Lecture 12

Lists (& Sequences)

Announcements for Today

Reading

- Read 10.0-10.2, 10.4-10.6
- Read all of Chapter 8 for Tue

- **Prelim, Oct 13th 7:30-9:30**
  - Material up to October 4th
  - Study guide next week
- **Conflict with Prelim time?**
  - Submit to Prelim 1 Conflict assignment on CMS
  - Must be in by next Tuesday!

Assignments

- A2 is is almost finished
  - **Tomorrow** in Gates 216
  - Graded out of 50 points
  - **Mean**: 45.8, **Median**: 48
  - **A**: 46 (72%), **B**: 38 (20%)
- A3 due next week
  - Due on Thurs, Oct. 6
  - Will grade over break

Sequences: Lists of Values

String

- s = 'abc d'

0	1	2	3	4
a	b	c		d

- Put characters in quotes
  - Use \' for quote character
- Access characters with []
  - s[0] is 'a'
  - s[5] causes an error
  - s[0:2] is 'ab' (excludes c)
  - s[2:] is 'c d'

List

- x = [5, 6, 5, 9, 15, 23]

0	1	2	3	4	5
5	6	5	9	15	23

- Put values inside [ ]
  - Separate by commas
- Access **values** with []
  - x[0] is 5
  - x[6] causes an error
  - x[0:2] is [5, 6] (excludes 2nd 5)
  - x[3:] is [9, 15, 23]

Sequences: Lists of Values

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  - x[0:2] is [5, 6] (excludes 2nd 5)
  - x[3:] is [9, 15, 23]

Sequence is a name we give to both

Lists Have Methods Similar to String

```
x = [5, 6, 5, 9, 15, 23]
```

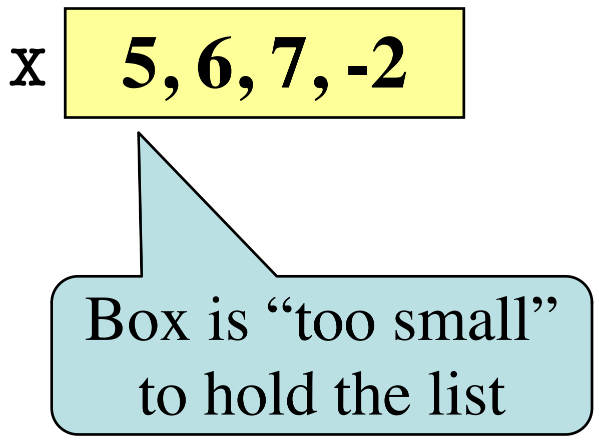
- `index(value)`
  - Return position of the value
  - **ERROR** if value is not there
  - `x.index(9)` evaluates to 3
- `count(value)`
  - Returns number of times value appears in list
  - `x.count(5)` evaluates to 2

But you get length of a list with a regular function, not method:

