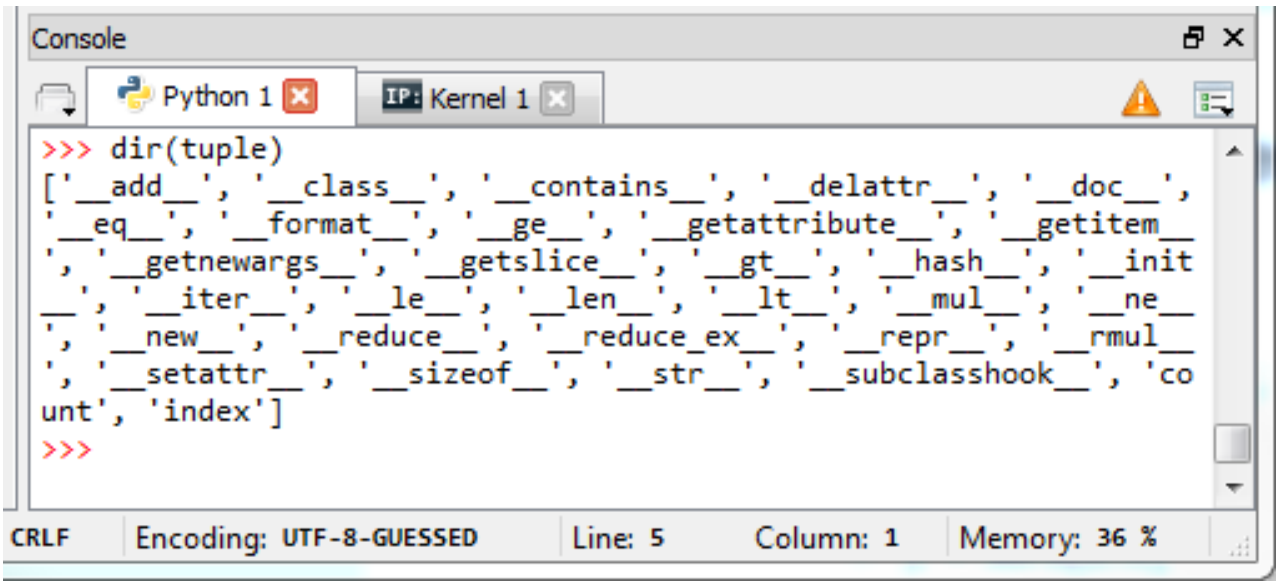
Python Tuples

Tuple Attributes

- use dir(tuple) command



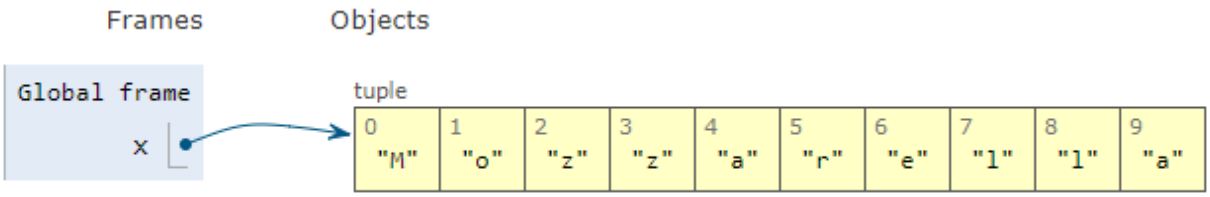
- names starting with __ refer to “local” class names/methods

Python Tuples

- ordered sequence of elements
- immutable (faster iterations)
- can contain immutable elements
- tuple data is write-protected

	0	1	2	3	4	5	6	7	8	9	
(	‘M’,	‘o’,	‘z’,	‘z’,	‘a’,	‘r’,	‘e’,	‘l’,	‘l’,	‘a’	)
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

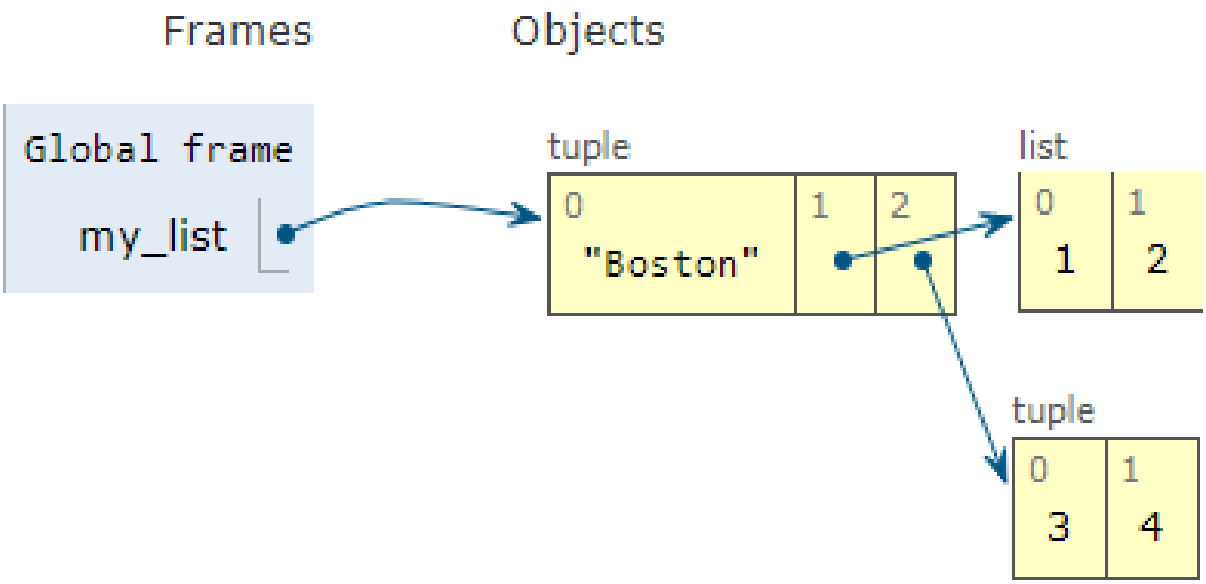
```
>>> x = (‘M’,‘o’,‘z’,‘z’,‘a’,‘r’,‘e’,‘l’,‘l’,a’)
```



Tuple with Mixed Types

- can contain mixed data types
- by contrasts, lists typically contain homogeneous data

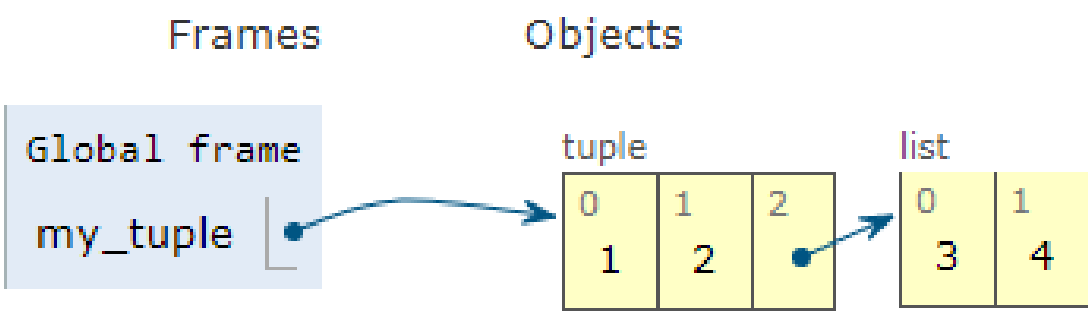
```
>>> my_tuple = (“Boston”, [1, 2], (4, 5))
```



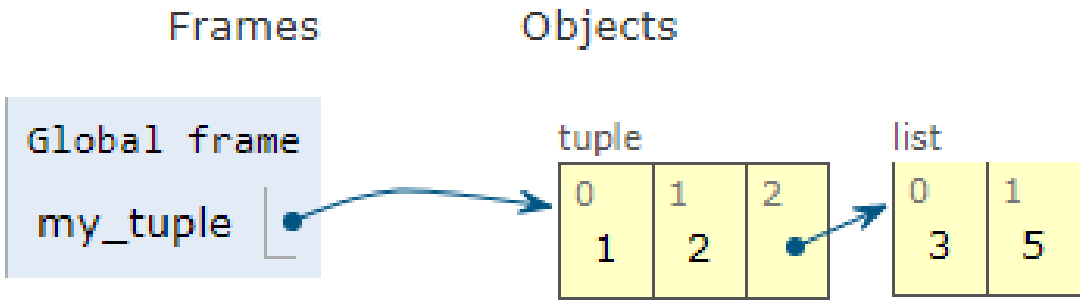
Tuple Immutability

- cannot be changed (immutable)
- nested mutable elements can be changed

```
>>> my_tuple = (1, 2, [3, 4])
```




```
>>> my_tuple[2][1] = 5
```



Tuple Packing/Unpacking

- packing: create tuple from a sequence

```
>>> choices = “Mozzarrella”, “Brie”
>>> choices
(“Mozzarrella”, “Brie”)
```

- unpacking: distribute tuple elements across variables

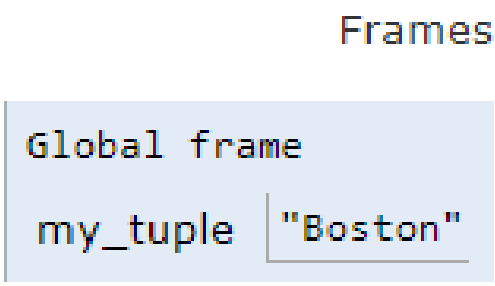
```
>>> choices = “Mozzarrella”, “Brie”
>>> choice_1, choice_2 = choices
>>> choice_2
“Brie”
```

- similar unpacking for lists

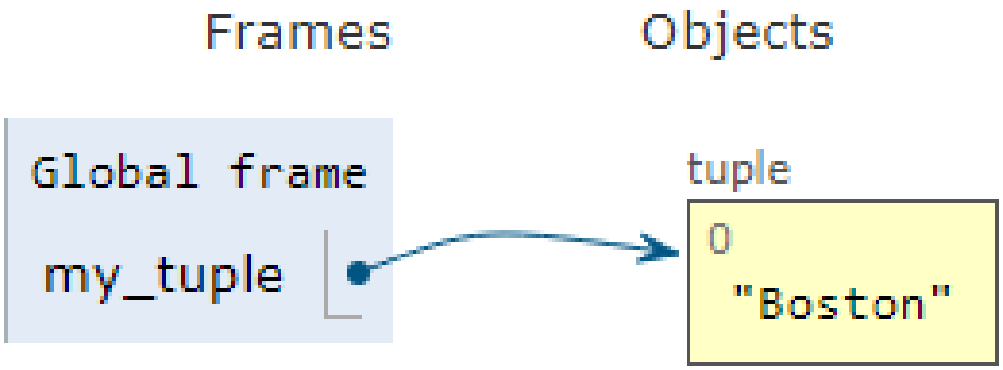
One Element Tuple

- tuple constructor is ambiguous
- use comma to indicate a tuple

```
>>> my_tuple = (“Boston”)      # string!
```




```
>>> my_tuple = (“Boston”, )    # tuple!
```



