# Python Data Structures

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# Lists

- An ordered group of items
- Does not need to be the same type
  - Could put numbers, strings or donkeys in the same list
- List notation
  - A = [1,”This is a list”, c, Donkey(“kong”)]

# Methods of Lists

- List.append(x)
  - adds an item to the end of the list
- List.extend(L)
  - Extend the list by appending all in the given list L
- List.insert(I,x)
  - Inserts an item at index I
- List.remove(x)
  - Removes the first item from the list whose value is x

# Examples of other methods

- a = [66.25, 333, 333, 1, 1234.5]    //Defines List
  - **print** a.count(333), a.count(66.25), a.count('x') //calls method
  - 2 1 0 //output
- a.index(333)
  - //Returns the first index where the given value appears
  - 1 //ouput
- a.reverse()                    //Reverses order of list
  - a                    //Prints list a
  - [333, 1234.5, 1, 333, -1, 66.25]    //Ouput
- a.sort()
  - a                    //Prints list a
  - [-1, 1, 66.25, 333, 333, 1234.5]    //Output

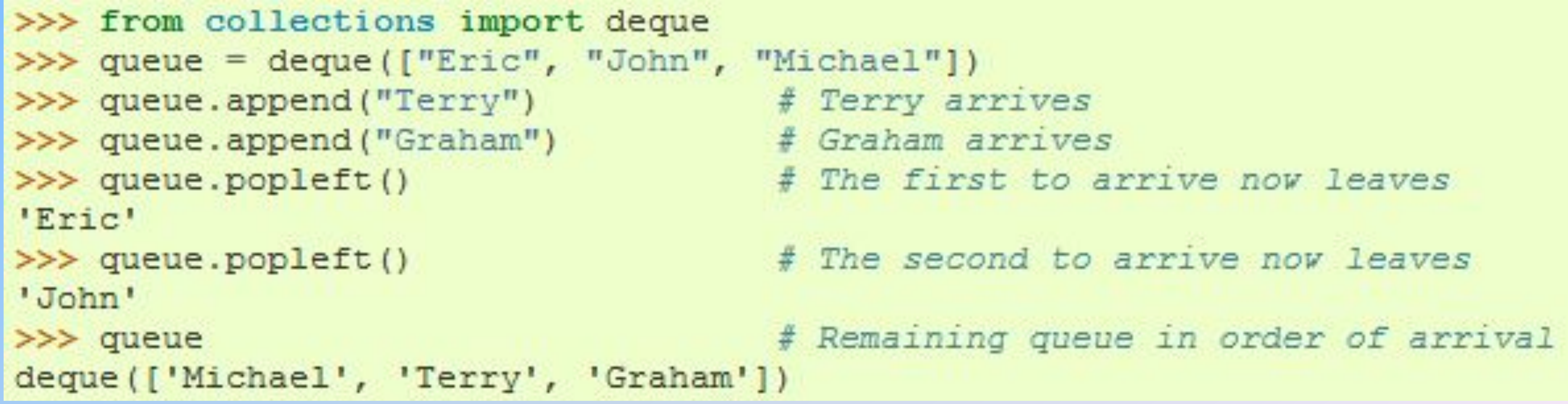
# Using Lists as Stacks

- The last element added is the first element retrieved
- To add an item to the stack, append() must be used
  - stack = [3, 4, 5]
  - stack.append(6)
  - Stack is now [3, 4, 5, 6]

- To retrieve an item from the top of the stack, pop must be used
  - Stack.pop()
  - 6 is output
  - Stack is now [3, 4, 5] again

