

Section 2.1 C++11

constexpr Functions

2. Just as with pointers, every **reference type** is a literal type irrespective of whether the type to which it refers is itself a literal type.

int&	int& is a <i>literal type</i>
T&	T& is a <i>literal type</i> (for any T).
T&&	T&& is a <i>literal type</i> (for any T).

3. A **class**, **struct**, or **union** is a literal type if it meets each of these four requirements.

- It has a **trivial destructor**.⁹
- Each **nonstatic data member** is a **nonvolatile literal type**.¹⁰
- Each base class is a **literal type**.
- There is some way to initialize an object of the type during constant evaluation; either it is an **aggregate type**, thereby affording **aggregate initialization**, or it has at least one **constexpr** constructor (possibly a template) that is not a *copy* or *move* constructor:

```
#include <string> // std::string
struct LiteralUDT
{
    static std::string s_cache;
    // OK, static data member can have a nonliteral type.

    int d_datum;
    // OK, nonstatic data member of nonvolatile literal type

    constexpr LiteralUDT(int datum) : d_datum(datum) { }
    // OK, has at least one constexpr constructor

    LiteralUDT() : d_datum(-1) { }
    // OK, can have nonconstexpr constructors

    // constexpr ~LiteralUDT() { } // not permitted until C++20
    // No need to define: implicitly generated destructor is trivial.
};

struct LiteralAggregate
{
    int d_value1;
    int d_value2;
};
```

⁹As of C++20, a destructor can be declared **constexpr** and even both **virtual** and **constexpr**.

¹⁰In C++17, this restriction is relaxed: For a **union** to be a literal type, only one, rather than all, of its **nonstatic data members** needs to be of a **nonvolatile literal type**.