Tuple as Object

	0	1	2	3	4	5	6	7	8	9	
(	‘M’,	‘o’,	‘z’,	‘z’,	‘a’,	‘r’,	‘e’,	‘l’,	‘l’,	‘a’	)
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

```
>>> x = (‘M’,‘o’,‘z’,‘z’,‘a’,‘r’,‘e’,‘l’,‘l’,a’)
>>> x.index(‘r’)
>>> 5
```

- tuple is an object
- what are tuple attributes?

variable name	delimiter	attribute	arguments
x	.	index	(‘r’)

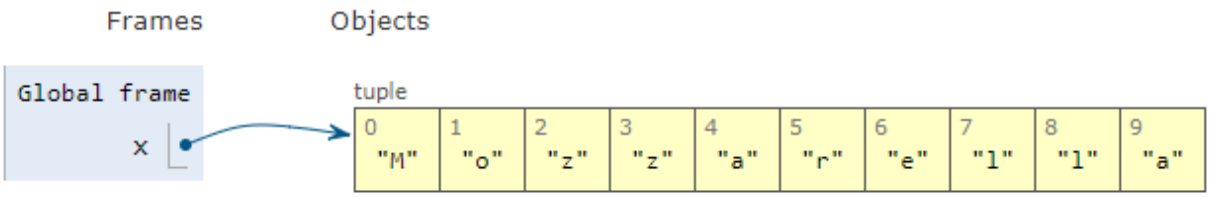
Tuple Indexing

- each tuple element has its position
- position identified by an index value

	0	1	2	3	4	5	6	7	8	9	
(	‘M’,	‘o’,	‘z’,	‘z’,	‘a’,	‘r’,	‘e’,	‘l’,	‘l’,	‘a’	)
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

```
>>> x = (‘M’,‘o’,‘z’,‘z’,‘a’,‘r’,‘e’,‘l’,‘l’,a’)
```

- indexing starts at 0, ends at (length – 1)
- can refer to slices but positive or negative indices

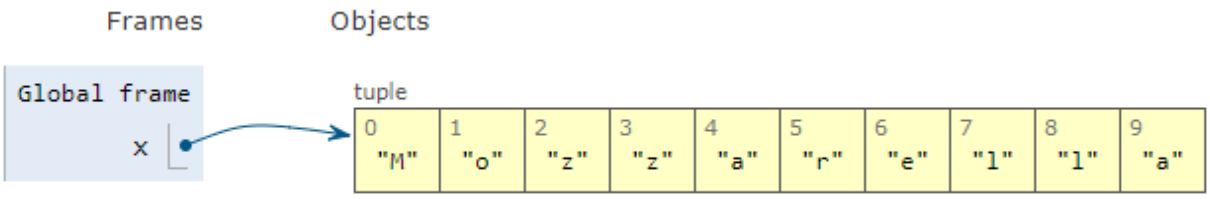


Tuple Slicing

- each element is identified by its position
- slice – elements between two positions

```
>>> x = ('M','o','z','z','a','r','e','l','l','a')
```

	0	1	2	3	4	5	6	7	8	9	
(	'M',	'o',	'z',	'z',	'a',	'r',	'e',	'l',	'l',	'a'	)
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

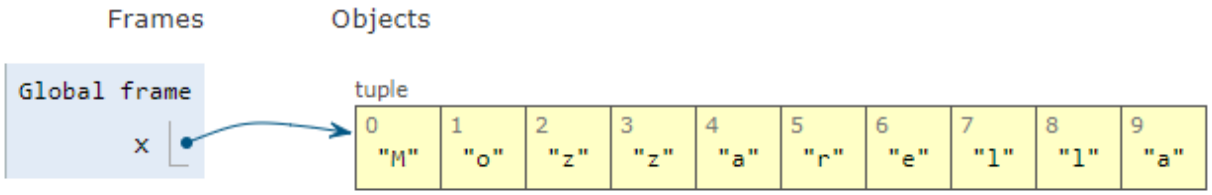


- indexing starts at 0, ends at (length – 1)
- can refer to slices but positive or negative indices

Tuple Slicing

	0	1	2	3	4	5	6	7	8	9	
(	‘M’,	‘o’,	‘z’,	‘z’,	‘a’,	‘r’,	‘e’,	‘l’,	‘l’,	‘a’	)
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

>>> x = (‘M’,‘o’,‘z’,‘z’,‘a’,‘r’,‘e’,‘l’,‘l’,a’)



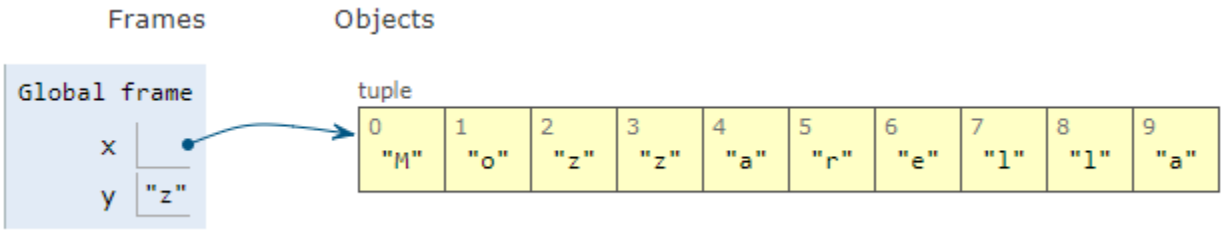
- slice operator:

variable		start		one past end	
x	(	i	:	j	)

Slicing with Single Index

	0	1	2	3	4	5	6	7	8	9	
(	'M',	'o',	'z',	'z',	'a',	'r',	'e',	'l',	'l',	'a'	)
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

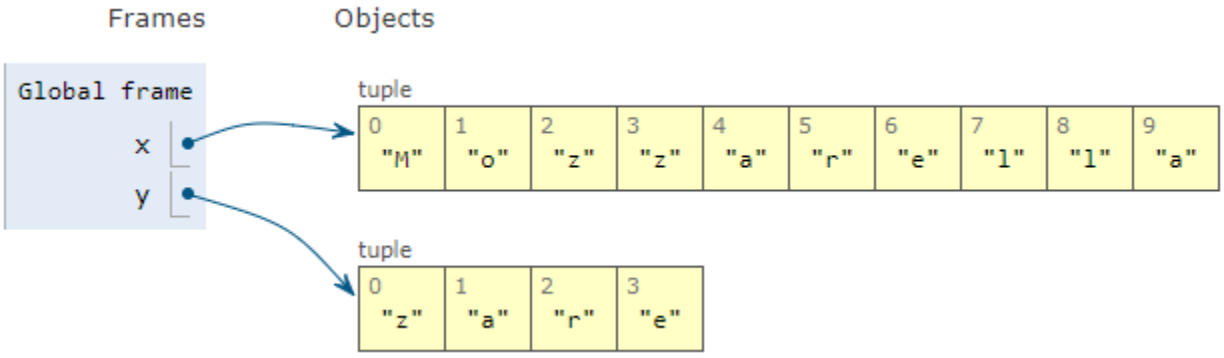
```
>>> x = ('M','o','z','z','a','r','e','l','l',a')
>>> y = x[2]
>>> y
>>> z
```



Slicing with Positive Indices

	0	1	2	3	4	5	6	7	8	9	
(	‘M’,	‘o’,	‘z’,	‘z’,	‘a’,	‘r’,	‘e’,	‘l’,	‘l’,	‘a’	)
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

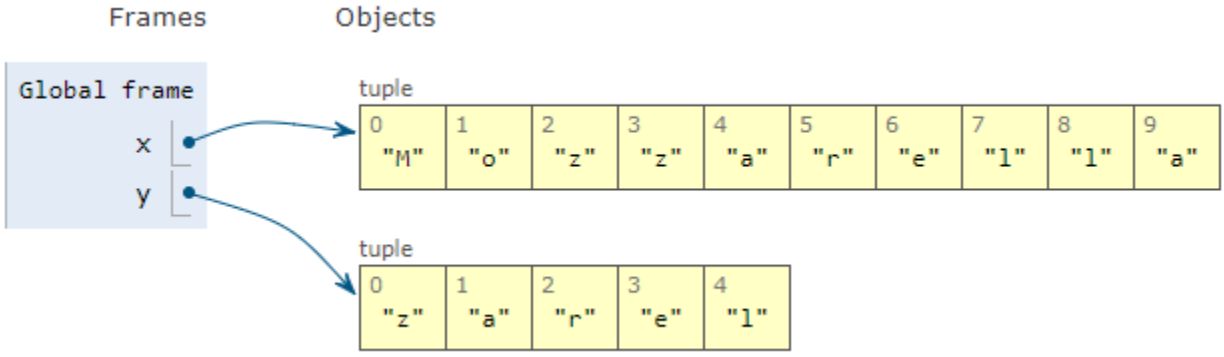
```
>>> x = (‘M’,‘o’,‘z’,‘z’,‘a’,‘r’,‘e’,‘l’,‘l’,a’)
>>> y = x[3 : 7]
>>> y
>>> ( ‘z’, ‘a’, ‘r’, ‘e’ )
```



Slicing w. Negative Indices

	0	1	2	3	4	5	6	7	8	9	
(	'M',	'o',	'z',	'z',	'a',	'r',	'e',	'l',	'l',	'a'	)
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

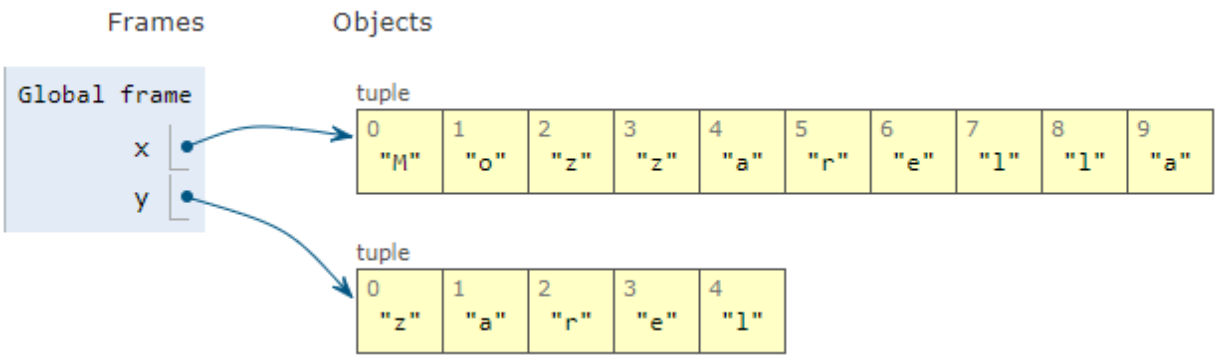
```
>>> x = ('M','o','z','z','a','r','e','l','l',a')
>>> y = x[−7 : −2]
>>> y
>>> ( 'z', 'a', 'r', 'e', 'l' )
```



