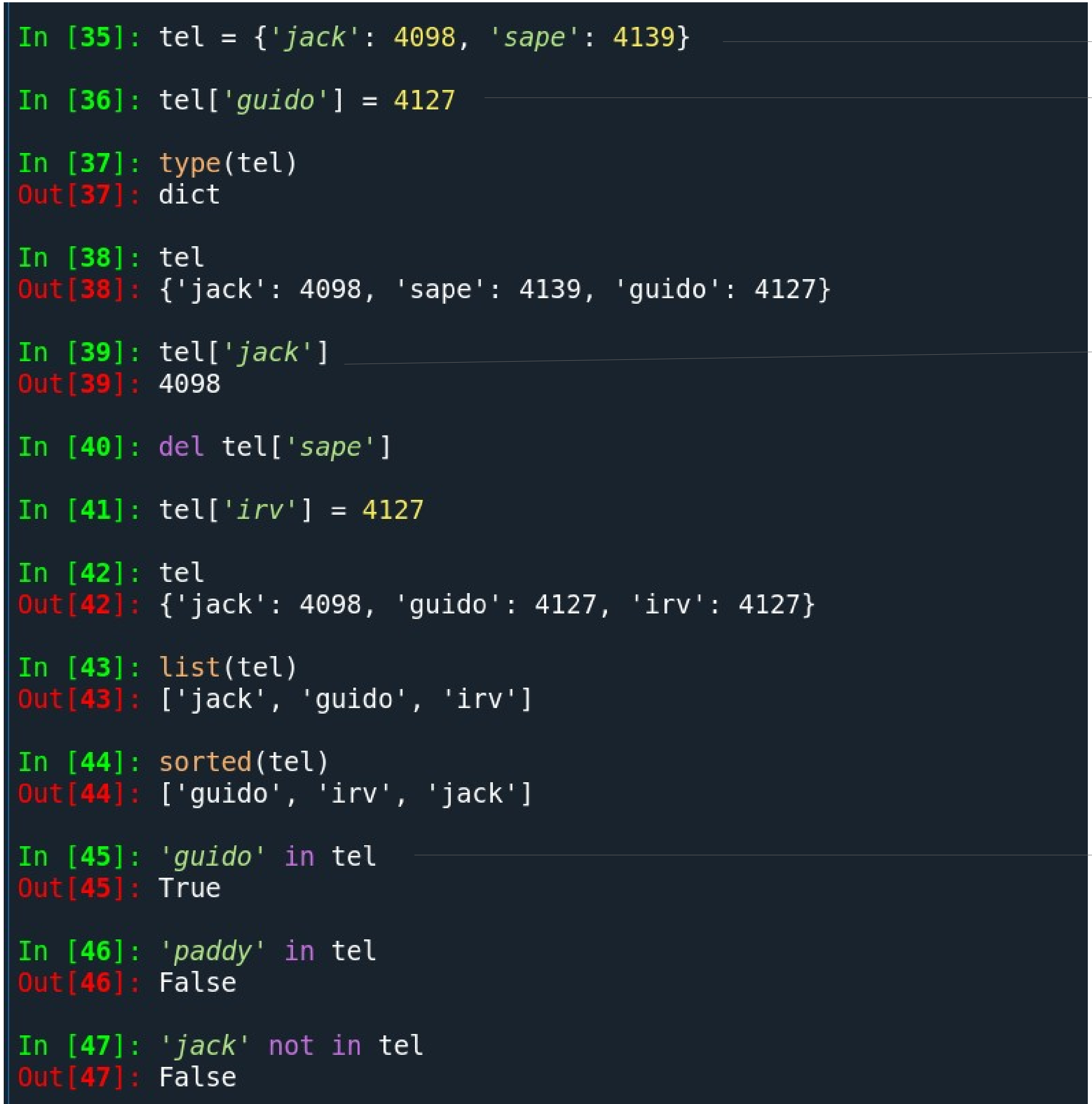
IC152 Lec 15

Feb 2021

Dictionaries

- Dictionaries are like lists, except that the index is any immutable type
- key:value pairs
- Also called associative arrays or hashtables
- Store a value and then retrieve it
- Dictionaries are mutable