# Using Lists as Queues

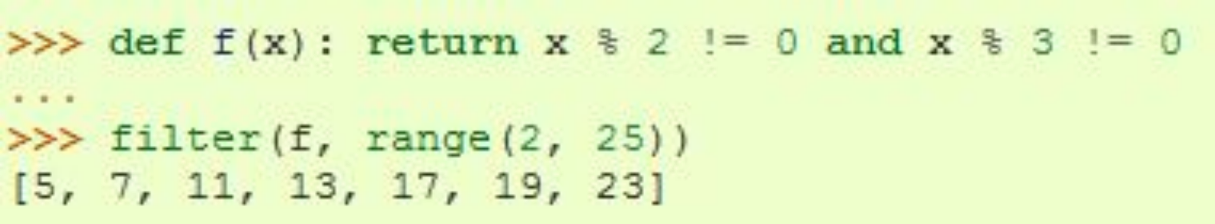
- First element added is the first element retrieved
- To do this collections.deque must be implemented



```
>>> from collections import deque
>>> queue = deque(["Eric", "John", "Michael"])
>>> queue.append("Terry")           # Terry arrives
>>> queue.append("Graham")          # Graham arrives
>>> queue.popleft()                 # The first to arrive now leaves
'Eric'
>>> queue.popleft()                 # The second to arrive now leaves
'John'
>>> queue                           # Remaining queue in order of arrival
deque(['Michael', 'Terry', 'Graham'])
```

# List Programming Tools

- Filter(function, sequence)
  - Returns a sequence consisting of the items from the sequence for which function(item) is true

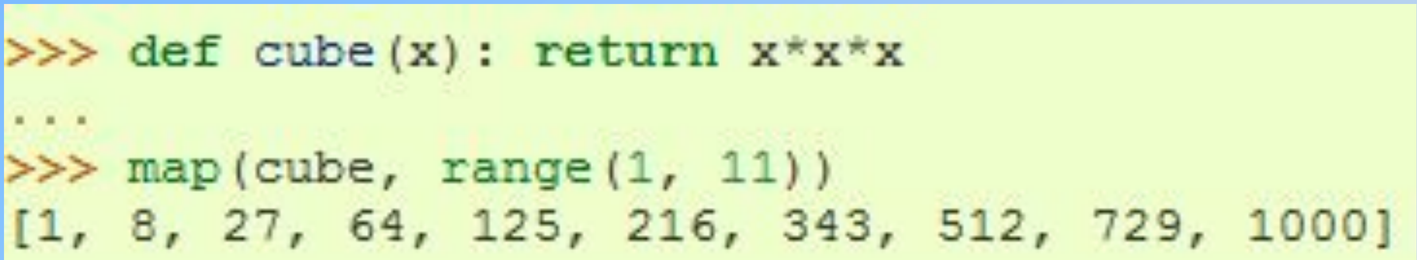


```
>>> def f(x): return x % 2 != 0 and x % 3 != 0
...
>>> filter(f, range(2, 25))
[5, 7, 11, 13, 17, 19, 23]
```

  - Computes primes up to 25

# Map Function

- Map(function, sequence)
  - Calls function(item) for each of the sequence's items

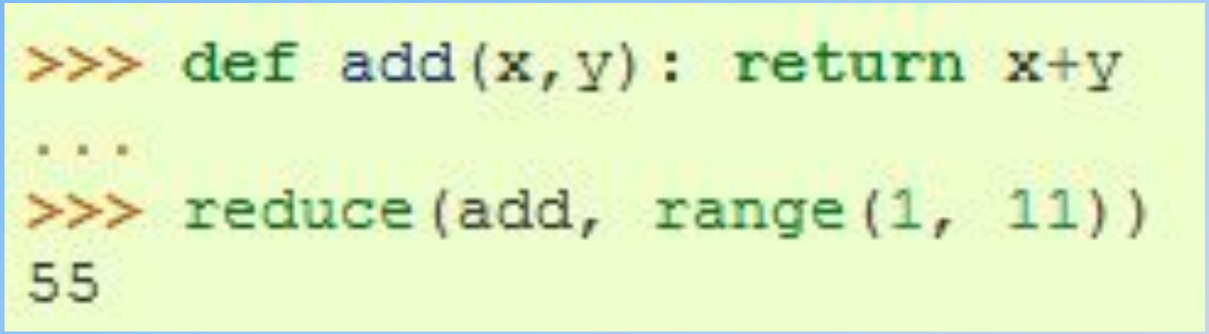


```
>>> def cube(x): return x*x*x
...
>>> map(cube, range(1, 11))
[1, 8, 27, 64, 125, 216, 343, 512, 729, 1000]
```

  - Computes the cube for the range of 1 to 11

# Reduce Function

- Reduce(function, sequence)
  - Returns a single value constructed by calling the binary function (function)

