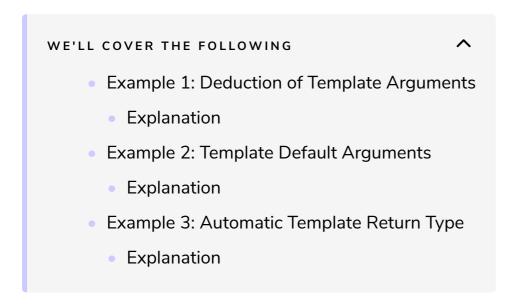
- Examples

Let's check out some examples of template arguments.



Example 1: Deduction of Template Arguments

```
// templateArgumentDeduction.cpp
                                                                                             G
#include <iostream>
template <typename T>
bool isSmaller(T fir, T sec){
  return fir < sec;</pre>
template <typename T, typename U>
bool isSmaller2(T fir, U sec){
  return fir < sec;</pre>
template <typename R, typename T, typename U>
R add(T fir, U sec){
  return fir + sec;
int main(){
  std::cout << std::boolalpha << std::endl;</pre>
  std::cout << "isSmaller(1,2): " << isSmaller(1,2) << std::endl;</pre>
  // std::cout << "isSmaller(1,5LL): " << isSmaller(1,5LL) << std::endl; // ERROR
  std::cout << "isSmaller<int>(1,5LL): " << isSmaller<int>(1,5LL) << std::endl;</pre>
```

```
std::cout << "isSmaller<double>(1,5LL): " << isSmaller<double>(1,5LL) << std::endl;
std::cout << std::endl;</pre>
std::cout << "isSmaller2(1,5LL): " << isSmaller2(1,5LL) << std::endl;</pre>
std::cout << std::endl;</pre>
std::cout << "add<long long int>(1000000,1000000): " << add<long long int>(1000000, 1000000
std::cout << "add<double,double>(1000000,1000000): " << add<double,double>(1000000, 1000000
std::cout << "add<double,double,float>(1000000,1000000): " << add<double,double,float>(1000
std::cout << std::endl;</pre>
```



Explanation

In the example above, we have defined 3 function templates

- isSmaller takes two arguments which have the same type and returns true if the first element is less than the second element (line 6). Invoking the function with arguments of different types would give a compile-time error (line 25).
- isSmaller2 takes two arguments which can have a different type. The function returns true if the first element is less than the second element (line 11).
- add takes two arguments which can have different types (line 16). The return type must be specified because it cannot be deduced from the function arguments.

Example 2: Template Default Arguments

```
// templateDefaultArgument.cpp
                                                                                           C)
#include <functional>
#include <iostream>
#include <string>
class Account{
public:
  explicit Account(double b): balance(b){}
  double getBalance() const {
    return balance;
private:
  double balance;
```

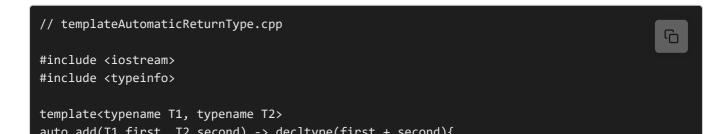
```
};
template <typename T, typename Pred= std::less<T> >
bool isSmaller(T fir, T sec, Pred pred= Pred() ){
  return pred(fir,sec);
int main(){
  std::cout << std::boolalpha << std::endl;</pre>
  std::cout << "isSmaller(3,4): " << isSmaller(3,4) << std::endl;</pre>
  std::cout << "isSmaller(2.14,3.14): " << isSmaller(2.14,3.14) << std::endl;
  std::cout << "isSmaller(std::string(abc),std::string(def)): " << isSmaller(std::string("abc</pre>
  bool resAcc= isSmaller(Account(100.0),Account(200.0),[](const Account& fir, const Account&
  std::cout << "isSmaller(Account(100.0),Account(200.0)): " << resAcc << std::endl;</pre>
  bool acc= isSmaller(std::string("3.14"),std::string("2.14"),[](const std::string& fir, cons
  std::cout << "isSmaller(std::string(3.14),std::string(2.14)): " << acc << std::endl;</pre>
  std::cout << std::endl;</pre>
```



Explanation

In the first example, we have passed only built-in data types. In this example, we have used the built-in types int, double, std::string in lines 26-28 and the Account class in line 30. The function template is Smaller is parametrized by a second template parameter, which defines the comparison criterion. The default for the comparison is the predefined function object std::less. A function object is a class for which the call operator (operator ()) is overloaded. This means that instances of function objects behave similar to functions. The Account class doesn't support the < operator. Thanks to the second template parameter, a lambda expression as in lines 30 and 33 can be used. This means two Account instances can be compared by their balance and strings by their number. stod converts a string to a double.

Example 3: Automatic Template Return Type



```
return first + second;
}
int main(){

std::cout << std::endl;

std::cout << "add(1, 1) = " << add(1,1) << std::endl;

std::cout << "typeid(add(1, 1)).name() = " << typeid(add(1, 1)).name() << std::endl;

std::cout << std::endl;

std::cout << "add(1, 2.1) = " << add(1, 2.1) << std::endl;

std::cout << "add(1, 2.1) = " << add(1, 2.1) << std::endl;

std::cout << "typeid(add(1, 2.1)).name() = " << typeid(add(1, 2.1)).name() << std::endl;

std::cout << "add(1000LL, 5) = " << add(1000LL, 5) << std::endl;

std::cout << "add(1000LL, 5)).name() = " << typeid(add(1000LL, 5)).name() << std::endl;

std::cout << std::endl;
}</pre>
```





[]

Explanation

The example has a function add which takes two arguments and returns their sum. The return type of the function is deduced by the compiler by applying the decltype operator on the sum of the arguments. The expression typeid(add(1, 2.1)).name() such as in line 21 returns a string representation of the type of the result.

We'll solve an exercise in the next lesson.