg(x, y);
  xchg(x, z);
}

int main(){

  std::cout << std::endl;

  int intA = 5;
  int intB = 10;
  int intC = 20;

  double doubleA = 5.5;
  double doubleB = 10.0;

  std::cout << "Before: " << intA << ", " << intB << std::endl;
  xchg(intA, intB);              // 1
  std::cout << "After: " << intA << ", " << intB << std::endl;

  std::cout << std::endl;

  std::cout << "Before: " << doubleA << ", " << doubleB << std::endl;
  xchg(doubleA, doubleB);        // 2
  std::cout << "After: " << doubleA << ", " << doubleB << std::endl;

  std::cout << std::endl;

  xchg<>(intA, intB);            // explicit 2
  xchg<int>(intA, intB);         // explicit 2: xchg<int>
  // xchg<double>(intA, intB);      // ERROR explicit xchg<double>

  std::cout << "Before: " << intA << ", " << intB << ", " << intC << std::endl;
  xchg(intA, intB, intC);        // 3
  std::cout << "After: " << intA << ", " << intB << ", " << intC << std::endl;

  std::cout << std::endl;
}
```

Explanation

Explanation

In the example above, we used the concept of function overloading by calling `xchg` with different arguments. We used the `xchg` function with different data types by passing two arguments and three arguments. In line 37, the non-template function is called, whereas, on all other calls to `xchg()`, the template function is used. The call `xchg<double, double>(intA, intB)` would be fine, when `xchg` takes its arguments by value.

In the next lesson, we'll solve an exercise related to function templates.