Examining the Identity
of a Sliced Python Object

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>>> b
[1, 2, 3] # unaffected by change to a
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>>> id(a) == id(b)
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The `id()` function returns an integer that (in CPython) is the memory address of the argument.

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[1, 2, 3] # unaffected by change to a

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False
```

The `id()` function returns an integer that (in CPython) is the memory address of the argument. Different objects that coexist at some moment have different memory addresses.

It isn't surprising that some other Python sequence types display the same behavior as a list when comparing the `id()` of the original object with a beginning-to-end slice:

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>>> import array
>>> id(array.array('i', [1, 2, 3])) == id(array.array('i', [1, 2, 3])**[:]**) # array

It isn't surprising that some other Python sequence types display the same behavior as a list when comparing the `id()` of the original object with a beginning-to-end slice:

```
>>> import array
>>> id(array.array('i', [1, 2, 3])) == id(array.array('i', [1, 2, 3])[:]) # array
False
```

It isn't surprising that some other Python sequence types display the same behavior as a list when comparing the `id()` of the original object with a beginning-to-end slice:

```
>>> import array
>>> id(array.array('i', [1, 2, 3])) == id(array.array('i', [1, 2, 3])[:]) # array
False
```

question	list	array
id(object) == id(object[:])	False	False

It isn't surprising that some other Python sequence types display the same behavior as a list when comparing the id() of the original object with a beginning-to-end slice:

```
>>> import array
>>> id(array.array('i', [1, 2, 3])) == id(array.array('i', [1, 2, 3])[:]) # array
False
```

question	list	array
id(object) == id(object[:])	False	False

(Here I use "object" to represent a literal object rather than a variable representing it.)

It isn't surprising that some other Python sequence types display the same behavior as a list when comparing the `id()` of the original object with a beginning-to-end slice:

>>> id((1, 2, 3)) == id((1, 2, 3)**[:]**) # tuple

It isn't surprising that some other Python sequence types display the same behavior as a list when comparing the `id()` of the original object with a beginning-to-end slice:

```
>>> id((1, 2, 3)) == id((1, 2, 3)[:]) # tuple
False
```

question	list	array	tuple
id(object) == id(object[:])	False	False	False

It isn't surprising that some other Python sequence types display the same behavior as a list when comparing the `id()` of the original object with a beginning-to-end slice:

```
>>> id((1, 2, 3)) == id((1, 2, 3)[:]) # tuple
False
```

question	list	array	tuple
id(object) == id(object[:])	False	False	False

But it may be surprising that not all do…

It isn't surprising that some other Python sequence types display the same behavior as a list when comparing the `id()` of the original object with a beginning-to-end slice. But it may be surprising that not all do:

```
>>> id('123') == id('123'[:]) # string
```

It isn't surprising that some other Python sequence types display the same behavior as a list when comparing the `id()` of the original object with a beginning-to-end slice. But it may be surprising that not all do:

```
>>> id('123') == id('123'[:]) # string
True
```

question	list	array	tuple	string
id(object) == id(object[:])	False	False	False	**True**

And it turns out that there are a number of identity questions we can ask about slices of objects that have different answers depending on the kind of object and the way we ask the question:

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```
>>> id([1, 2, 3][:]) == id([1, 2, 3][:]) # list
False
```

And it turns out that there are a number of identity questions we can ask about slices of objects that have different answers depending on the kind of object and the way we ask the question:

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>>> id([1, 2, 3][:]) == id([1, 2, 3][:]) # list
False
>>> id(array.array('i', [1, 2, 3])[:]) == id(array.array('i', [1, 2, 3])[:]) # array
False
```

And it turns out that there are a number of identity questions we can ask about slices of objects that have different answers depending on the kind of object and the way we ask the question:

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>>> id([1, 2, 3][:]) == id([1, 2, 3][:]) # list
False
>>> id(array.array('i', [1, 2, 3])[:]) == id(array.array('i', [1, 2, 3])[:]) # array
False
>>> id((1, 2, 3)[:]) == id((1, 2, 3)[:]) # tuple
False
```