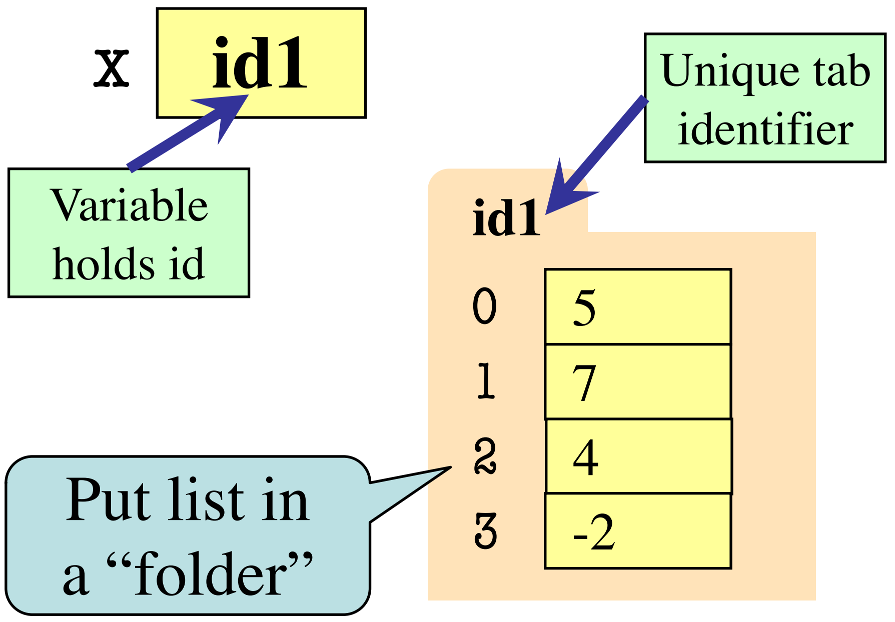
`len(x)`

Representing Lists

Wrong



Correct

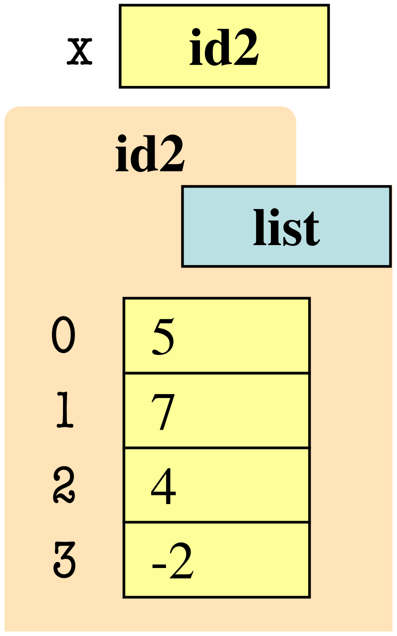


x = [5, 7, 4,-2]

Lists vs. Class Objects

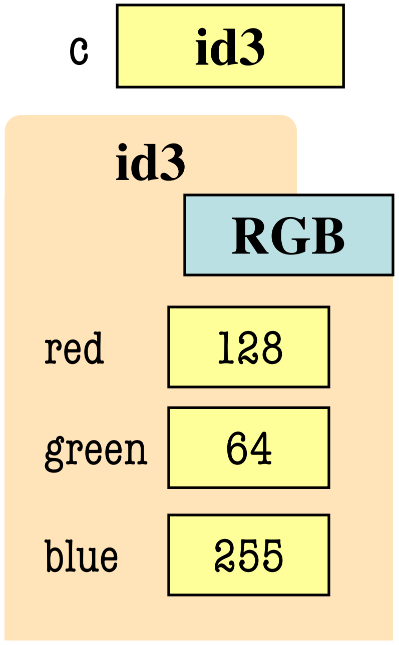
List

- Attributes are indexed
  - Example: `x[2]`



RGB

- Attributes are named
  - Example: `c.red`



When Do We Need to Draw a Folder?

- When the value **contains** other values
  - This is essentially want we mean by ‘object’
- When the value is **mutable**

Type	Container?	Mutable?
`int`	**No**	**No**
`float`	**No**	**No**
`str`	**Yes***	**No**
`Point3`	**Yes**	**Yes**
`RGB`	**Yes**	**Yes**
`list`	**Yes**	**Yes**

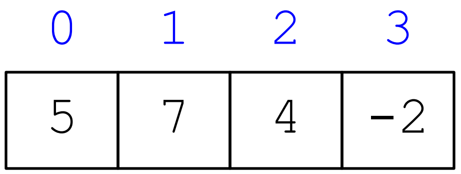
Lists are Mutable

- **List assignment**:

