

# C++

## Static members

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# Introduction

- There are two types of static members:
  - Static data member
  - Static method member
- Static members are shared between all the instances of a class: they do not belong to the objects but to the class

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# Static methods

- Static methods are like global function
- Static methods can access only static data (static methods do not have a **this** pointer)
- Calling a static method is done by prefixing its name by the class name and “::”
  - For a class A and a method f(): A::f();
- Like any other methods, static methods can access private data of the class

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# Example of usage

```
class A {
private:
    int _a;
public:
    A() : _a(0) {}
    static void f() {
        std::cout << "static method f" << std::endl;
    }
};

int main() {
    A::f(); // will print "static method f"
}
```

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## Static data

- Static variables (static data members) are shared among the instances of the class
- Static data members are similar to global variables but they have a better protection (provided by the class)
- A global variable is accessed by prefixing its name by the name of the class and “:.”
  - Example: for a class A and a static var \_a, it can be accessed by A::\_a;
- Static data members have the same protection mechanism as other data members. A private static data member can not be accessed from outside of the class
- Static data / method members are also called **class data / method**
- Static data members can not be initialized in the class definition. They must be defined outside of the class definition (for example in the class implementation (.cpp) file)

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## Example

```
// In file Cars.h
class Cars {
private:
    static int num_produced;

public:
    Cars() { num_produced++; }
    static int get_num_produced() {
        return num_produced;
    }
};
```

```
// In file Cars_main.cpp
#include "Cars.h"
int Cars::num_produced = 0;

int main() {
    cout << Cars::get_num_produced() << endl;
    Cars c1;
    cout << Cars::get_num_produced() << endl;
    Cars c2;
    cout << Cars::get_num_produced() << endl;
}
```

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## Example of usage

- Static methods can be used in the named constructor idiom
  - Ctors always have the same name of the class
  - Ctors differentiated by the parameter list
  - Sometimes we want to have different ctors but with the same number of parameters and same type

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## Named constructor idiom

We would like to have a class Point with two ctors:

- one to construct a point from Cartesian coord
- one to construct a point from Polar coord

```
class Point {
public:
    Point (float x, float y); // Cartesian coord
    Point (float r, float t); // Polar coord
    // Error: ambiguous ctor
};

int main() {
    Point p(1.0, 3.0); // ambiguous: which ctor ?
}
```

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# Named constructor idiom

```
class Point {  
public:  
    // construct a point from Cart coord  
    static Point createFromCart(float x, float y);  
    // construct a point from Polar coord  
    static Point createFromPolar (float r, float t);  
  
private:  
    Point(float x, float y); // Cart coord  
    float x, y; // Cart coord  
};  
  
int main() {  
    Point p1 = Point::createFromCart(1.0, 3.0);  
}
```

Named constructors