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>>> id([1, 2, 3][:]) == id([1, 2, 3][:]) # list
False
>>> id(array.array('i', [1, 2, 3])[:]) == id(array.array('i', [1, 2, 3])[:]) # array
False
>>> id((1, 2, 3)[:]) == id((1, 2, 3)[:]) # tuple
False
>>> id('123'[:]) == id('123'[:]) # string
True
```

And it turns out that there are a number of identity questions we can ask about slices of objects that have different answers depending on the kind of object and the way we ask the question:

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>>> id([1, 2, 3][:]) == id([1, 2, 3][:]) # list
False
>>> id(array.array('i', [1, 2, 3])[:]) == id(array.array('i', [1, 2, 3])[:]) # array
False
>>> id((1, 2, 3)[:]) == id((1, 2, 3)[:]) # tuple
False
>>> id('123'[:]) == id('123'[:]) # string
True
```

question	list	array	tuple	string
id(object) == id(object[:])	False	False	False	**True**
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False
>>> id((1, 2, 3)[:]) == id((1, 2, 3)[:]) # tuple
False
>>> id('123'[:]) == id('123'[:]) # string
True
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question	list	array	tuple	string
id(object) == id(object[:])	False	False	False	**True**
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Lists and arrays seem always to behave the same way

And it turns out that there are a number of identity questions we can ask about slices of objects that have different answers depending on the kind of object and the way we ask the question:

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>>> id([1, 2, 3][:]) == id([1, 2, 3][:]) # list
False
>>> id(array.array('i', [1, 2, 3])[:]) == id(array.array('i', [1, 2, 3])[:]) # array
False
>>> id((1, 2, 3)[:]) == id((1, 2, 3)[:]) # tuple
False
>>> id('123'[:]) == id('123'[:]) # string
True
```

question	list/array	tuple	string
id(object) == id(object[:])	False	False	**True**
id(object[:]) == id(object[:])	False	False	**True**

Lists and arrays seem always to behave the same way, but tuples and strings do not.

A variable to which an object is assigned has a different pattern of slice-identity among the various datatypes:

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question	list, array	tuple	string
id(object) == id(object[:])	False	False	**True**
id(object[:]) == id(object[:])	False	False	**True**
var = object id(var) == id(var[:])	False	**True**	**True**
var2 = var[:] id(var) == id(var2)	False	**True**	**True**

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question	list, array	tuple	string
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var2 = var[:] id(var) == id(var2)	False	**True**	**True**

```
>>> x = (1, 2, 3) # tuple
>>> id(x) == id(x[:])
True
>>> y = x[:]
>>> id(x) == id(y)
True
```

A variable to which an object is assigned has a different pattern of slice-identity among the various datatypes:

question	list, array	tuple	string
id(object) == id(object[:])	False	False	**True**
id(object[:]) == id(object[:])	False	False	**True**
var = object id(var) == id(var[:])	False	**True**	**True**
var2 = var[:] id(var) == id(var2)	False	**True**	**True**
id(var[:]) == id(var[:])	**True**	**True**	**True**
id(var[:]) == id(var2[:])	**True**	**True**	**True**

A variable to which an object is assigned has a different pattern of slice-identity among the various datatypes:

question	list, array	tuple	string
id(object) == id(object[:])	False	False	**True**
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var = object id(var) == id(var[:])	False	**True**	**True**
var2 = var[:] id(var) == id(var2)	False	**True**	**True**
id(var[:]) == id(var[:])	**True**	**True**	**True**
id(var[:]) == id(var2[:])	**True**	**True**	**True**

>>> id(x[:]) == id(x[:]) # list
True
>>> id(x[:]) == id(y[:]) # list
True

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id(object) == id(object[:])	False	False	**True**
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var = object id(var) == id(var[:])	False	**True**	**True**
var2 = var[:] id(var) == id(var2)	False	**True**	**True**
id(var[:]) == id(var[:])	**True**	**True**	**True**
id(var[:]) == id(var2[:])	**True**	**True**	**True**
id(var) == id(object)	False	False	**True**
id(var2) == id(object)	False	False	**True**
id(var[:]) == id(object)	**True**	False	**True**

Variables and the objects from which they were originally assigned also behave differently:

question	list, array	tuple	string
id(object) == id(object[:])	False	False	**True**
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var = object id(var) == id(var[:])	False	**True**	**True**
var2 = var[:] id(var) == id(var2)	False	**True**	**True**
id(var[:]) == id(var[:])	**True**	**True**	**True**
id(var[:]) == id(var2[:])	**True**	**True**	**True**
id(var) == id(object)	False	False	**True**
id(var2) == id(object)	False	False	**True**
id(var[:]) == id(object)	**True**	False	**True**