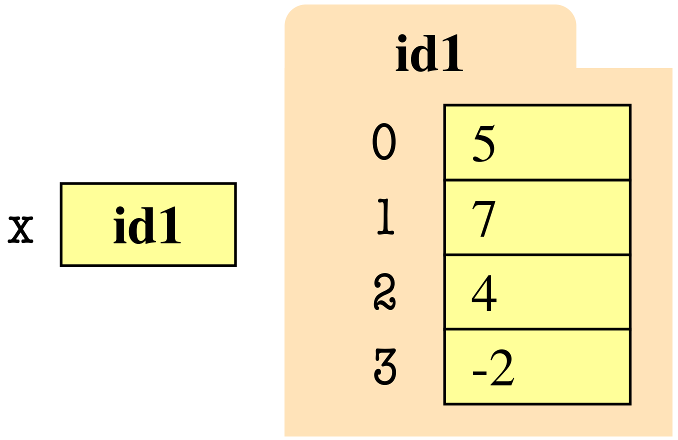
  <var>[<index>] = <value>

  - Reassign at index
  - Affects folder contents
  - Variable is unchanged
- Strings cannot do this
  - s = 'Hello World!'
  - s[0] = 'J' **ERROR**
  - String are **immutable**

- x = [5, 7,4,-2]



- x[1] = 8



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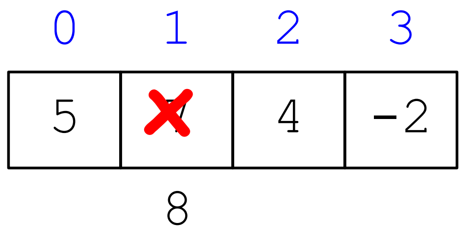

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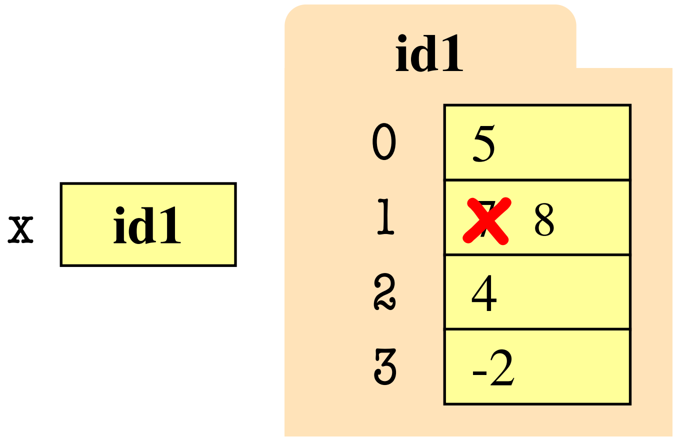


List Methods Can Alter the List

`x = [5, 6, 5, 9]`

See Python API for more

- `append(value)`
  - A **procedure method**, not a fruitful method
  - Adds a new value to the end of list
  - `x.append(-1)` *changes* the list to `[5, 6, 5, 9, -1]`
- `insert(index, value)`
  - Put the value into list at index; shift rest of list right
  - `x.insert(2,-1)` changes the list to `[5, 6, -1, 5, 9,]`
- `sort()`