Slicing with Positive and Negative Indices

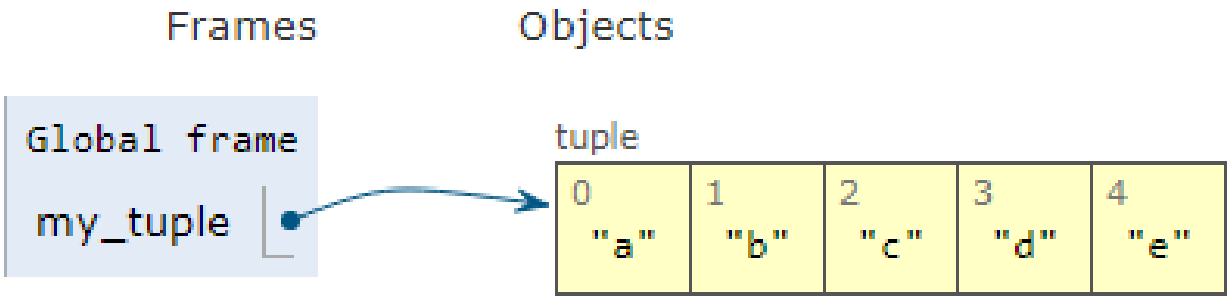
	0	1	2	3	4	5	6	7	8	9	
(	'M',	'o',	'z',	'z',	'a',	'r',	'e',	'l',	'l',	'a'	)
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

```
>>> x = ('M','o','z','z','a','r','e','l','l',a')
>>> y = x[3 : −2]
>>> y
>>> ( 'z', 'a', 'r', 'e', 'l' )
```

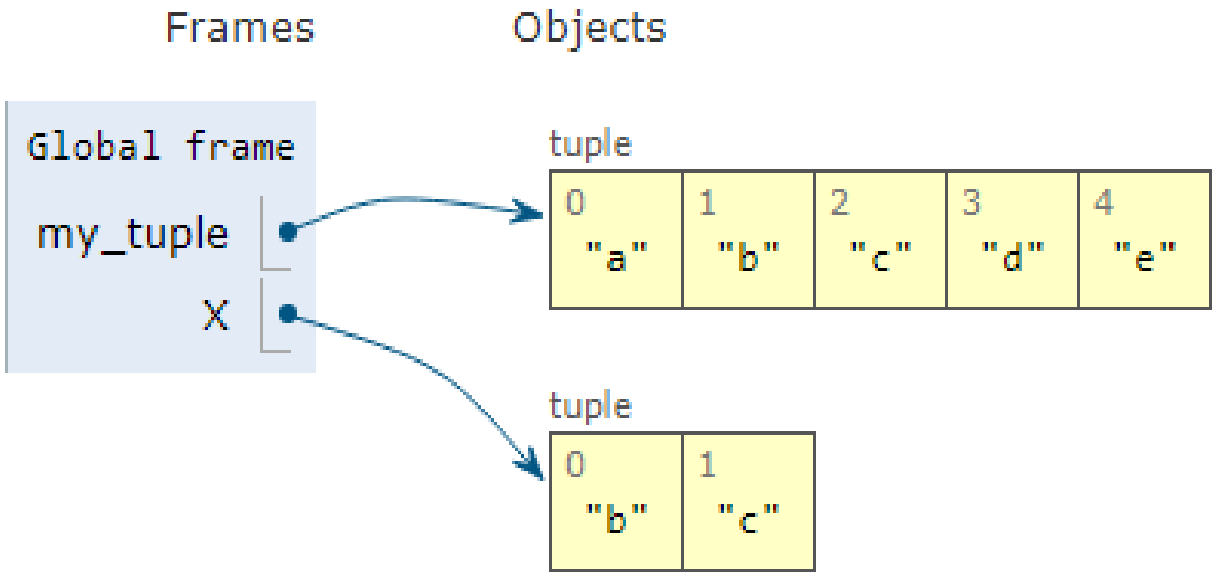


Tuple Slicing

>> my_tuple = (“a”, “b”, “c”, “d”, “e”)

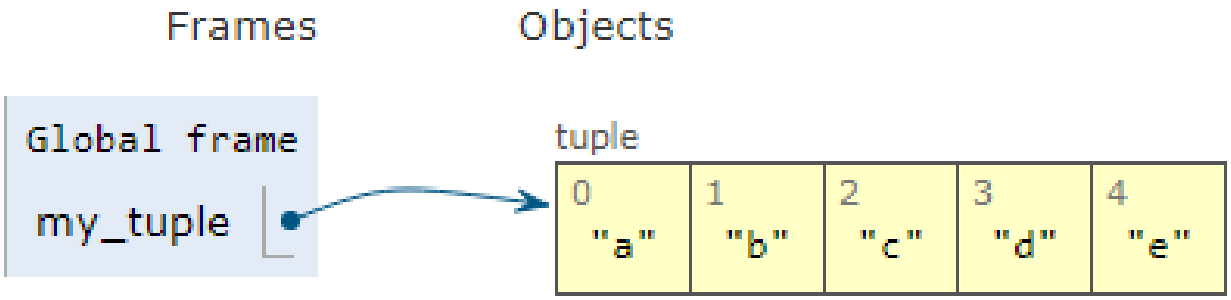


>> X = my_tuple[1:3]

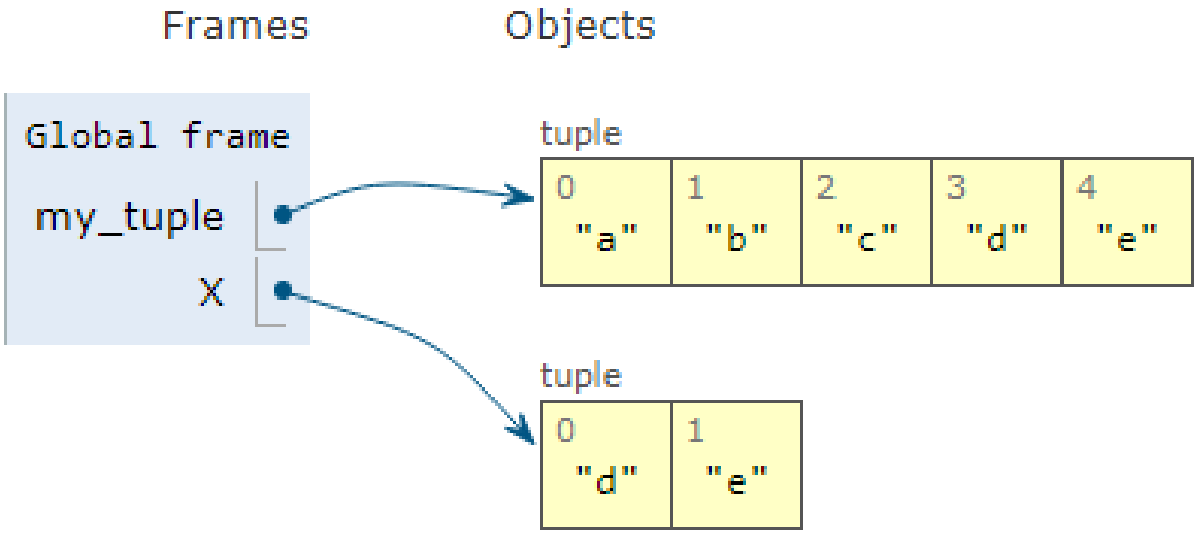


Tuple Slicing (cont'd)

>> my_tuple = ("a", "b", "c", "d", "e")



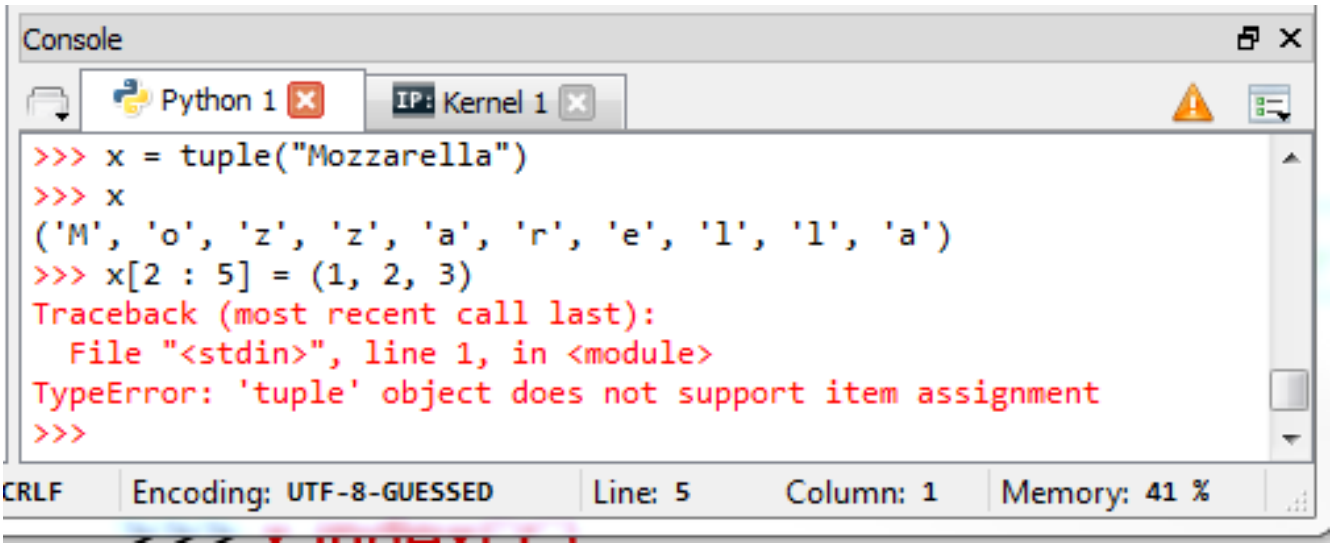
>> X = my_tuple[3:]



Tuple Slice Replacement

	0	1	2	3	4	5	6	7	8	9	
(	'M',	'o',	'z',	'z',	'a',	'r',	'e',	'l',	'l',	'a'	)
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

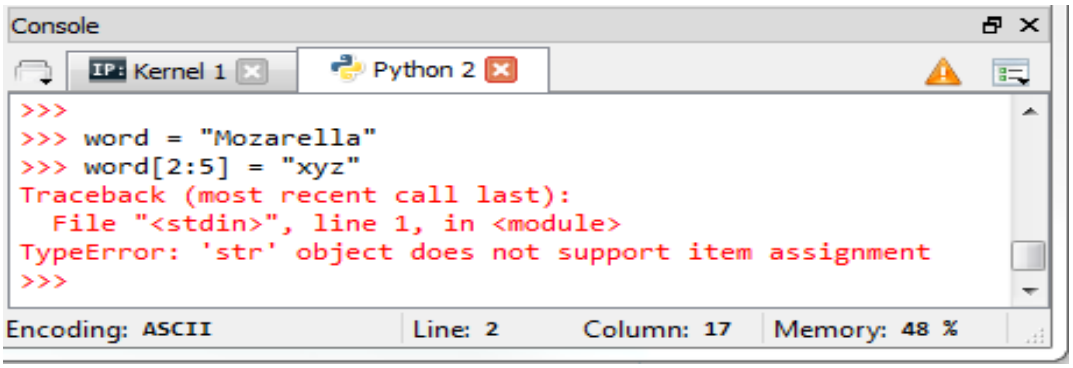
- tuples are immutable (like strings)
- cannot change sub-tuples without creating new tuple!!!



