Python: brief introduction

1.1. Types

```
#clear
a=2
b=3.0
c=a+b
d=2*a
```

A) c is float, d is float

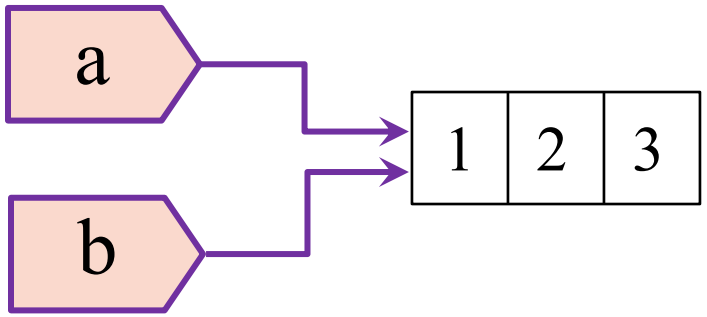
B) c is float, d is int

C) c is int, d is int

D) c is int, d is float

1.2. Names and values

```
a = [1,2,3]
b = a
```

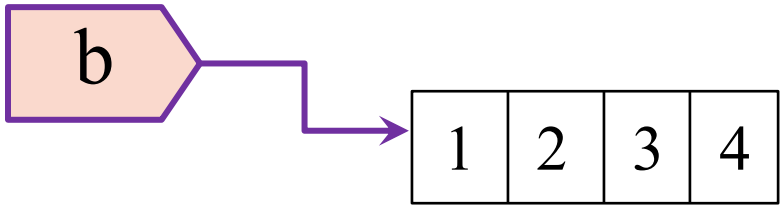


The list | 1 | 2 | 3 | is an object, and both *names*

a and b are bounded to the same list (*values*)

Modifying an object

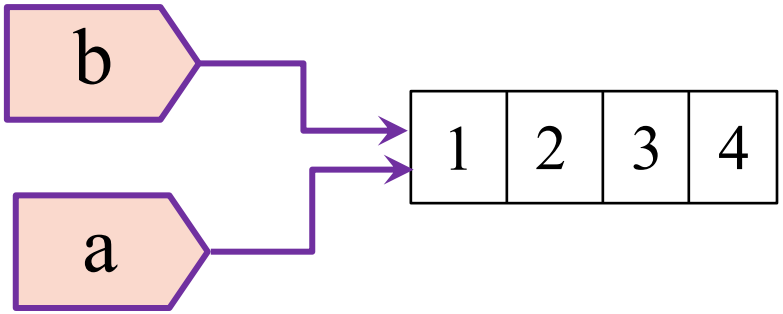
```
a = [1,2,3]
b = a
b.append(4)
```



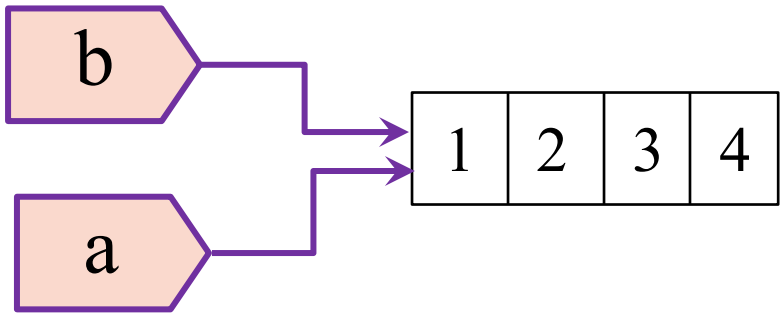
b.append(4) modifies the object list [1,2,3]

What happens to the name "a"?

Because "a" and "b" are bounded to the same location, they will have the same values once the list is modified



Get the “id” for an object




```
#clear
print(id(a), id(b))
```

```
2053127830536 2053127830536
```

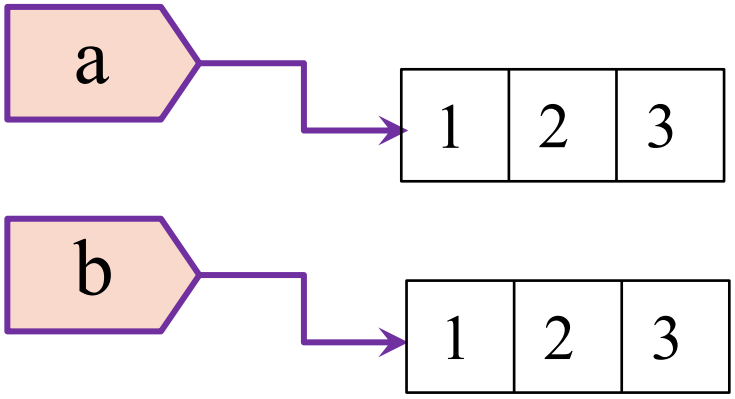
Since “a” and “b” are bounded to the same object, then they have the same “id”

```
#clear
a is b
```