```
>>> id(x[:]) == id([1, 2, 3]) # list
True
```

```
>>> id(x) == id((1, 2, 3)) # tuple
False
```

It seems random.

It seems random. Is it?

It seems random. Is it? Or is there a deep moral correctness in this diverse behavior?

Branner, The Identity of Sliced Python Objects. p. 58

Rē correctness: Most interesting is that the three implementations CPython, PyPy, and Jython (each v. 2.7) all return different patterns of **True** and False with respect to these questions:

question	list, array	tuple	string
id(object) == id(object[:])	False	False	**C True** Py/J
id(object[:]) == id(object[:])	False	False	**C True** Py/J
id(var) == id(var[:])	False	**C True** Py/J	**C/Py True** J
id(var) == id(var2)	False	**C True** Py/J	**C/Py True** J
id(var[:]) == id(var[:])	**C True** Py/J	**C True** Py/J	**C/Py True** J
id(var[:]) == id(var2[:])	**C True** Py/J	**C True** Py/J	**C/Py True** J
id(var) == id(object)	False	False	**C True** Py/J
id(var2) == id(object)	False	False	**C True** Py/J
id(var[:]) == id(object)	**C True** Py/J	False	**C True** Py/J

Key: **blue & bold = True**; red & non-bold = False
C: CPython; Py: PyPy; J: Jython.

question	list, array	tuple	string
id(object) == id(object[:])	False	False	**C True** Py/J
id(object[:]) == id(object[:])	False	False	**C True** Py/J
id(var) == id(var[:])	False	**C True** Py/J	**C/Py True** J
id(var) == id(var2)	False	**C True** Py/J	**C/Py True** J
id(var[:]) == id(var[:])	**C True** Py/J	**C True** Py/J	**C/Py True** J
id(var[:]) == id(var2[:])	**C True** Py/J	**C True** Py/J	**C/Py True** J
id(var) == id(object)	False	False	**C True** Py/J
id(var2) == id(object)	False	False	**C True** Py/J
id(var[:]) == id(object)	**C True** Py/J	False	**C True** Py/J

Key: **blue & bold** = **True**; red & non-bold = False

That is the main point of this presentation.

question	list, array	tuple	string
id(object) == id(object[:])	False	False	**C True** Py/J
id(object[:]) == id(object[:])	False	False	**C True** Py/J
id(var) == id(var[:])	False	**C True** Py/J	**C/Py True** J
id(var) == id(var2)	False	**C True** Py/J	**C/Py True** J
id(var[:]) == id(var[:])	**C True** Py/J	**C True** Py/J	**C/Py True** J
id(var[:]) == id(var2[:])	**C True** Py/J	**C True** Py/J	**C/Py True** J
id(var) == id(object)	False	False	**C True** Py/J
id(var2) == id(object)	False	False	**C True** Py/J
id(var[:]) == id(object)	**C True** Py/J	False	**C True** Py/J

Key: **blue & bold = True**; red & non-bold = False

That is the main point of this presentation. (Note that Jython tests False everywhere that CPython tests **True** here; PyPy is mixed.)

question	list, array	tuple	string
id(object) == id(object[:])	False	False	**C True** Py/J
id(object[:]) == id(object[:])	False	False	**C True** Py/J
id(var) == id(var[:])	False	**C True** Py/J	**C/Py True** J
id(var) == id(var2)	False	**C True** Py/J	**C/Py True** J
id(var[:]) == id(var[:])	**C True** Py/J	**C True** Py/J	**C/Py True** J
id(var[:]) == id(var2[:])	**C True** Py/J	**C True** Py/J	**C/Py True** J
id(var) == id(object)	False	False	**C True** Py/J
id(var2) == id(object)	False	False	**C True** Py/J
id(var[:]) == id(object)	**C True** Py/J	False	**C True** Py/J