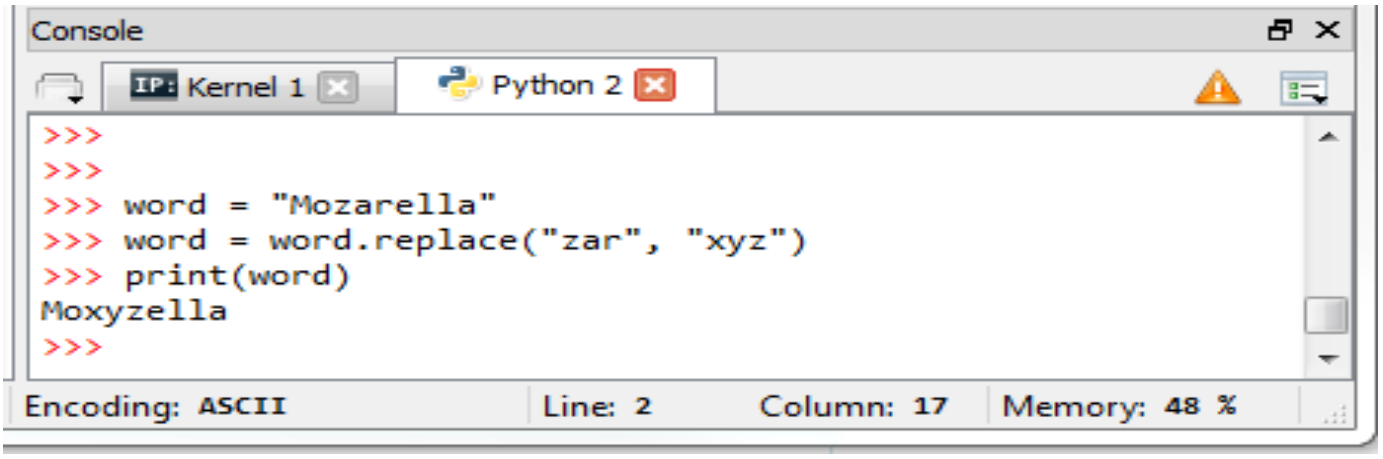
Valid vs. Invalid Slicing

	0	1	2	3	4	5	6	7	8	
(	'M'	'o'	'z'	'a'	'r'	'e'	'l'	'l'	'a'	)
	-9	-8	-7	-6	-5	-4	-3	-2	-1	

- why is this illegal?



- but this is legal !



Tuple Slicing: Quiz

	0	1	2	3	4	5	6	7	8	9	
(	'M',	'o',	'z',	'z',	'a',	'r',	'e',	'l',	'l',	'a'	)
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

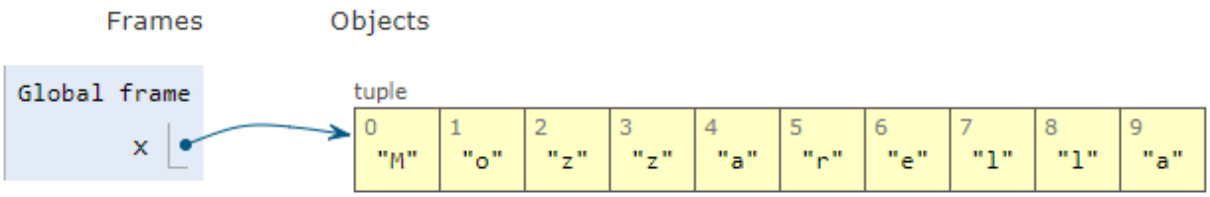
- what is the result of these operations?

```
>>> x = ('M','o','z','z','a','r','e','l','l',a')
>>> y = x[−1]
>>> z = x[2 : 6]
>>> w = x[−7 : −3]
>>> v = x[ : ]
```

Tuple Slicing: Quiz (cont'd)

	0	1	2	3	4	5	6	7	8	9	
(	'M',	'o',	'z',	'z',	'a',	'r',	'e',	'l',	'l',	'a'	)
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

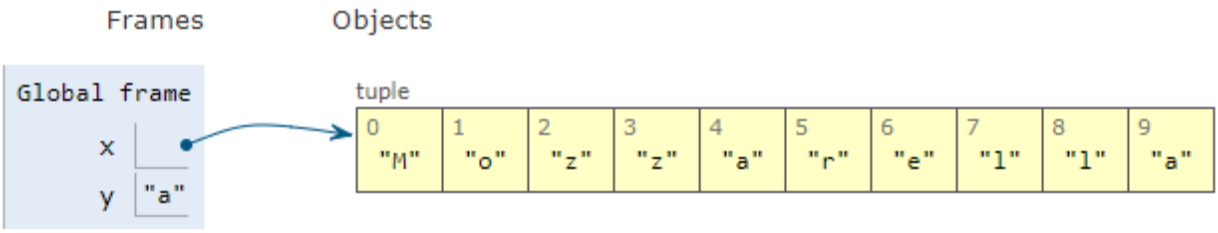
```
>>> x = ('M','o','z','z','a','r','e','l','l',a')
```



Tuple Slicing: Quiz (cont'd)

	0	1	2	3	4	5	6	7	8	9	
(	'M',	'o',	'z',	'z',	'a',	'r',	'e',	'l',	'l',	'a'	)
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

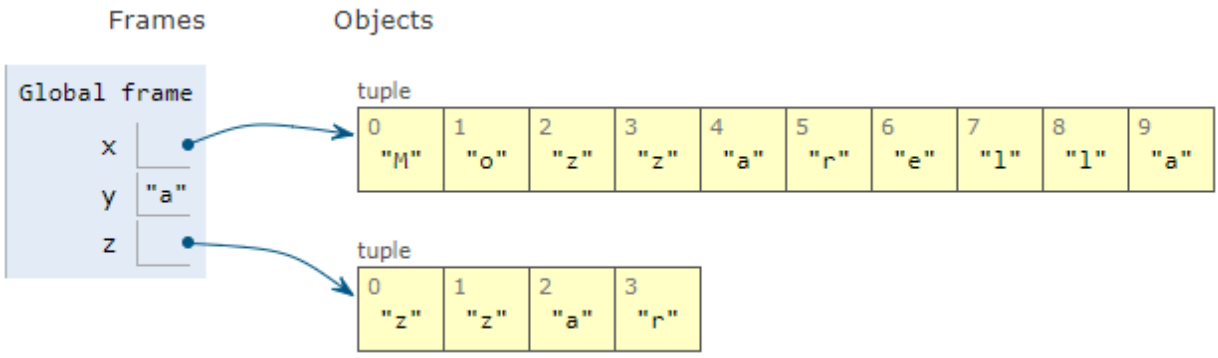
```
>>> x = ('M','o','z','z','a','r','e','l','l',a')
>>> y = x[−1]
>>> a
```



Tuple Slicing: Quiz (cont'd)

	0	1	2	3	4	5	6	7	8	9	
(	'M',	'o',	'z',	'z',	'a',	'r',	'e',	'l',	'l',	'a'	)
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

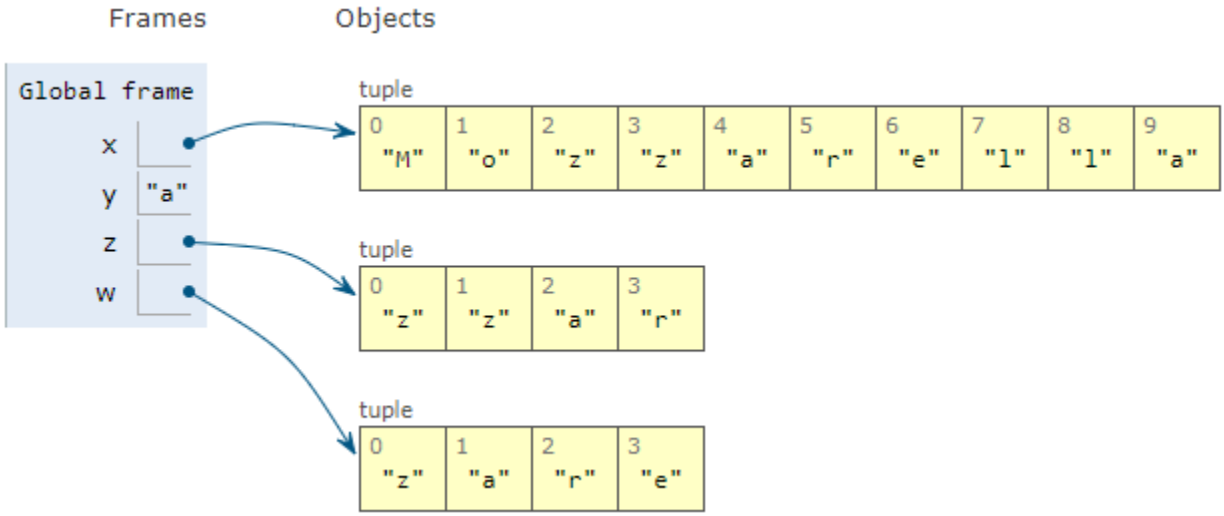
```
>>> x = ('M','o','z','z','a','r','e','l','l',a')
>>> y = x[−1]
>>> z = x[2 : 6]
```



Tuple Slicing: Quiz (cont'd)

(	0	1	2	3	4	5	6	7	8	9	)
	'M',	'o',	'z',	'z',	'a',	'r',	'e',	'l',	'l',	'a'	
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

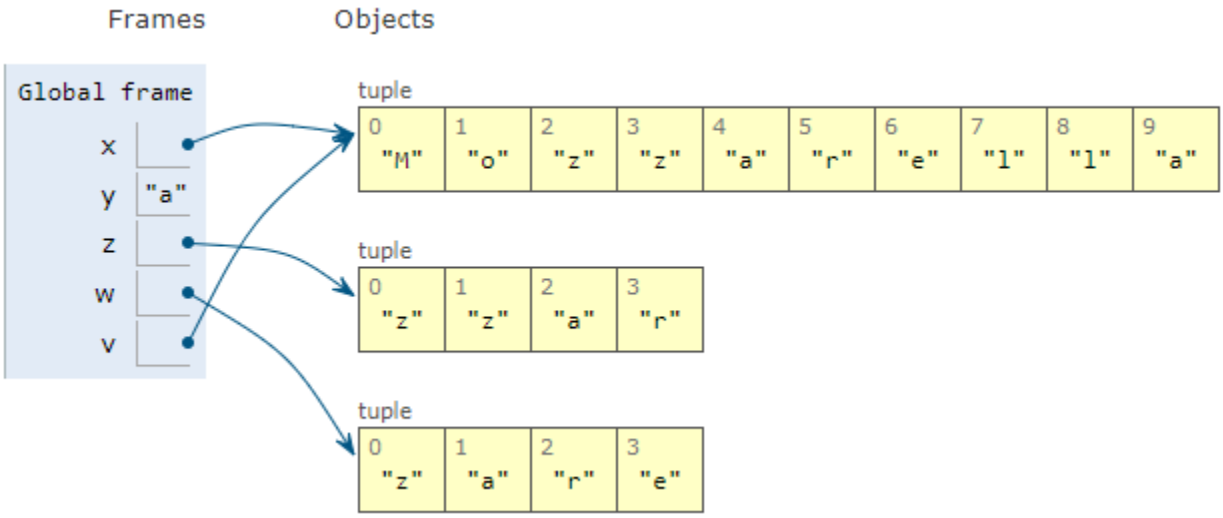
```
>>> x = ('M','o','z','z','a','r','e','l','l',a')
>>> y = x[−1]
>>> z = x[2 : 6]
>>> w = x[−7 : −3]
```