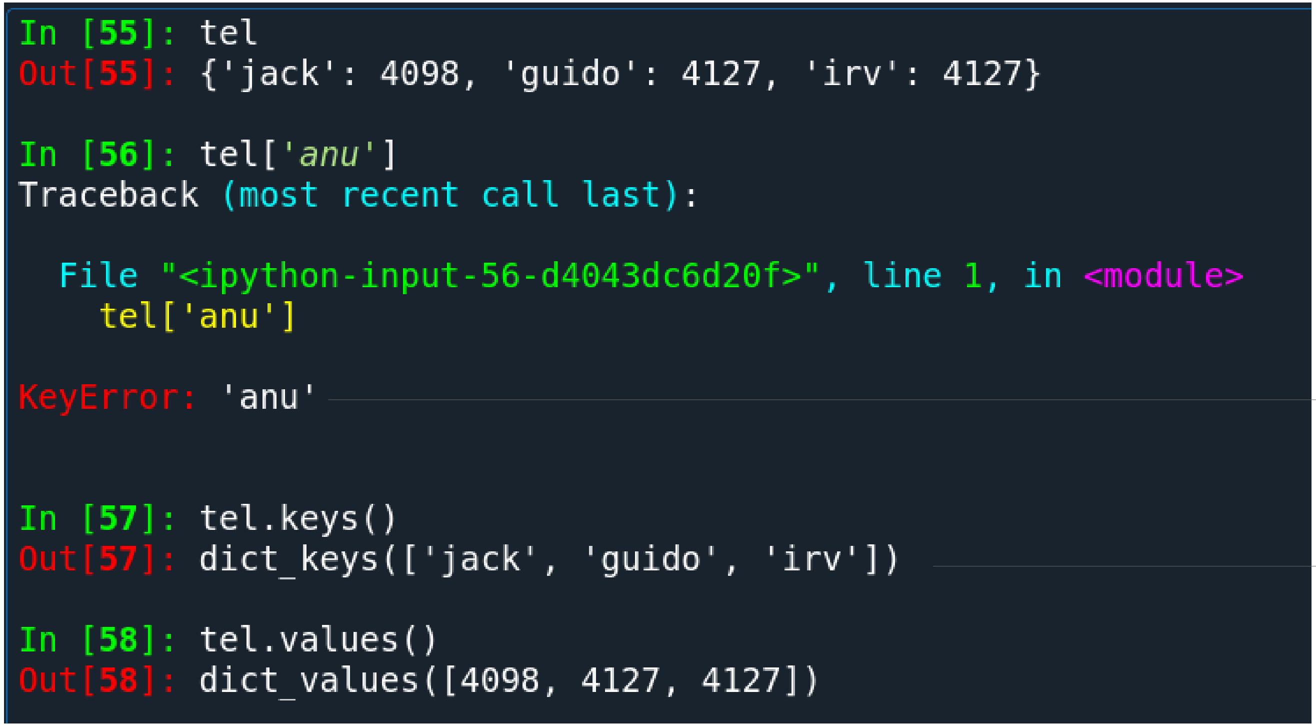
```
In [35]: tel = {'jack': 4098, 'sape': 4139}

In [36]: tel['guido'] = 4127

In [37]: type(tel)
Out[37]: dict

In [38]: tel
Out[38]: {'jack': 4098, 'sape': 4139, 'guido': 4127}

In [39]: tel['jack']
Out[39]: 4098

In [40]: del tel['sape']

In [41]: tel['irv'] = 4127

In [42]: tel
Out[42]: {'jack': 4098, 'guido': 4127, 'irv': 4127}

In [43]: list(tel)
Out[43]: ['jack', 'guido', 'irv']

In [44]: sorted(tel)
Out[44]: ['guido', 'irv', 'jack']

In [45]: 'guido' in tel
Out[45]: True

In [46]: 'paddy' in tel
Out[46]: False

In [47]: 'jack' not in tel
Out[47]: False
```

Defining a dictionary

Add another element

Retrieve a value

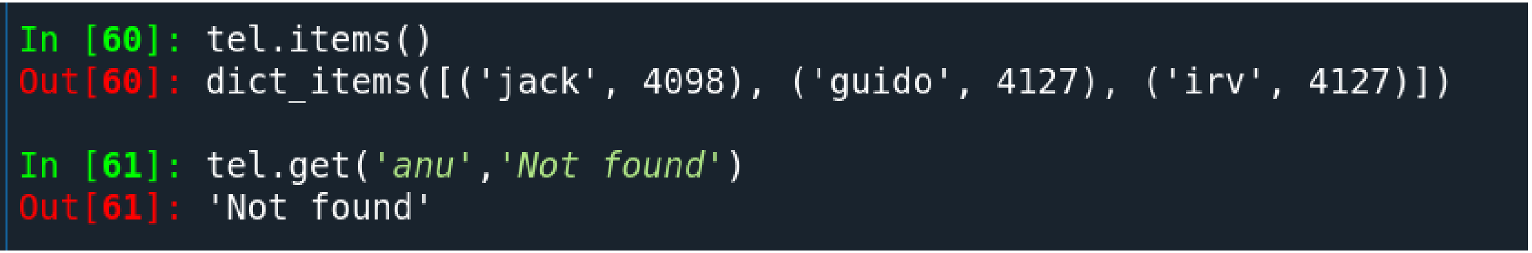
in keyword



```
In [55]: tel
Out[55]: {'jack': 4098, 'guido': 4127, 'irv': 4127}

In [56]: tel['anu']
Traceback (most recent call last):

  File "<ipython-input-56-d4043dc6d20f>", line 1, in <module>
    tel['anu']

KeyError: 'anu'


In [57]: tel.keys()
Out[57]: dict_keys(['jack', 'guido', 'irv'])

In [58]: tel.values()
Out[58]: dict_values([4098, 4127, 4127])
```