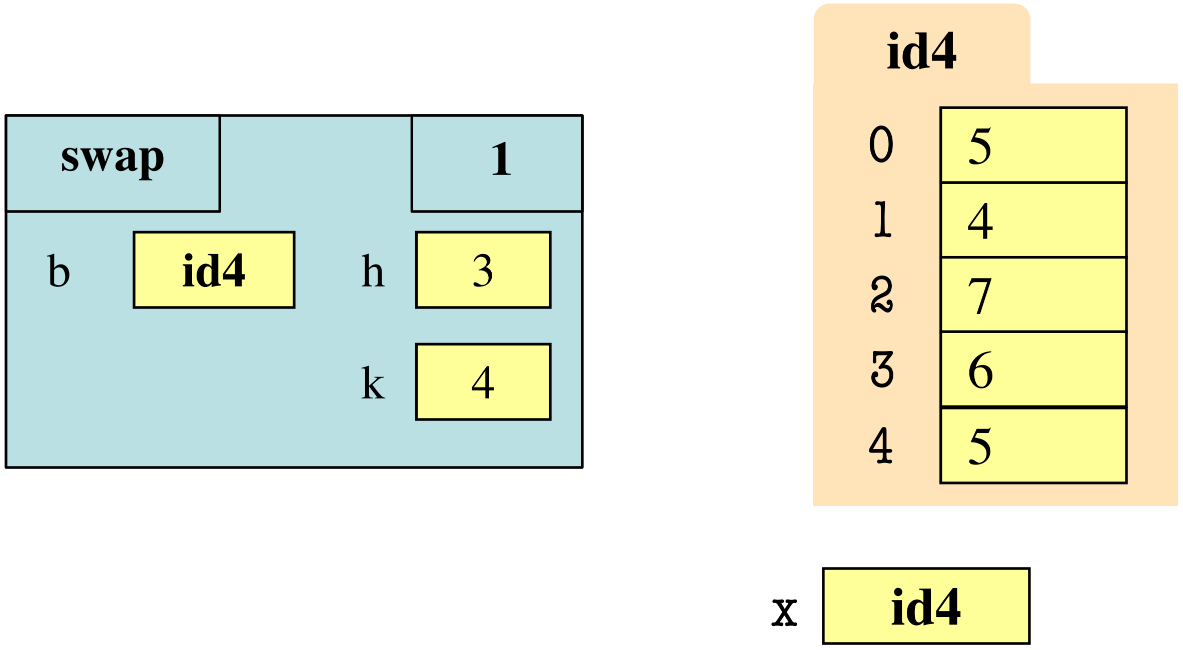
What do you think this does?

Lists and Functions: Swap

```
def swap(b, h, k):
    """Procedure swaps b[h] and b[k] in b
     Precondition: b is a mutable list, h
     and k are valid positions in the list"""
1   temp= b[h]
2   b[h]= b[k]
3   b[k]= temp
```

Swaps b[h] and b[k], because parameter b contains name of list.

swap(x, 3, 4)



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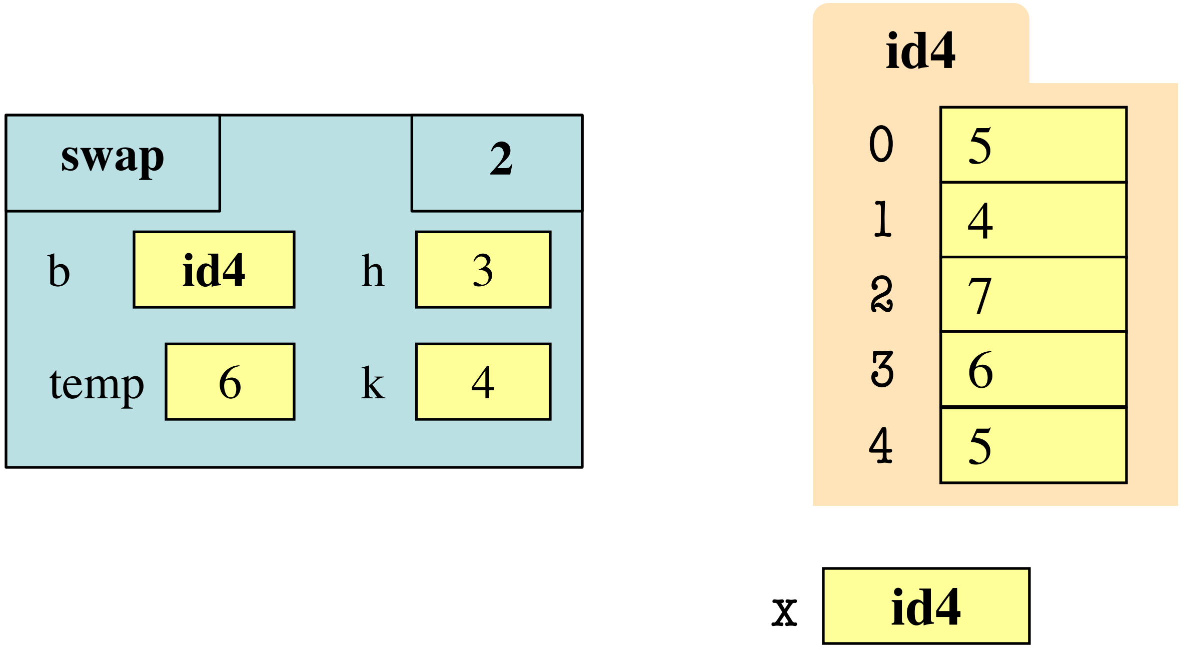