Tuple Slicing: Quiz (cont'd)

	0	1	2	3	4	5	6	7	8	9	
(	'M',	'o',	'z',	'z',	'a',	'r',	'e',	'l',	'l',	'a'	)
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

```
>>> x = ('M','o','z','z','a','r','e','l','l','a')
>>> y = x[−1]
>>> z = x[2 : 6]
>>> w = x[−7 : −3]
>>> v = x[ : ]
```

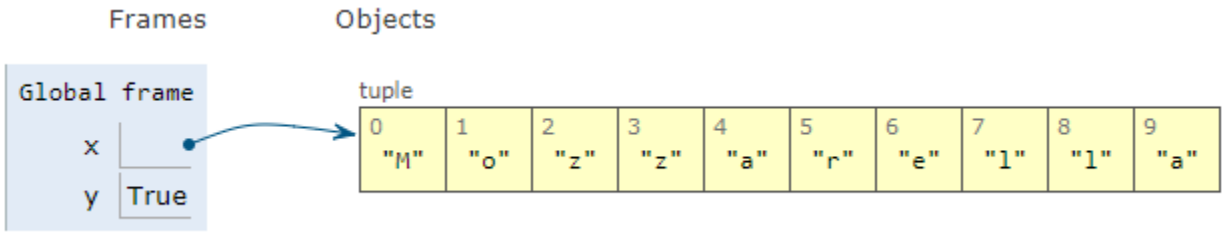


- example of a "shallow" copy

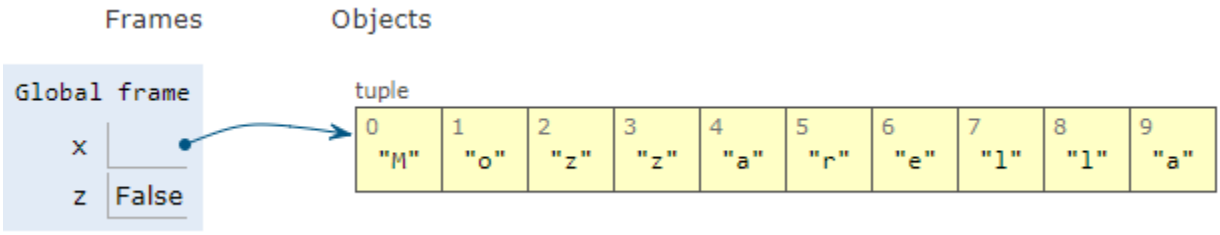
Tuple Membership: *in*, *not in*

	0	1	2	3	4	5	6	7	8	9	
(	'M',	'o',	'z',	'z',	'a',	'r',	'e',	'l',	'l',	'a'	)
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

```
>>> x = ('M','o','z','z','a','r','e','l','l',a')
>>> y = 'r' in x
```

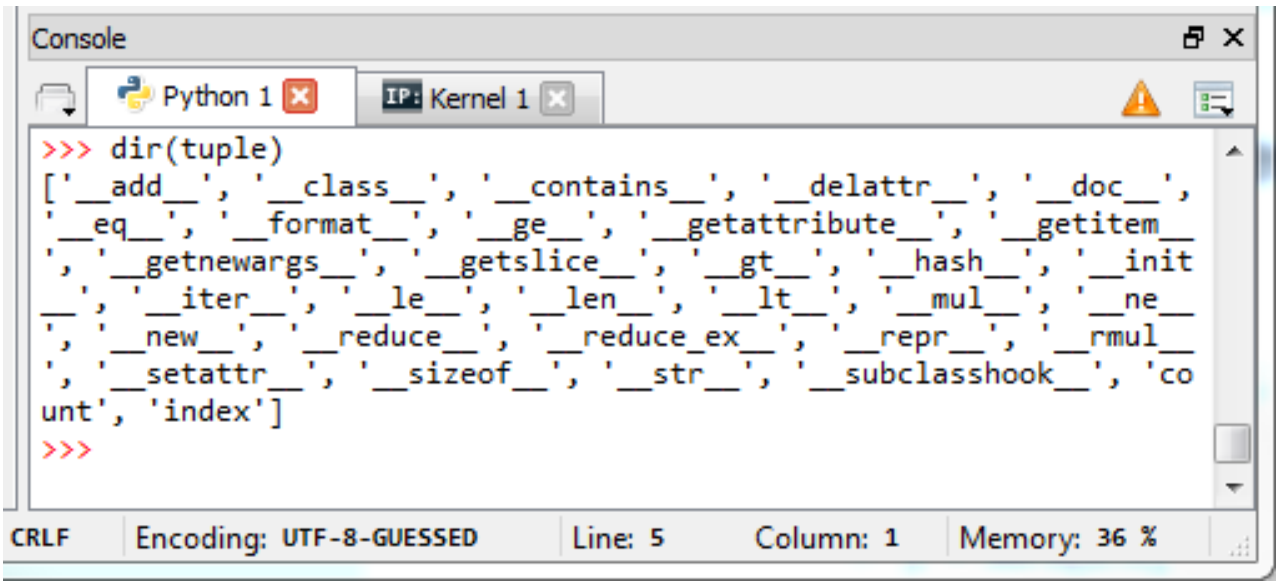



```
>>> z = "a" not in x
```



Tuple Attributes

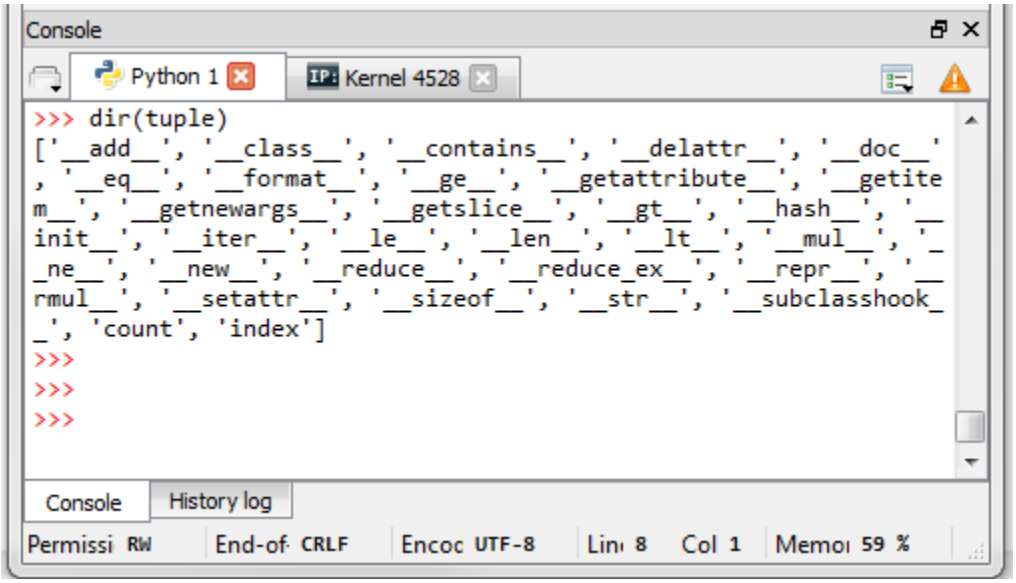
- use dir(tuple) command



- names starting with __ refer to “local” class names/methods

tuple Type Methods

```
>>> dir(tuple)
```



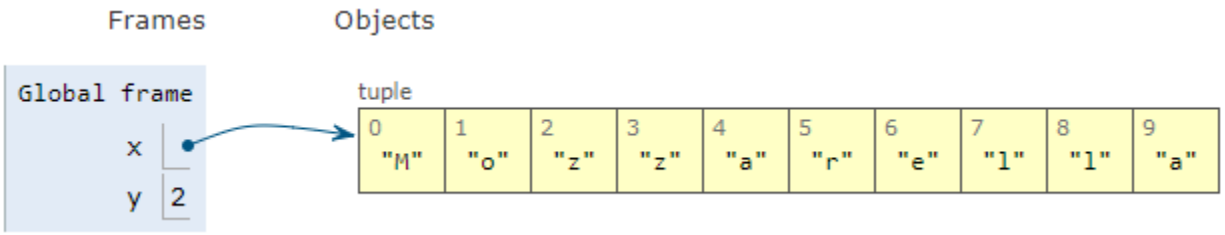

```
>>> ('Mozzarella', 'Brie').__len__()
2
>>> ('Mozzarella', 'Brie').__sizeof__()
40
```

Tuple Methods

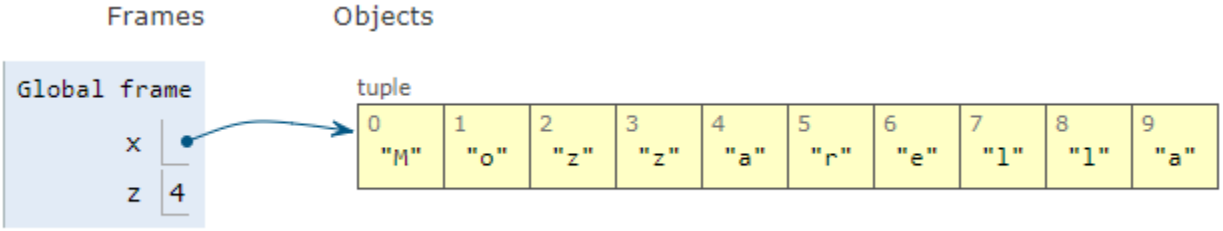
	0	1	2	3	4	5	6	7	8	9	
(	‘M’,	‘o’,	‘z’,	‘z’,	‘a’,	‘r’,	‘e’,	‘l’,	‘l’,	‘a’	)
	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	

- cannot add/remove items for tuples
- two methods: *count*(x) and *index*(x)

```
>>> x = (‘M’,‘o’,‘z’,‘z’,‘a’,‘r’,‘e’,‘l’,‘l’,a’)
>>> y = x.count(‘a’)
```