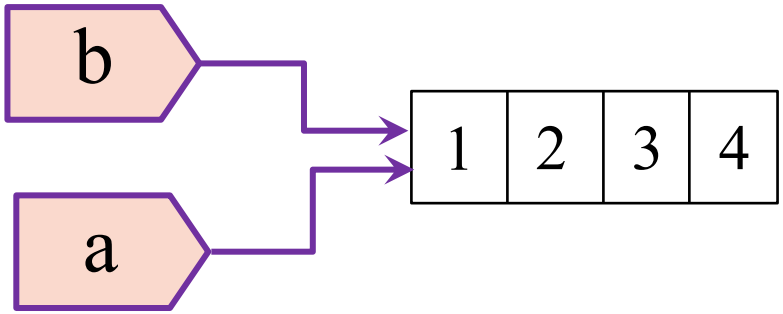
Check if both names have the same “id”

In summary ...

```
a = [1,2,3]
b = [1,2,3]
print("IS    ", a is b)
print("EQUAL", a == b)
```




```
a = [1,2,3]
b = a
```



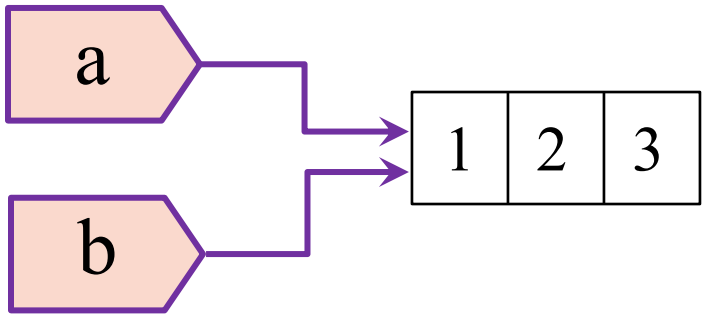
Mutable and immutable types

Mutable objects: can be changed after they are created (e.g. lists, dictionaries)

Immutable objects: cannot be changed after they are created (e.g. tuples, strings, floats)

Mutable object: List

```
a = [1,2,3]
b = a
```




```
a = a + [4]
print(b)
print(a)
a is b
```

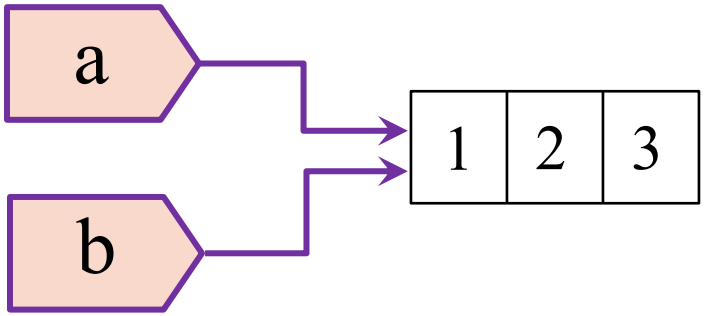
```
a += [4]
print(b)
print(a)
a is b
```

Do you get the same results when running these two pieces of code?

A) YES B) NO

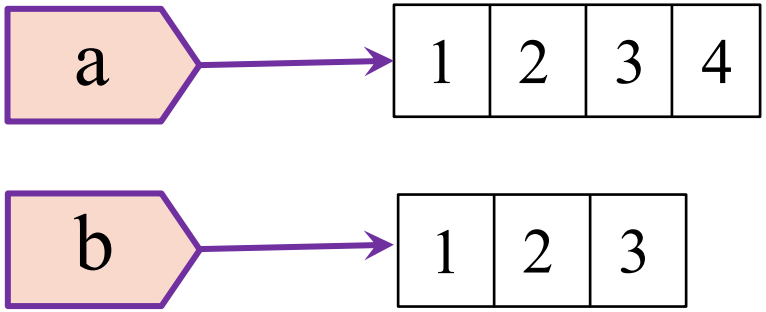
Mutable object: List

```
a = [1,2,3]
b = a
```