Key: **blue & bold = True**; red & non-bold = False

That is the main point of this presentation. (Note that Jython tests False everywhere that CPython tests **True** here; PyPy is mixed.) In sum: the behavior of the `id()` function is uniform neither with respect to the various sequences nor among the three main implementations.

(For reference here is how "identity" is defined in the three versions illustrated here:

CPython: "Return the 'identity' of an object. This is an integer which is guaranteed to be unique and constant for this object during its lifetime. Two objects with non-overlapping lifetimes may have the same `id()` value. CPython implementation detail: **This is the address of the object in memory.**" https://docs.python.org/2.7/library/functions.html?#id. Python 2.7.8 (default, Jul 2 2014, 10:14:46) [GCC 4.2.1 Compatible Apple LLVM 5.1 (clang-503.0.40)] on darwin

PyPy: "**Using the default GC (called minimark), the built-in function `id()` [of PyPy] works like it does in CPython.** With other GCs it returns numbers that are not real addresses (because an object can move around several times) and calling it a lot can lead to performance problem." http://pypy.readthedocs.org/en/latest/cpython_differences.html Python 2.7.6 (32f35069a16d, Jun 06 2014, 20:12:47)

Jython: "Return the 'identity' of an object. This is an integer (or long integer) which is guaranteed to be unique and constant for this object during its lifetime. Two objects with non-overlapping lifetimes may have the same `id()` value. (Implementation note: **this is the address of the object.**)" http://www.jython.org/docs/library/functions.html [PyPy 2.3.1 with GCC 4.2.1 Compatible Apple LLVM 5.0 (clang-500.2.79)] on darwin Jython 2.7b2 (default:a5bc0032cf79+, Apr 22 2014, 21:20:17) [Java HotSpot(TM) 64-Bit Server VM (Oracle Corporation)] on java1.7.0_51)

Another interesting feature is that CPython alternates the IDs of a sliced object and a sliced variable differently if they are simply printed rather than appearing in the same comparison:

>>> def test_list():	>>> def test_list():
... x = [1, 2, 3][:]	... print id([1, 2, 3][:])
... print id(x[:])	... print id([1, 2, 3][:])
... print id(x[:])	... print id([1, 2, 3][:])
... print id(x[:])	... print id([1, 2, 3][:])
... print id(x[:])	
>>> test_list()	>>> test_list()
4451744728	**4451745160**
4451744728	**4451676816**
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For a list, the literal object uses two alternating memory addresses in this example, while a variable uses the same memory address.

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>>> def test_list():	>>> def test_list():
... x = [1, 2, 3][:]	... print id([1, 2, 3][:]) # do this four times
... print id(x[:]) # do this four times	
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The three implementations behave differently in this respect; Jython again is always False:

question	list, array	tuple	string
id(var[:]), 4x in fn same	**C True** Py/J	**C True** Py/J	**C/Py True** J
id(object[:]), 4x in fn same	C False*; Py/J	False	**C/Py True** J

* IDs appear in alternation.

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