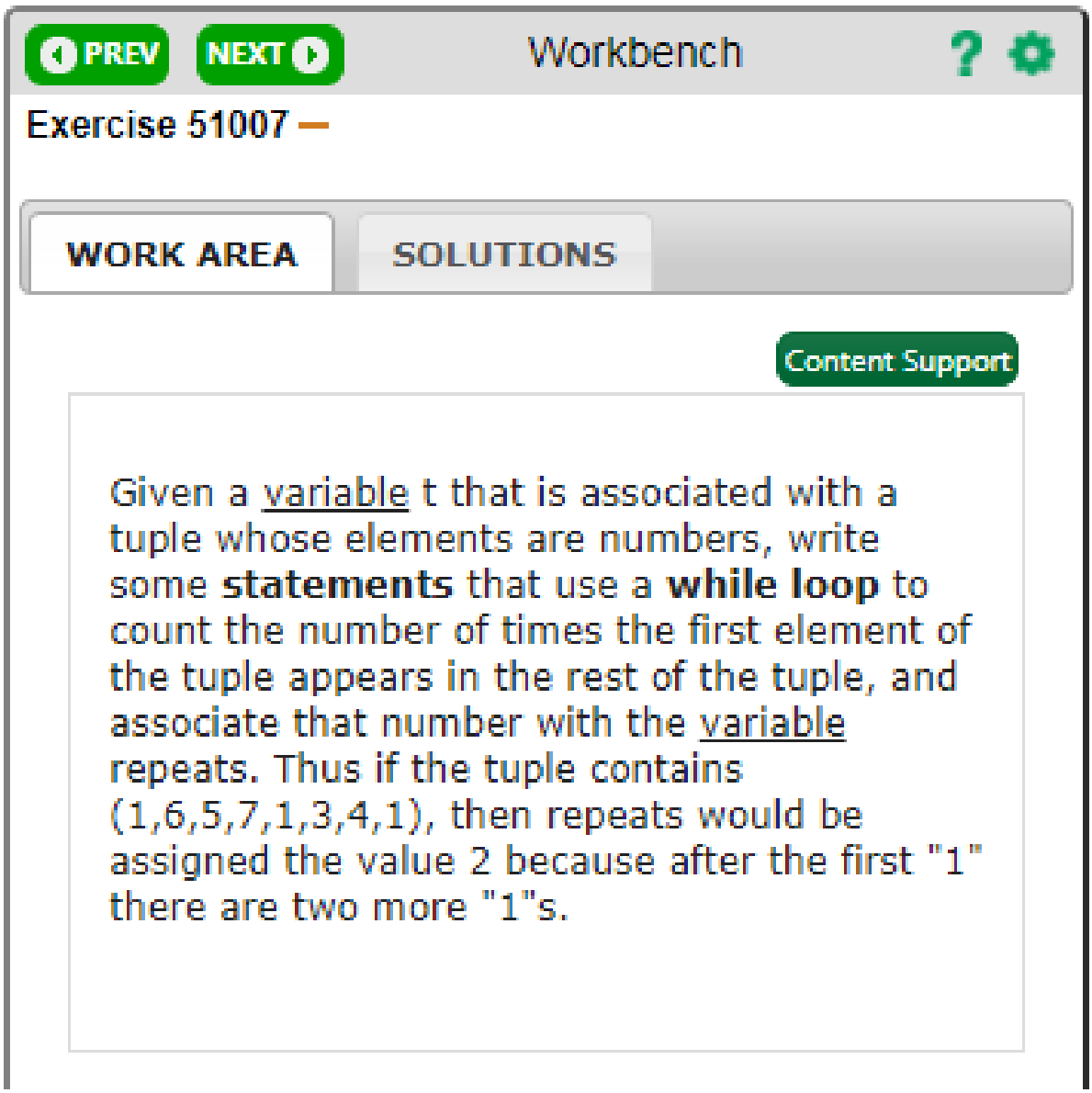



```
>>> z = x.index(‘a’)
```



Review Problems

Programming Exercise



Programming Exercise Worksheet

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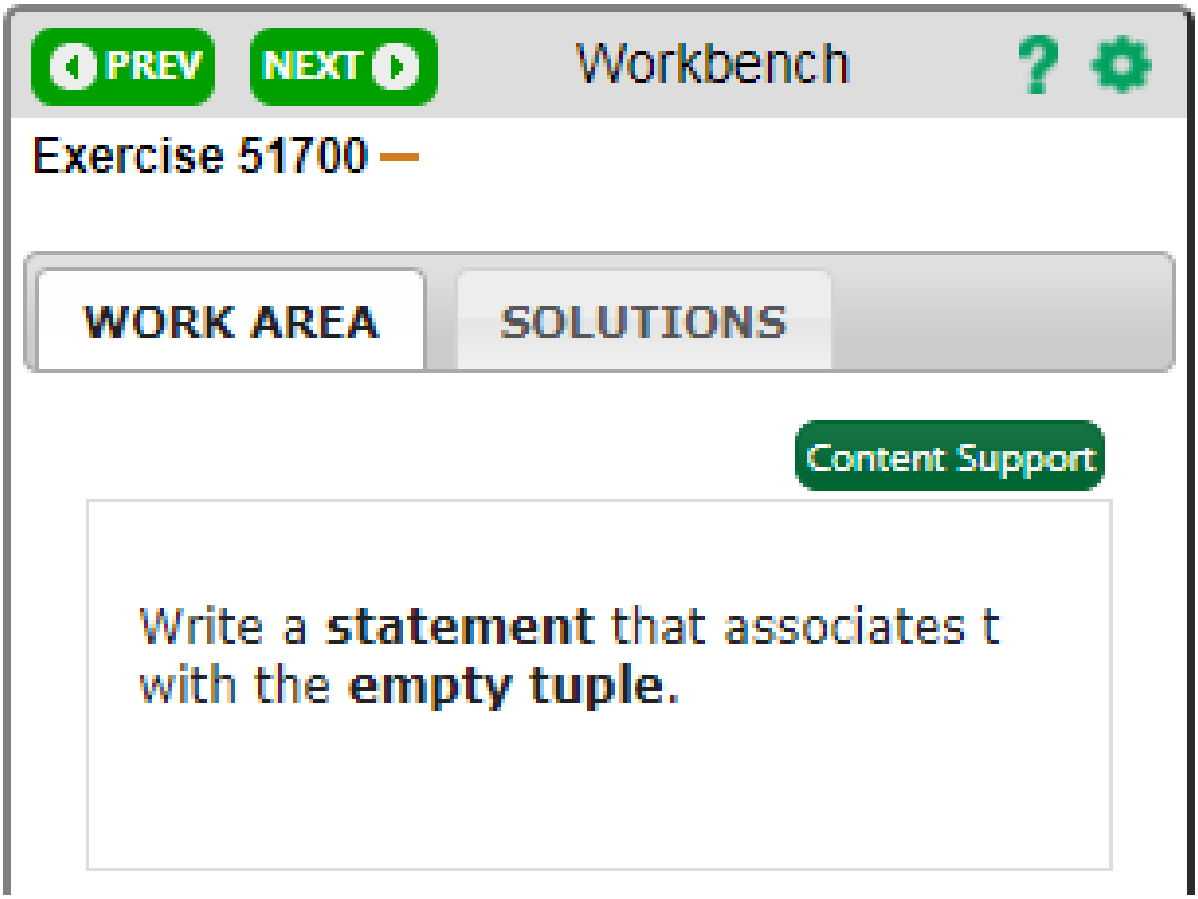
Programming Exercise



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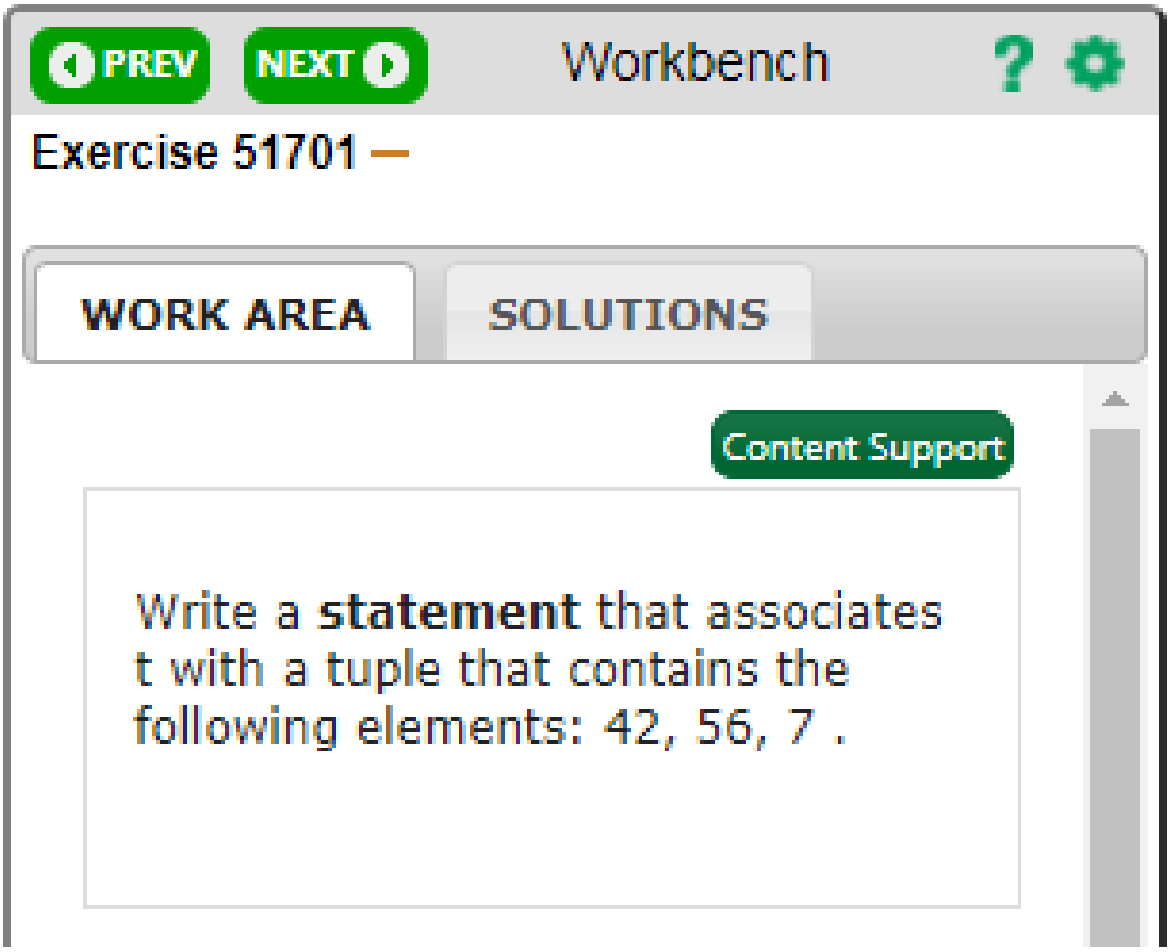
Programming Exercise