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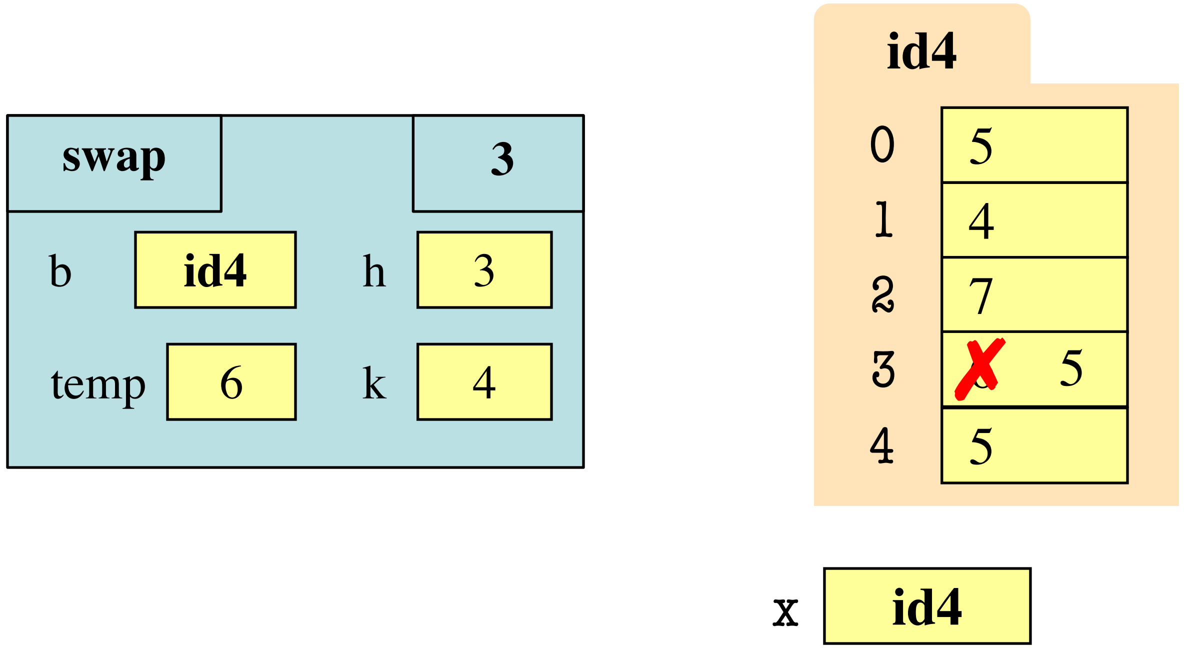