KeyError

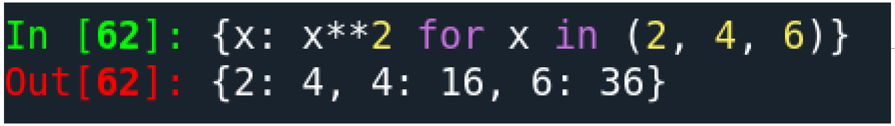
Returns a view



```
In [60]: tel.items()
Out[60]: dict_items([('jack', 4098), ('guido', 4127), ('irv', 4127)])

In [61]: tel.get('anu','Not found')
Out[61]: 'Not found'
```

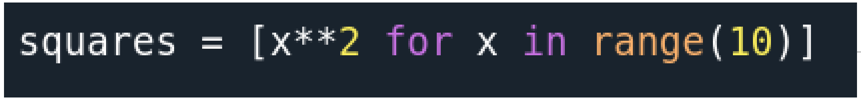
Remember:

- Cannot have multiple items with same key
- Keys have to be immutable
- Values need not be unique, they can be mutable or immutable



```
In [62]: {x: x**2 for x in (2, 4, 6)}
Out[62]: {2: 4, 4: 16, 6: 36}
```

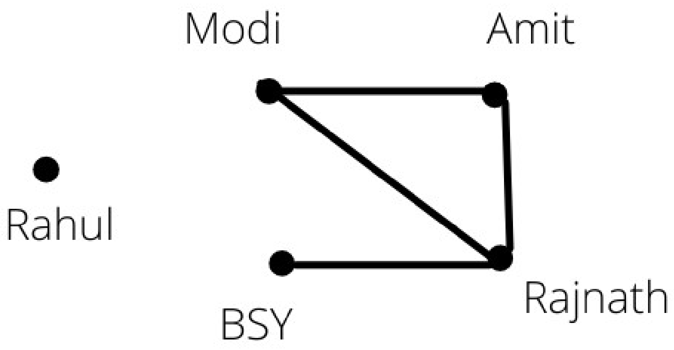
Dict comprehension



```
squares = [x**2 for x in range(10)]
```

List comprehension

An application of dictionary



Friendship graph

	M	A	Rj	BS	Rh
M	1	1	1	0	0
A	1	1	1	0	0
Rj	1	1	1	1	0
BS	0	0	1	1	0
Rh	0	0	0	0	1

Adjacency matrix representing friendship graph

Half the elements are zero: sparse matrix

Sparse matrix: an application of dictionary

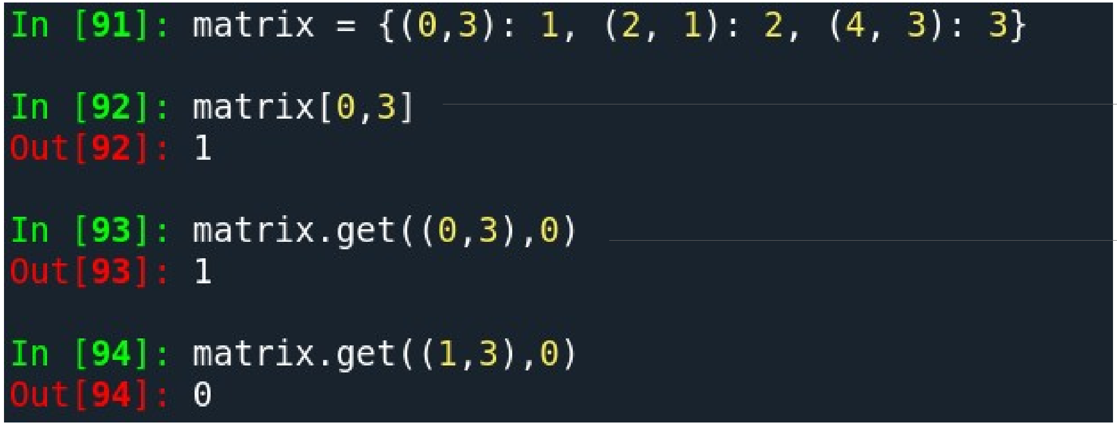
$$\begin{bmatrix} 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 2 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 3 & 0 \end{bmatrix}$$

A sparse matrix.

```
matrix = [ [0,0,0,1,0],
           [0,0,0,0,0],
           [0,2,0,0,0],
           [0,0,0,0,0],
           [0,0,0,3,0] ]
```

As a list of lists.

HW: implement sparse matrix operations using a dictionary:
add, scale, trace. Use provided skeleton code.



```
In [91]: matrix = {(0,3): 1, (2, 1): 2, (4, 3): 3}

In [92]: matrix[0,3]
Out[92]: 1

In [93]: matrix.get((0,3),0)
Out[93]: 1

In [94]: matrix.get((1,3),0)
Out[94]: 0
```

Note the syntax. Its a tuple, not two indices

Use the `get()` function