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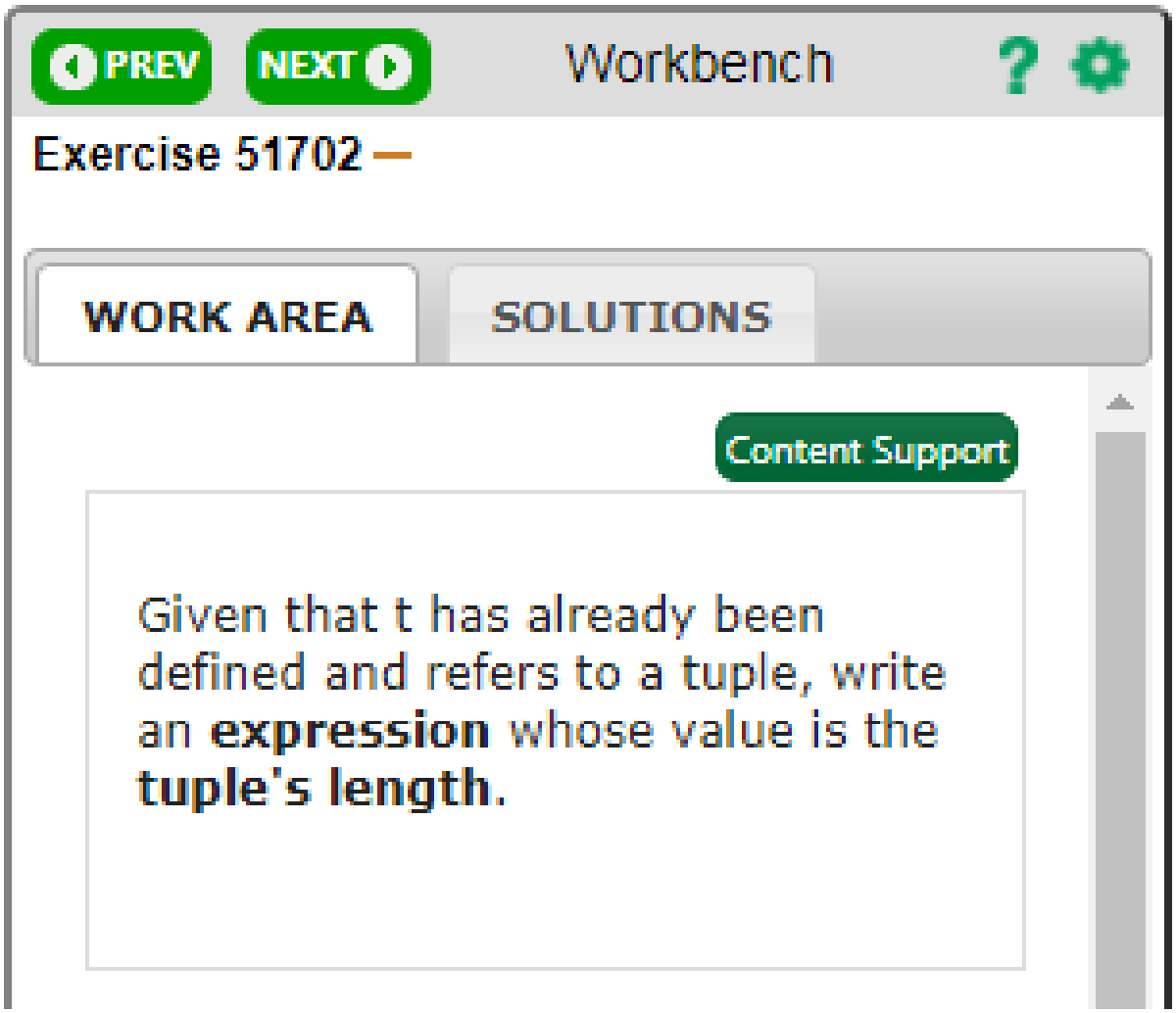
Programming Exercise



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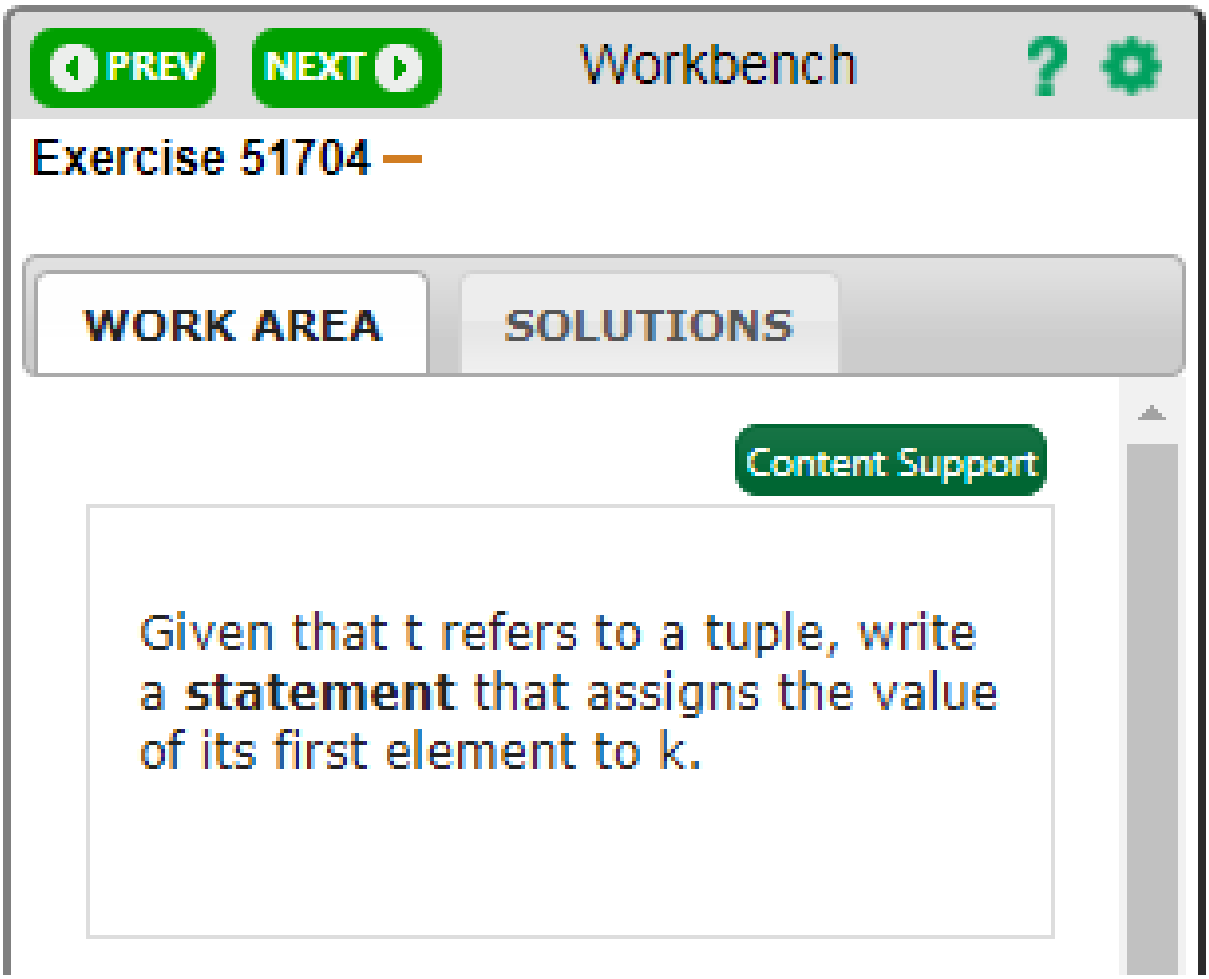
Programming Exercise



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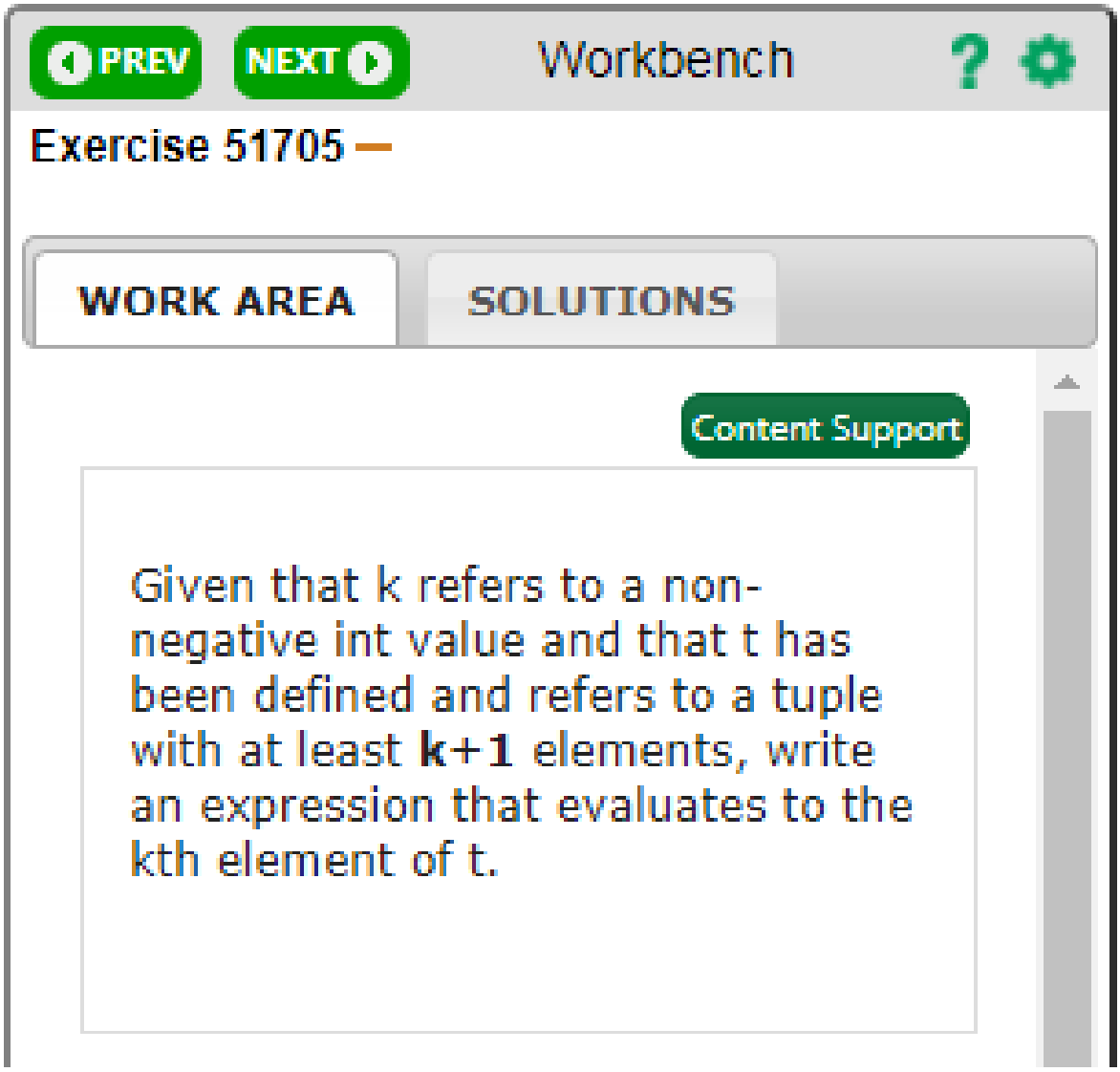
Programming Exercise