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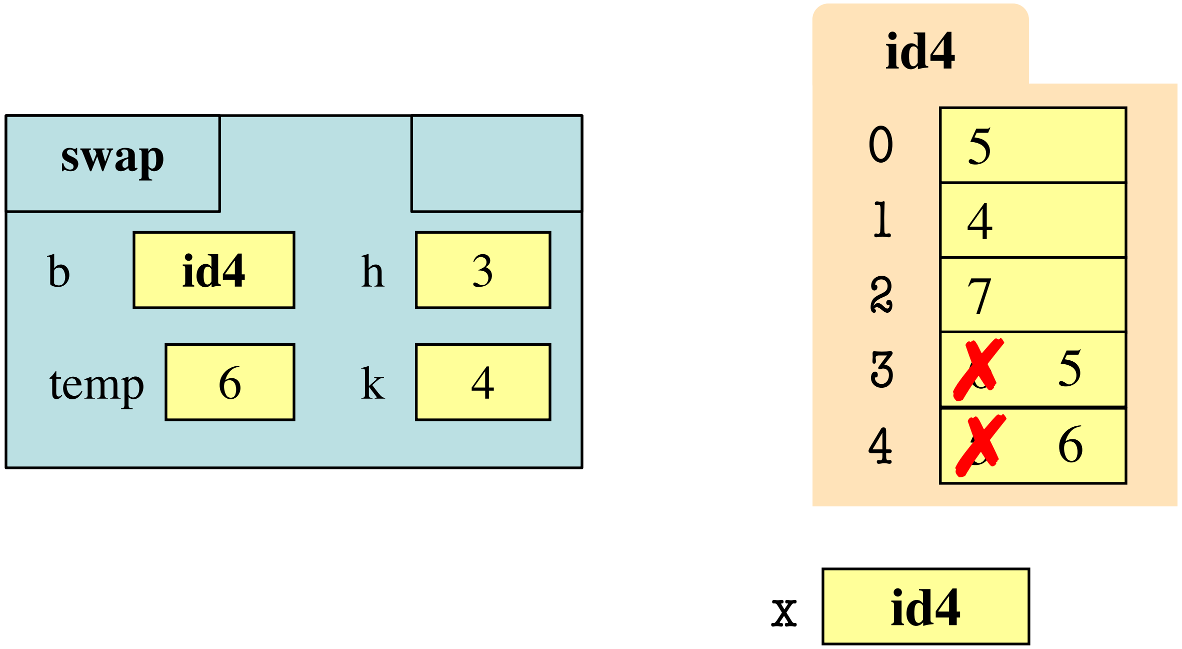
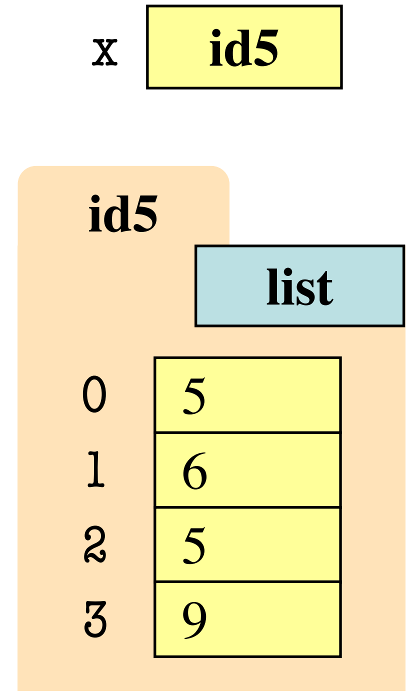
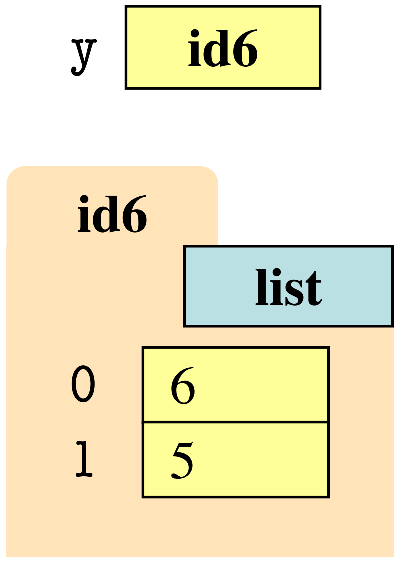


List Slices Make Copies

```
x = [5, 6, 5, 9]
```

```
y = x[1:3]
```





copy = new folder

Exercise Time

- Execute the following:

```
>>> x = [5, 6, 5, 9, 10]
>>> x[3] = -1
>>> x.insert(1,2)
```

- What is x[4]?

