Sequences: Lists of Values

String	List
• 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'	• 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]

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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)

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Representing Lists

Wrong	Correct
x 5, 6, 7, -2 Box is "too small" to hold the list	x id1 Variable holds id Unique tab identifier id1 0 5 1 7 2 4 3 -2 Put list in a "folder"

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

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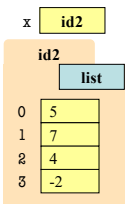
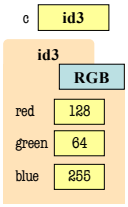
Lists vs. Class Objects

List	RGB
• Attributes are indexed ▪ Example: x[2]	• Attributes are named ▪ Example: c.red





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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
Point	Yes	Yes
RGB	Yes	Yes
list	Yes	Yes

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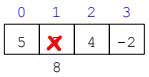
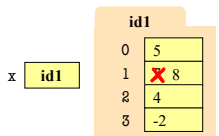
Lists are Mutable

- 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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List Methods Can Alter the List

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

- 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()

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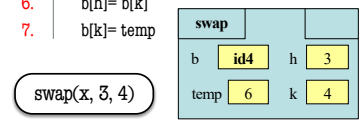
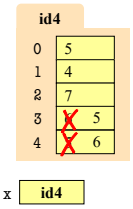
Lists and Functions: Swap

```
1. def swap(b, h, k):
2.     """ Swaps b[h] and b[k] in b
3.     Precond: b is a mutable list,
4.     h, k are valid positions"""
5.     temp= b[h]
6.     b[h]= b[k]
7.     b[k]= temp
```

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

swap(x, 3, 4)





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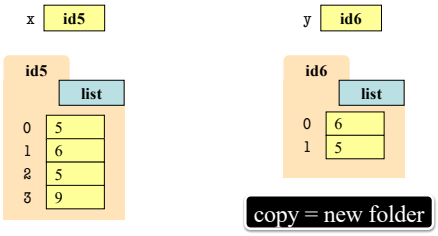
List Slices Make Copies

x = [5, 6, 5, 9] | y = x[1:3]



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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

- 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

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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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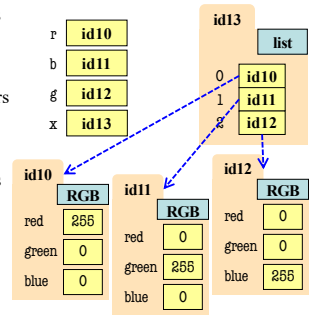
Lists of Objects

- 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 = introcs.RGB(255,0,0)
  >>> g = introcs.RGB(0,255,0)
  >>> b = introcs.RGB(0,0,255)
  >>> x = [r,g,b]
  ```



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