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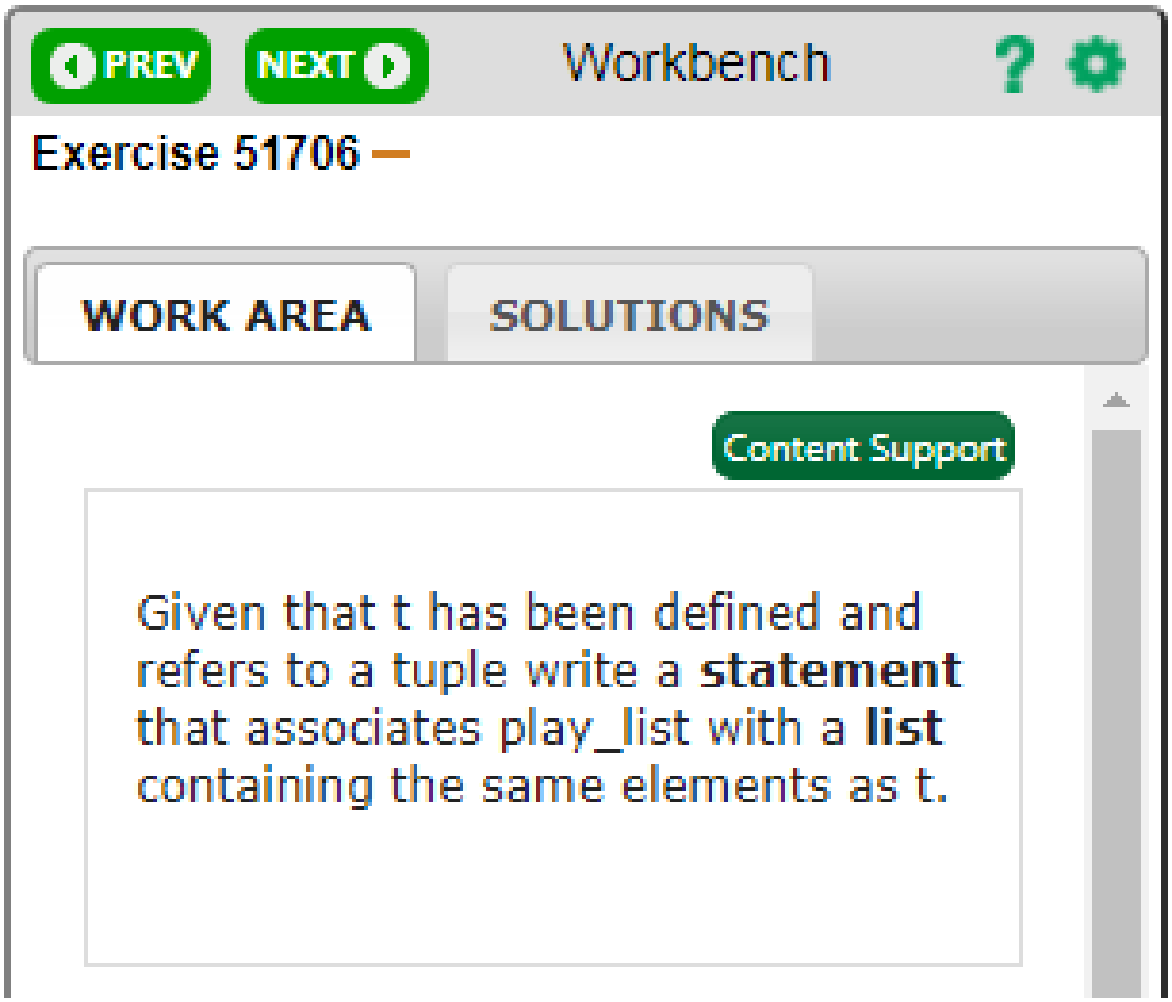

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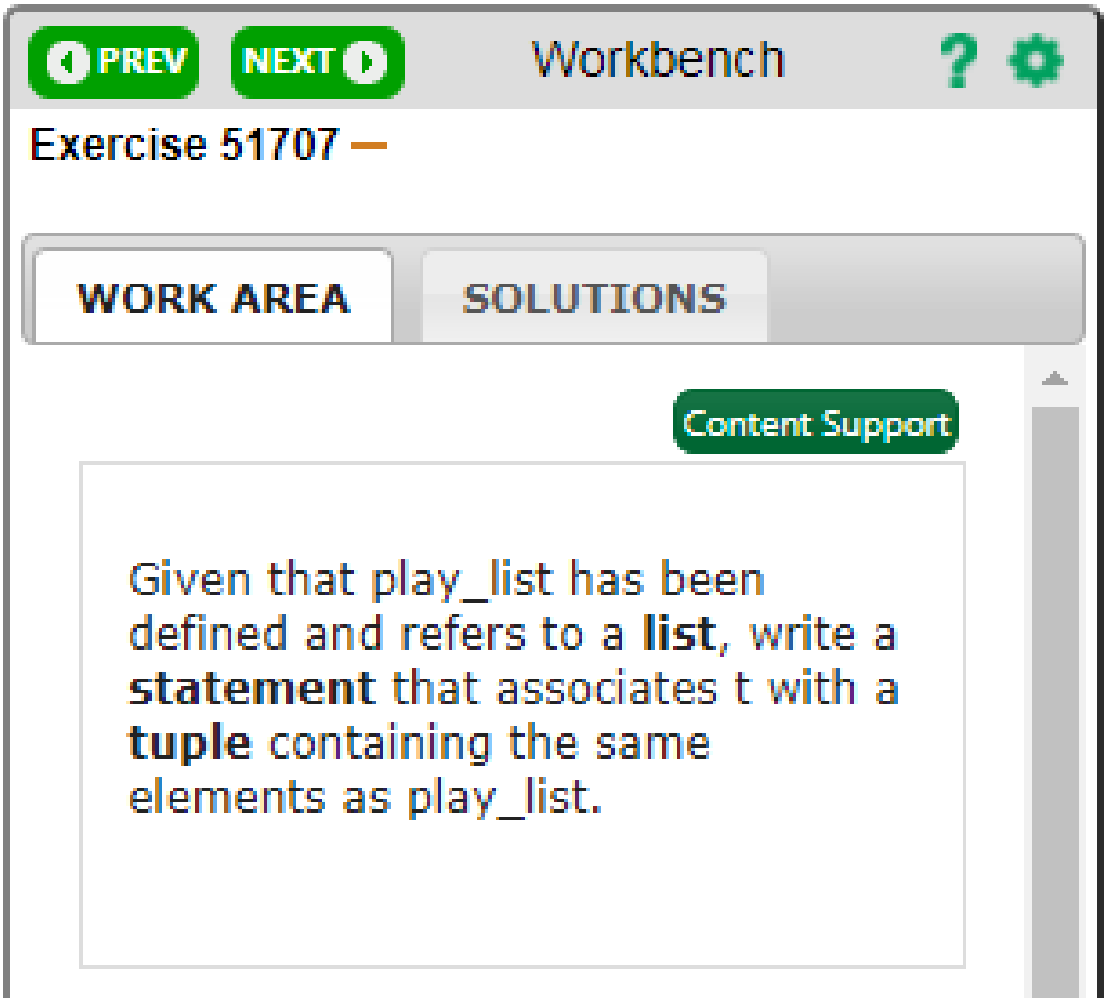
Programming Exercise



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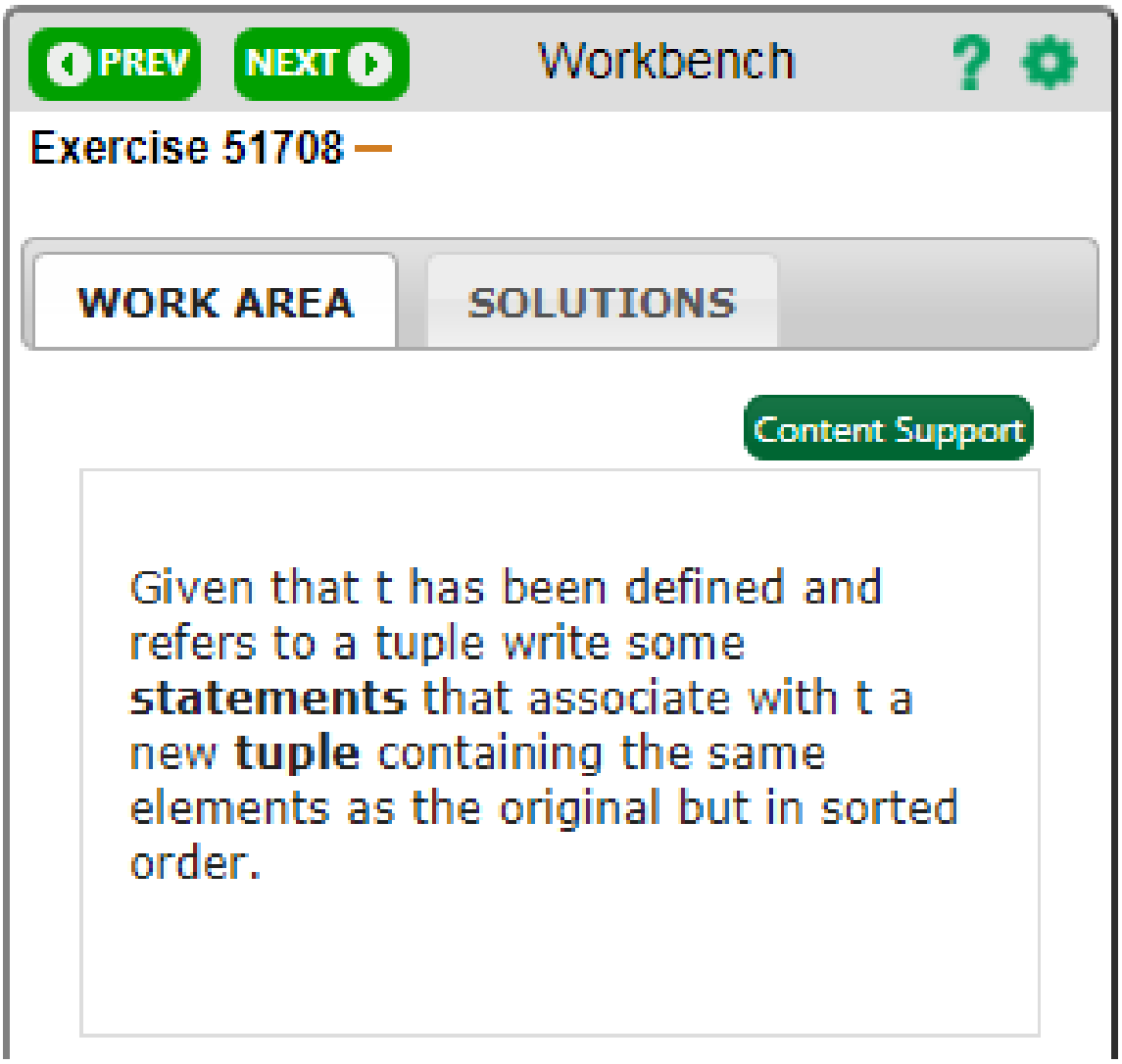
Programming Exercise



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