A: 10
B: 9
C: -1
D: **ERROR**
E: I don't know

Exercise Time

- Execute the following:

```
>>> x = [5, 6, 5, 9, 10]
>>> x[3] = -1
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```

- What is x[4]?

-1

- Execute the following:

```
>>> x = [5, 6, 5, 9, 10]
>>> y = x[1:]
>>> y[0] = 7
```

- What is x[1]?

A: 7
B: 5
C: 6
D: **ERROR**
E: I don't know

Exercise Time

- Execute the following:

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>>> x = [5, 6, 5, 9, 10]
>>> x[3] = -1
>>> x.insert(1,2)
```

- What is x[4]?

$\boxed{-1}$

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- What is x[1]?

$\boxed{6}$

Lists and Expressions

- List brackets [] can contain expressions
- This is a list **expression**
  - Python must evaluate it
  - Evaluates each expression
  - Puts the value in the list
- Example:

```
>>> a = [1+2,3+4,5+6]
>>> a
[3, 7, 11]
```

- Execute the following:

```
>>> a = 5
>>> b = 7
>>> x = [a, b, a+b]
```

- What is x[2]?

A: 'a+b'
B: 12
C: 57
D: **ERROR**
E: I don't know

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- Execute the following:

```
>>> a = 5
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```

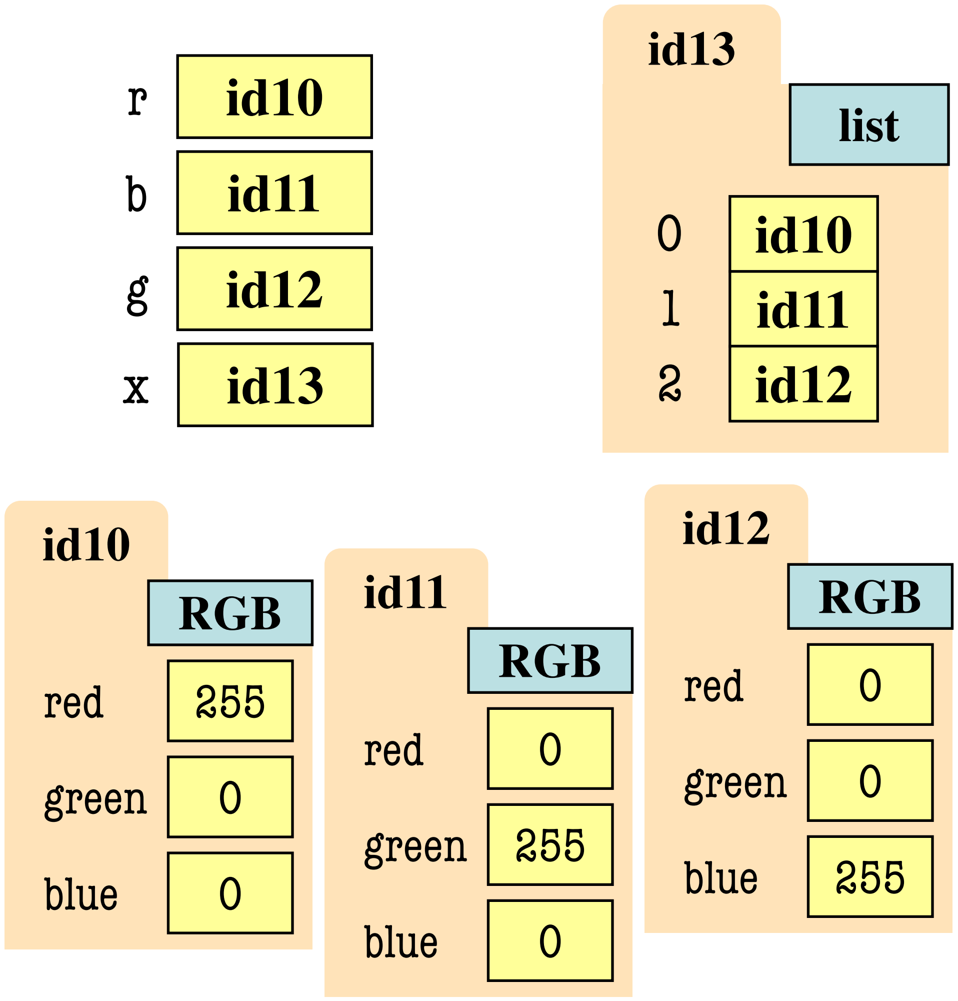
- What is x[2]?

$\boxed{12}$

Lists of Objects

- List positions are variables
  - Can store base types
  - But cannot store folders
  - Can store folder identifiers
- Folders linking to folders
  - Top folder for the list
  - Other folders for contents
- Example:

```
>>> r = colormodel.RED
>>> b = colormodel.BLUE
>>> g = colormodel.GREEN
>>> x = [r,b,g]
```



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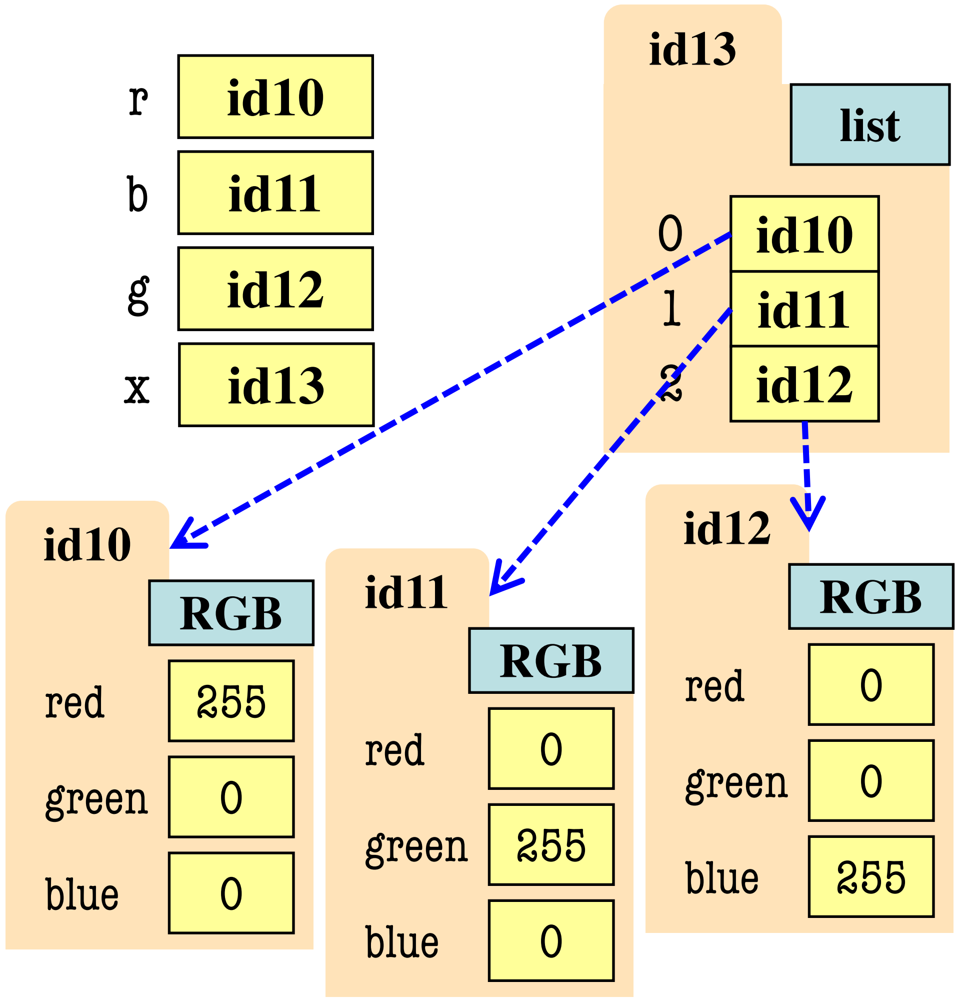

r id10
b id11
g id12
x id13
id13
list
0 id10
1 id11
2 id12
id10
RGB
red 255
green 0
blue 0
id11
RGB
red 0
green 255
blue 0
id12
RGB
red 0
green 0
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