

**FINAL**

# Lab12 : Templates

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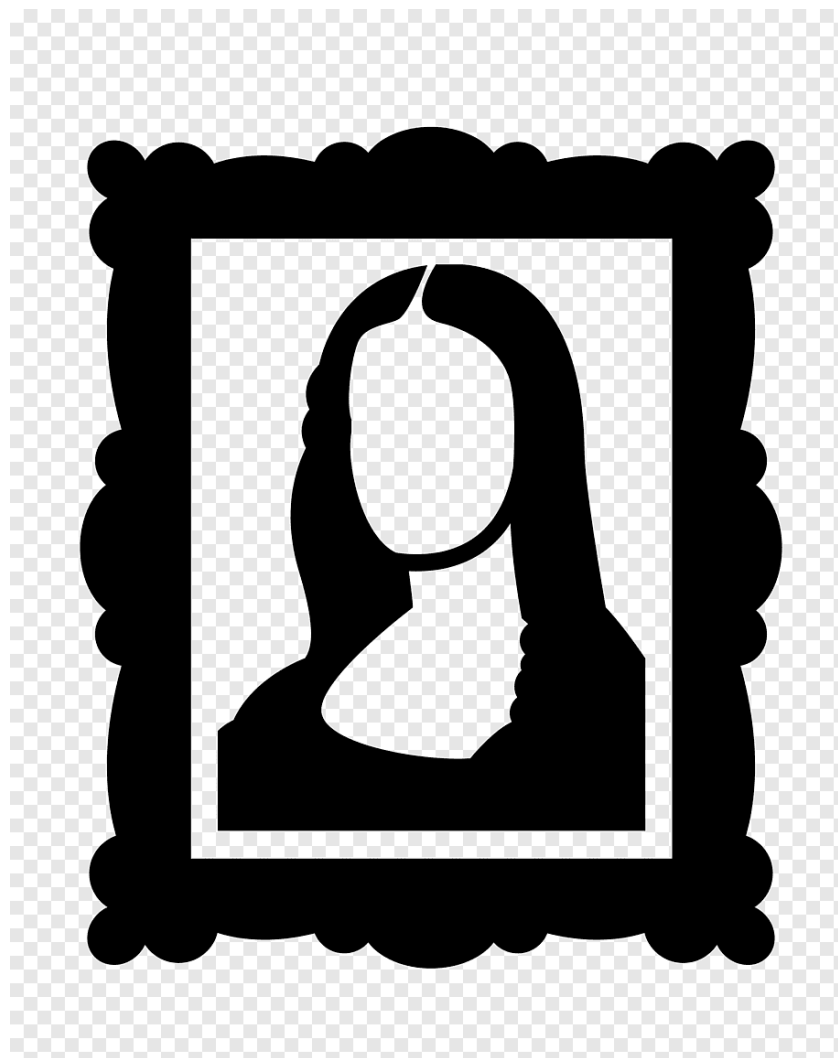
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# Template!



# Array Library from Lab 9

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```
1 #include <cstdlib>
2 #include <iostream>
3
4 int* construct_array(int n) {
5     int* a = (int*)std::malloc(n * sizeof(int));
6     return a;
7 }
8
9 void destroy_array(int* a) { std::free(a); }
10
11 void read_array(int* a, int n) {
12     std::cout << "Enter " << n << " numbers: ";
13     for (int i = 0; i < n; ++i) std::cin >> a[i];
14 }
15
16 void print_array(int* a, int n) {
17     for (int i = 0; i < n; ++i) std::cout << a[i] << ' ';
18     std::cout << '\n';
19 }
20
21 int* add_array(int* a, int* b, int n) {
22     int* c = construct_array(n);
23     for (int i = 0; i < n; ++i) c[i] = a[i] + b[i];
24     return c;
25 }
```

# Array Class from Lab 11

```
4 class Array {
5     int _size;
6     int* _data;
7
8 public:
9     Array(int size) {
10         _size = size;
11         _data = (int*)std::malloc(size * sizeof(int));
12     }
13
14     ~Array() { std::free(_data); }
15
16     void read() {
17         std::cout << "Enter " << _size << " numbers: ";
18         for (int i = 0; i < _size; ++i) std::cin >> _data[i];
19     }
20
21     void print() {
22         for (int i = 0; i < _size; ++i) std::cout << _data[i] << ' ';
23         std::cout << '\n';
24     }
25
26     void add(const Array& b) {
27         for (int i = 0; i < _size; ++i) _data[i] += b._data[i];
28     }
29
30     bool operator==(const Array& b) {
31         for (int i = 0; i < _size; ++i)
32             if (_data[i] != b._data[i]) return false;
33         return true;
34     }
35 };
```

# Problem: Array Template Class

```
43
44 int main() {
45     Array<int> a(3);
46     a.read();
47
48     Array<int> b(3);
49     b.read();
50
51     std::cout << "a == b: " << (a == b) << '\n';
52
53     a.add(b);
54     std::cout << "a += b: ";
55     a.print();
56 }
```

lab12.cpp

```
> g++ -std=c++11 lab12.cpp
> ./a.out
Enter 3 numbers: 1 2 3
Enter 3 numbers: 4 5 6
a == b: 0
a += b: 5 7 9
>
```

```
43
44 int main() {
45     Array<float> a(3);
46     a.read();
47
48     Array<float> b(3);
49     b.read();
50
51     std::cout << "a == b: " << (a == b) << '\n';
52
53     a.add(b);
54     std::cout << "a += b: ";
55     a.print();
56 }
```

lab12.cpp

```
> g++ -std=c++11 lab12.cpp
> ./a.out
Enter 3 numbers: .1 .2 .3
Enter 3 numbers: .1 .2 .3
a == b: 1
a += b: 0.2 0.4 0.6
>
```

# Solution

```
4 template <typename T>
5 class Array {
6     int _size;
7     T* _data;
8
9 public:
10    Array(int size) {
11        _size = size;
12        _data = (T*)std::malloc(size * sizeof(T));
13    }
14    ~Array() { std::free(_data); }
15
16    void read() {
17        std::cout << "Enter " << _size << " numbers: ";
18        for (int i = 0; i < _size; ++i) std::cin >> _data[i];
19    }
20
21    void print() {
22        for (int i = 0; i < _size; ++i) std::cout << _data[i] << ' ';
23        std::cout << '\n';
24    }
25
26    void add(const Array& b) {
27        for (int i = 0; i < _size; ++i) _data[i] += b._data[i];
28    }
29
30    bool operator==(const Array& b) {
31        for (int i = 0; i < _size; ++i)
32            if (_data[i] != b._data[i]) return false;
33        return true;
34    }
35 };
```

# Assignment

---

```
49
50 int main() {
51     Array<float> a(3);
52     a.read();
53
54     std::cout << "a.sum(): " << a.sum() << '\n';
55
56     std::cout << "a.max(): " << a.max() << '\n';
57 }
```

~  
~  
~  
~  
~  
~  
~

lab12.cpp [+]

```
> g++ -std=c++11 lab12.cpp
> ./a.out
Enter 3 numbers: 2.1 3.14 -2.1
a.sum(): 3.14
a.max(): 3.14
> █
```