

Number Protocol

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\ (cpython-main) (Doc) (c-api) number.rst, line 1)

Unknown directive type "highlight".

```
.. highlight:: c
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\ (cpython-main) (Doc) (c-api) number.rst, line 9)

Unknown directive type "c:function".

```
.. c:function:: int PyNumber_Check(PyObject *o)

Returns ``1`` if the object *o* provides numeric protocols, and false otherwise.
This function always succeeds.

.. versionchanged:: 3.8
    Returns ``1`` if *o* is an index integer.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\ (cpython-main) (Doc) (c-api) number.rst, line 18)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_Add(PyObject *o1, PyObject *o2)

Returns the result of adding *o1* and *o2*, or ``NULL`` on failure. This is the
equivalent of the Python expression ``o1 + o2``.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\ (cpython-main) (Doc) (c-api) number.rst, line 24)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_Subtract(PyObject *o1, PyObject *o2)

Returns the result of subtracting *o2* from *o1*, or ``NULL`` on failure. This is
the equivalent of the Python expression ``o1 - o2``.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\ (cpython-main) (Doc) (c-api) number.rst, line 30)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_Multiply(PyObject *o1, PyObject *o2)

Returns the result of multiplying *o1* and *o2*, or ``NULL`` on failure. This is
the equivalent of the Python expression ``o1 * o2``.
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\ (cpython-main) (Doc) (c-api) number.rst, line 36)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_MatrixMultiply(PyObject *o1, PyObject *o2)

Returns the result of matrix multiplication on *o1* and *o2*, or ``NULL`` on
failure. This is the equivalent of the Python expression ``o1 @ o2``.

.. versionadded:: 3.5
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\ (cpython-main) (Doc) (c-api) number.rst, line 44)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_FloorDivide(PyObject *o1, PyObject *o2)
```

Return the floor of **o1** divided by **o2**, or ``NULL`` on failure. This is the equivalent of the Python expression ``o1 // o2``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\ (cpython-main) (Doc) (c-api) number.rst, line 50)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_TrueDivide(PyObject *o1, PyObject *o2)
```

Return a reasonable approximation for the mathematical value of **o1** divided by **o2**, or ``NULL`` on failure. The return value is "approximate" because binary floating point numbers are approximate; it is not possible to represent all real numbers in base two. This function can return a floating point value when passed two integers. This is the equivalent of the Python expression ``o1 / o2``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\ (cpython-main) (Doc) (c-api) number.rst, line 59)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_Remainder(PyObject *o1, PyObject *o2)
```

Returns the remainder of dividing **o1** by **o2**, or ``NULL`` on failure. This is the equivalent of the Python expression ``o1 % o2``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\ (cpython-main) (Doc) (c-api) number.rst, line 65)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_Divmod(PyObject *o1, PyObject *o2)
```

```
.. index:: builtin: divmod
```

See the built-in function :func:`divmod`. Returns ``NULL`` on failure. This is the equivalent of the Python expression ``divmod(o1, o2)``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\ (cpython-main) (Doc) (c-api) number.rst, line 73)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_Power(PyObject *o1, PyObject *o2, PyObject *o3)
```

```
.. index:: builtin: pow
```

See the built-in function :func:`pow`. Returns ``NULL`` on failure. This is the equivalent of the Python expression ``pow(o1, o2, o3)`` , where **o3** is optional. If **o3** is to be ignored, pass :c:data:`Py_None` in its place (passing ``NULL`` for **o3** would cause an illegal memory access).

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\ (cpython-main) (Doc) (c-api) number.rst, line 83)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_Negative(PyObject *o)
```

Returns the negation of **o** on success, or ``NULL`` on failure. This is the equivalent of the Python expression ``-o``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\cpython-main) (Doc) (c-api) number.rst, line 89)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_Positive(PyObject *o)
```

Returns **o** on success, or ``NULL`` on failure. This is the equivalent of the Python expression ``+o``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\cpython-main) (Doc) (c-api) number.rst, line 95)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_Absolute(PyObject *o)
```

```
.. index:: builtin: abs
```

Returns the absolute value of **o**, or ``NULL`` on failure. This is the equivalent of the Python expression ``abs(o)``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\cpython-main) (Doc) (c-api) number.rst, line 103)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_Invert(PyObject *o)
```

Returns the bitwise negation of **o** on success, or ``NULL`` on failure. This is the equivalent of the Python expression ``~o``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\cpython-main) (Doc) (c-api) number.rst, line 109)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_Lshift(PyObject *o1, PyObject *o2)
```

