**Fixed-size byte arrays**[**ℑ**](https://docs.soliditylang.org/en/v0.8.15/types.html#fixed-size-byte-arrays)

The value types bytes1, bytes2, bytes3, …, bytes32 hold a sequence of bytes from one to up to 32.

Operators:

* Comparisons: <=, <, ==, !=, >=, > (evaluate to bool)
* Bit operators: &, |, ^ (bitwise exclusive or), ~ (bitwise negation)
* Shift operators: << (left shift), >> (right shift)
* Index access: If x is of type bytesI, then x[k] for 0 <= k < I returns the k th byte (read-only).

The shifting operator works with unsigned integer type as right operand (but returns the type of the left operand), which denotes the number of bits to shift by. Shifting by a signed type will produce a compilation error.

Members:

* .length yields the fixed length of the byte array (read-only).

**Note**

The type bytes1[] is an array of bytes, but due to padding rules, it wastes 31 bytes of space for each element (except in storage). It is better to use the bytes type instead.

**Dynamically-sized byte array**[**ℑ**](https://docs.soliditylang.org/en/v0.8.15/types.html#dynamically-sized-byte-array)

**bytes:**

Dynamically-sized byte array, see [Arrays](https://docs.soliditylang.org/en/v0.8.15/types.html#arrays). Not a value-type!

**string:**

Dynamically-sized UTF-8-encoded string, see [Arrays](https://docs.soliditylang.org/en/v0.8.15/types.html#arrays). Not a value-type!