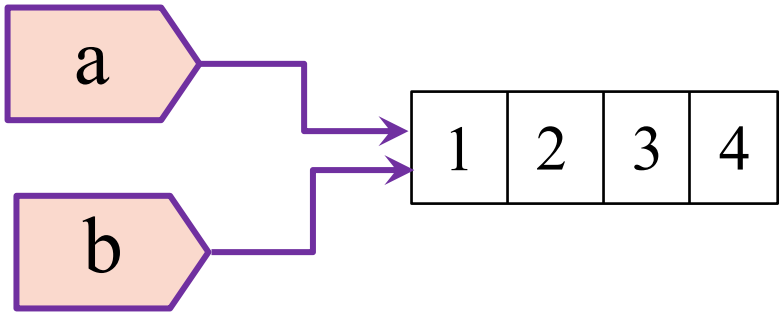
"a" gets reassigned to a new object, "b" is still bounded to the initial object.

```
a = a + [4]
print(b)
print(a)
a is b
```



The object list is modified, however, "a" and "b" remain bounded to the object.

```
a += [4]
print(b)
print(a)
a is b
```



1.2. Names and values

Which of the following code snippets

A)
```
a = ['hello','goodbye']
b = 'hey'
a.append(b)
c = a + [b]
```

B)
```
a = ['hello','goodbye']
b = 'hey'
c = a + [b]
a += b
```

C)
```
a = ['hello','goodbye']
b = 'hey'
c = a + [b]
a.append(b)
```

Results in

```
print(a==c)
```

```
True
```

1.3. Advanced Names

```
fruit = 'apple'

lunch = []
lunch.append(fruit)

dinner = lunch
dinner.append('fish')

fruit = 'pear'

meals = [fruit, lunch, dinner]
print(meals)
```

1.3. Naming advanced

What is the correct output for the following code snippet?

```
John = 'computer_science'
Tim = John
Tim += ', math'
Anna = ['electrical']
Julie = Anna
Julie += ['physics']
print(John, Anna)
```

Choice*

A) computer_science, math ['electrical', 'physics']

B) computer_science, math ['electrical']

C) computer_science ['electrical', 'physics']

D) computer_science ['electrical']

1.4 Indexing

```
a = [0,1,2,3,4,5,6,7,8,9]
```

$a[i:j:k]$

i – *starting index*
j – *stopping index (not included)*
k – *step*

```
a = [0,1,2,3,4,5,6,7,8,9]
```

```
a[1::2][::-1]
```

What is the output for the command line above?

A) [1,3,5,7,9]
B) [1,3]
C) [3,1]
D) [9,7]
E) [9,7,5,3,1]

1.5 Control Flow

```
#clear
mylist = []

for i in range(50):

    if i % 7 == 0:

        mylist.append(i**2)
```

```
mylist
```

```
[0, 49, 196, 441, 784, 1225, 1764, 2401]
```

```
#clear
mylist = [i**2 for i in range(50) if i % 7 == 0]
print(mylist)
```

```
[0, 49, 196, 441, 784, 1225, 1764, 2401]
```

1.6 Functions

```
def add_minor(person):
    person.append('math')

def switch_majors(person):
    person = ['physics']
    person.append('economics')

John = ['computer_science']
Tim = John
add_minor(Tim)
switch_majors(John)
print(John, Tim)
```

Choice*

A) ['computer_science', 'economics'], ['computer_science', 'economics']

B) ['physics', 'economics'], ['computer_science']

C) ['physics', 'economics'], ['physics', 'economics']

D) ['computer_science', 'math'], ['computer_science', 'math']

E) ['physics', 'economics'], ['computer_science', 'math']

1.7 Objects

```
#clear
class test:
    def __init__(self):
        self.variable = 'Old'
        self.Change(self.variable)
    def Change(self, var):
        var = 'New'
obj=test()
print(obj.variable)
```

A) Error message, because the function Change can't be called in the __init__ function

B) 'Old'

C) 'New'

A)

```
a = [3,4]
b = [6,7]

def do_stuff(a,b):
    return( a.append(5),  b.append(8) )

do_stuff(a,b)
```

B)

```
a = 3
b = 5

def do_stuff(a,b):
    a += 1
    b += 2

do_stuff(a,b)
```

C)

```
a = [3,4]
b = [6,7]

def do_stuff(a,b):
    a += [5]
    b += [8]

do_stuff(a,b)
```

Which code snippet does not modify the variables?

2.2 Numpy Indexing

```
a = np.array([[1, 4, 9], [2, 8, 18]])
```

2.3 Broadcasting

```
a = np.arange(9).reshape(3, 3)
print(a.shape)
print(a)
```

```
b = np.arange(4, 4+9).reshape(3, 3)
print(b.shape)
print(b)
```

```
a = np.arange(9).reshape(3, 3)
print(a.shape)
print(a)
```

```
b = np.arange(3)
print(b.shape)
print(b)
```

2.3 Broadcasting

Given A and B numpy arrays such that:

A.shape is (5,4)
B.shape is (1,4)

What is the shape of A + B?

A) (1,4)
B) (5,1,4)
C) (5,4)
D) Not a valid operation