Returns the result of left shifting **o1** by **o2** on success, or ``NULL`` on failure. This is the equivalent of the Python expression ``o1 << o2``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\cpython-main) (Doc) (c-api) number.rst, line 115)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_Rshift(PyObject *o1, PyObject *o2)
```

Returns the result of right shifting **o1** by **o2** on success, or ``NULL`` on failure. This is the equivalent of the Python expression ``o1 >> o2``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\cpython-main) (Doc) (c-api) number.rst, line 121)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_And(PyObject *o1, PyObject *o2)
```

Returns the "bitwise and" of *o1* and *o2* on success and ``NULL`` on failure. This is the equivalent of the Python expression ``o1 & o2``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\ (cpython-main) (Doc) (c-api) number.rst, line 127)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_Xor(PyObject *o1, PyObject *o2)
```

Returns the "bitwise exclusive or" of *o1* by *o2* on success, or ``NULL`` on failure. This is the equivalent of the Python expression ``o1 ^ o2``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\ (cpython-main) (Doc) (c-api) number.rst, line 133)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_Or(PyObject *o1, PyObject *o2)
```

Returns the "bitwise or" of *o1* and *o2* on success, or ``NULL`` on failure. This is the equivalent of the Python expression ``o1 | o2``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\ (cpython-main) (Doc) (c-api) number.rst, line 139)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_InPlaceAdd(PyObject *o1, PyObject *o2)
```

Returns the result of adding *o1* and *o2*, or ``NULL`` on failure. The operation is done *in-place* when *o1* supports it. This is the equivalent of the Python statement ``o1 += o2``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\ (cpython-main) (Doc) (c-api) number.rst, line 146)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_InPlaceSubtract(PyObject *o1, PyObject *o2)
```

Returns the result of subtracting *o2* from *o1*, or ``NULL`` on failure. The operation is done *in-place* when *o1* supports it. This is the equivalent of the Python statement ``o1 -= o2``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\ (cpython-main) (Doc) (c-api) number.rst, line 153)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_InPlaceMultiply(PyObject *o1, PyObject *o2)
```

Returns the result of multiplying *o1* and *o2*, or ``NULL`` on failure. The operation is done *in-place* when *o1* supports it. This is the equivalent of the Python statement ``o1 *= o2``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\ (cpython-main) (Doc) (c-api) number.rst, line 160)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_InPlaceMatrixMultiply(PyObject *o1, PyObject *o2)
```

Returns the result of matrix multiplication on `*o1*` and `*o2*`, or ```NULL``` on failure. The operation is done `*in-place*` when `*o1*` supports it. This is the equivalent of the Python statement ```o1 @= o2```.

.. versionadded:: 3.5

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\cpython-main) (Doc) (c-api) number.rst, line 169)

Unknown directive type "c:function".

.. c:function:: PyObject* PyNumber_InPlaceFloorDivide(PyObject *o1, PyObject *o2)

Returns the mathematical floor of dividing `*o1*` by `*o2*`, or ```NULL``` on failure. The operation is done `*in-place*` when `*o1*` supports it. This is the equivalent of the Python statement ```o1 //= o2```.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\cpython-main) (Doc) (c-api) number.rst, line 176)

Unknown directive type "c:function".

.. c:function:: PyObject* PyNumber_InPlaceTrueDivide(PyObject *o1, PyObject *o2)

Return a reasonable approximation for the mathematical value of `*o1*` divided by `*o2*`, or ```NULL``` on failure. The return value is "approximate" because binary floating point numbers are approximate; it is not possible to represent all real numbers in base two. This function can return a floating point value when passed two integers. The operation is done `*in-place*` when `*o1*` supports it. This is the equivalent of the Python statement ```o1 /= o2```.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\cpython-main) (Doc) (c-api) number.rst, line 186)

Unknown directive type "c:function".

.. c:function:: PyObject* PyNumber_InPlaceRemainder(PyObject *o1, PyObject *o2)

Returns the remainder of dividing `*o1*` by `*o2*`, or ```NULL``` on failure. The operation is done `*in-place*` when `*o1*` supports it. This is the equivalent of the Python statement ```o1 %= o2```.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\cpython-main) (Doc) (c-api) number.rst, line 193)

Unknown directive type "c:function".

.. c:function:: PyObject* PyNumber_InPlacePower(PyObject *o1, PyObject *o2, PyObject *o3)

.. index:: builtin: pow

See the built-in function :func:`pow`. Returns ```NULL``` on failure. The operation is done `*in-place*` when `*o1*` supports it. This is the equivalent of the Python statement ```o1 **= o2``` when `o3` is :c:data:`Py_None`, or an in-place variant of ```pow(o1, o2, o3)``` otherwise. If `*o3*` is to be ignored, pass :c:data:`Py_None` in its place (passing ```NULL``` for `*o3*` would cause an illegal memory access).

