- Examples

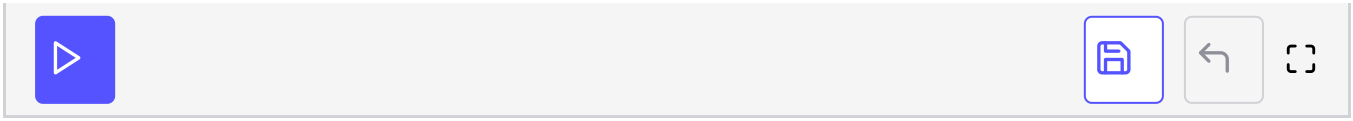
In this lesson, we'll learn about some examples of class templates.

WE'LL COVER THE FOLLOWING

Example 1: Templates in class

```
// templateClassTemplate.cpp

#include <iostream>

class Account{
public:
  explicit Account(double amount=0.0): balance(amount){}

  void deposit(double amount){
    balance+= amount;
  }

  void withdraw(double amount){
    balance-= amount;
  }

  double getBalance() const{
    return balance;
  }

private:
  double balance;
};

template <typename T, int N>
class Array{
```

```
public:
  Array()= default;
  int getSize() const;


private:
  T elem[N];
};

template <typename T, int N>
int Array<T,N>::getSize() const {
  return N;
}

int main(){

  std::cout << std::endl;

  Array<double,10> doubleArray;
  std::cout << "doubleArray.getSize(): " << doubleArray.getSize() << std::endl;

  Array<Account,1000> accountArray;
  std::cout << "accountArray.getSize(): " << accountArray.getSize() << std::endl;

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



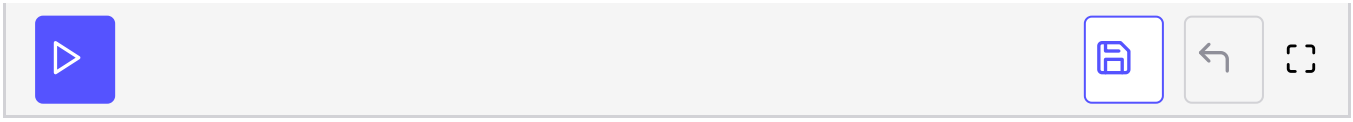
Explanation

We have created two `Array` class objects, `doubleArray` and `accountArray`, in lines 45 and 48. By calling the generic function `getSize()` in line 37, we can access the size of different objects.

Example 2: Inheritance in Class Templates

```
// templateClassTemplateInheritance.cpp

#include <iostream>

template <typename T>
class Base{
public:
  void func1() const {
    std::cout << "func1()" << std::endl;
  }
  void func2() const {
    std::cout << "func2()" << std::endl;
  }
  void func3() const {
    std::cout << "func3()" << std::endl;
  }
};
```

```
template <typename T>
class Derived: public Base<T>{
public:
  using Base<T>::func2;

  void callAllBaseFunctions(){
    this->func1();
    func2();
    Base<T>::func3();
  }
};

int main(){
  std::cout << std::endl;

  Derived<int> derived;
  derived.callAllBaseFunctions();

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



Explanation

We have implemented both a `Base` and a `Derived` class. `Derived` publicly inherits from `Base` and may, therefore, use its method `callAllBaseFunctions` in line 24, and the methods `func1`, `func2`, and `func3` from the `Base` class.

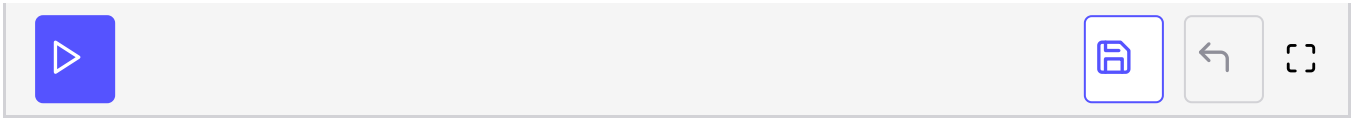
- **Make the name dependent:** The call `this->func1` in line 25 is dependent. In this case, the name lookup will consider all base classes.
- **Introduce the name into the current scope:** The expression `using Base<T>::func2` (line 22) introduces `func2` into the current scope.
- **Call the name fully qualified:** Calling `func3` fully qualified (line 27) will break virtual dispatch and may cause new surprises.

We have created a `Derived` class object named `derived`. By using this object, we can access the base class functions by calling the method `callAllBaseFunctions`.

Example 3: Methods in Class Templates

```
// templateClassTemplateMethods.cpp

#include <algorithm>
#include <iostream>
```

```
#include <vector>

template <typename T, int N>

class Array{

public:
  Array()= default;

  template <typename T2>
  Array<T, N>& operator=(const Array<T2, N>& arr){
    elem.clear();
          elem.insert(elem.begin(), arr.elem.begin(), arr.elem.end());
          return *this;
  }

  int getSize() const;

  std::vector<T> elem;
};

template <typename T, int N>
int Array<T, N>::getSize() const {
  return N;
}

int main(){

  Array<double, 10> doubleArray{};
  Array<int, 10> intArray{};

  doubleArray= intArray;

  Array<std::string, 10> strArray{};
  Array<int, 100> bigIntArray{};

  // doubleArray= strArray;            // ERROR: cannot convert ‘const std::basic_string<char
  // doubleArray= bigIntArray;         // ERROR: no match for ‘operator=’ in ‘doubleArray = b
}
```



Explanation

In the example above, we have initialized two instances of the `Array` class namely `doubleArray` and `intArray` in lines 32 and 33. We're using the generic `=` operator to copy the `intArray` elements to `doubleArray` in line 35. Looking carefully, note that the generic `=` is only applicable when both arrays have the same length.

In the next lesson, we have a small challenge to test our knowledge of class templates.