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\cpython-main) (Doc) (c-api) number.rst, line 204)

Unknown directive type "c:function".

.. c:function:: PyObject* PyNumber_InPlaceLshift(PyObject *o1, PyObject *o2)

Returns the result of left shifting `*o1*` by `*o2*` on success, or ```NULL``` on

failure. The operation is done **in-place** when **o1** supports it. This is the equivalent of the Python statement `o1 <= o2`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\cpython-main) (Doc) (c-api) number.rst, line 211)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_InPlaceRshift(PyObject *o1, PyObject *o2)
```

Returns the result of right shifting **o1** by **o2** on success, or `NULL` on failure. The operation is done **in-place** when **o1** supports it. This is the equivalent of the Python statement `o1 >>= o2`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\cpython-main) (Doc) (c-api) number.rst, line 218)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_InPlaceAnd(PyObject *o1, PyObject *o2)
```

Returns the "bitwise and" of **o1** and **o2** on success and `NULL` on failure. The operation is done **in-place** when **o1** supports it. This is the equivalent of the Python statement `o1 &= o2`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\cpython-main) (Doc) (c-api) number.rst, line 225)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_InPlaceXor(PyObject *o1, PyObject *o2)
```

Returns the "bitwise exclusive or" of **o1** by **o2** on success, or `NULL` on failure. The operation is done **in-place** when **o1** supports it. This is the equivalent of the Python statement `o1 ^= o2`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\cpython-main) (Doc) (c-api) number.rst, line 232)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_InPlaceOr(PyObject *o1, PyObject *o2)
```

Returns the "bitwise or" of **o1** and **o2** on success, or `NULL` on failure. The operation is done **in-place** when **o1** supports it. This is the equivalent of the Python statement `o1 |= o2`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\cpython-main) (Doc) (c-api) number.rst, line 239)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_Long(PyObject *o)
```

```
.. index:: builtin: int
```

Returns the **o** converted to an integer object on success, or `NULL` on failure. This is the equivalent of the Python expression `int(o)`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\cpython-main) (Doc) (c-api) number.rst, line 247)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_Float(PyObject *o)
```

```
.. index:: builtin: float
```

Returns the *o* converted to a float object on success, or ``NULL`` on failure. This is the equivalent of the Python expression ``float(o)``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\cpython-main) (Doc) (c-api) number.rst, line 255)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_Index(PyObject *o)
```

Returns the *o* converted to a Python int on success or ``NULL`` with a :exc:`TypeError` exception raised on failure.

```
.. versionchanged:: 3.10
```

The result always has exact type :class:`int`. Previously, the result could have been an instance of a subclass of ``int``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\cpython-main) (Doc) (c-api) number.rst, line 265)

Unknown directive type "c:function".

```
.. c:function:: PyObject* PyNumber_ToBase(PyObject *n, int base)
```

Returns the integer *n* converted to base *base* as a string. The *base* argument must be one of 2, 8, 10, or 16. For base 2, 8, or 16, the returned string is prefixed with a base marker of ``'0b'``, ``'0o'``, or ``'0x'``, respectively. If *n* is not a Python int, it is converted with :c:func:`PyNumber_Index` first.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\cpython-main) (Doc) (c-api) number.rst, line 274)

Unknown directive type "c:function".

```
.. c:function:: Py_ssize_t PyNumber_AsSsize_t(PyObject *o, PyObject *exc)
```

Returns *o* converted to a `Py_ssize_t` value if *o* can be interpreted as an integer. If the call fails, an exception is raised and ``-1`` is returned.

If *o* can be converted to a Python int but the attempt to convert to a `Py_ssize_t` value would raise an :exc:`OverflowError`, then the *exc* argument is the type of exception that will be raised (usually :exc:`IndexError` or :exc:`OverflowError`). If *exc* is ``NULL``, then the exception is cleared and the value is clipped to ``PY_SSIZE_T_MIN`` for a negative integer or ``PY_SSIZE_T_MAX`` for a positive integer.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\c-api\cpython-main) (Doc) (c-api) number.rst, line 287)

Unknown directive type "c:function".

```
.. c:function:: int PyIndex_Check(PyObject *o)
```

Returns ``1`` if *o* is an index integer (has the ``nb_index`` slot of the ``tp_as_number`` structure filled in), and ``0`` otherwise. This function always succeeds.