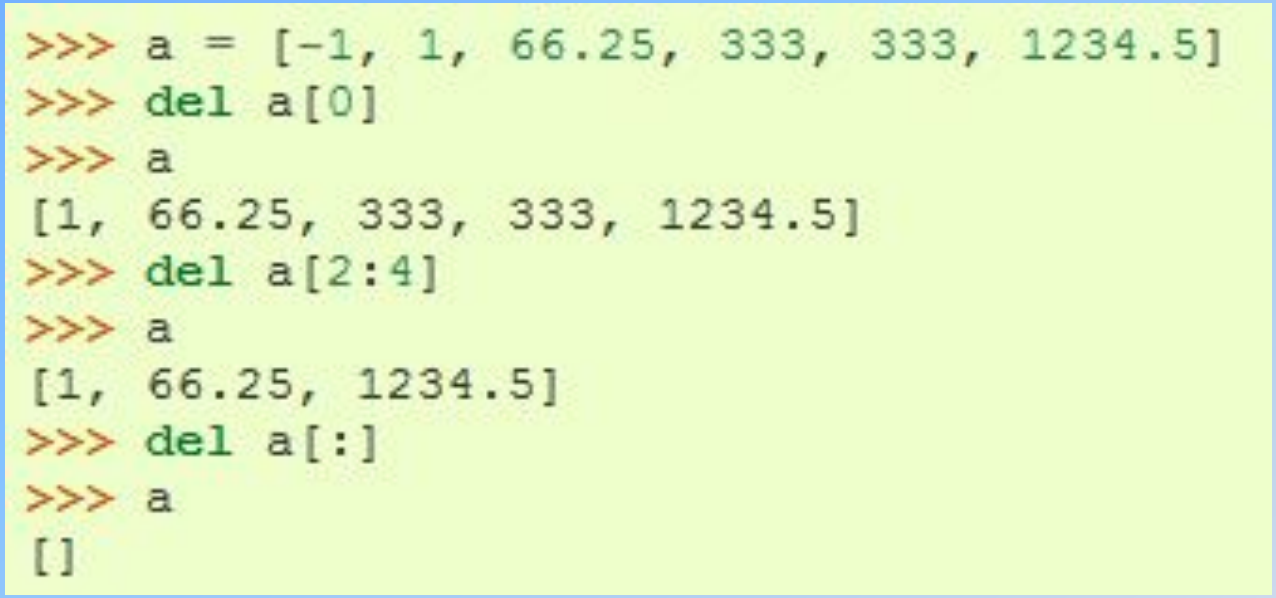


```
>>> def add(x,y): return x+y
...
>>> reduce(add, range(1, 11))
55
```

  - Computes the sum of the numbers 1 to 10

# The del statement

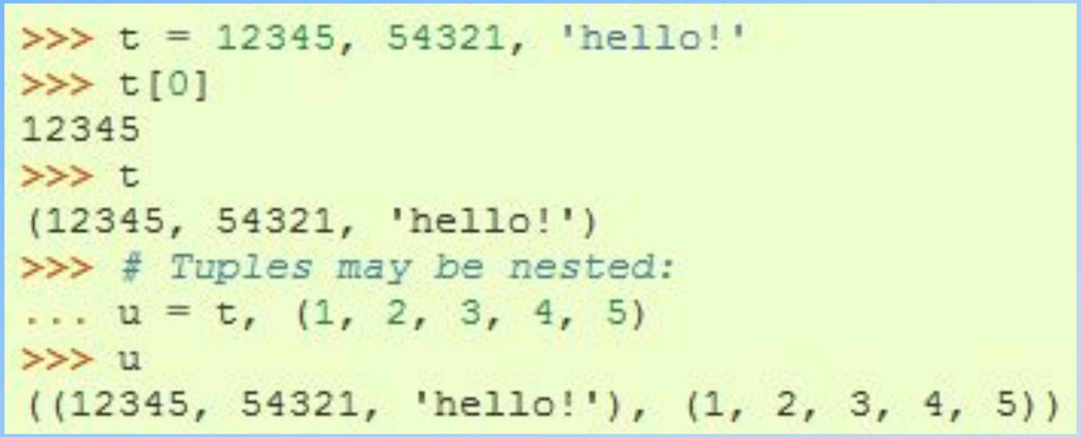
- A specific index or range can be deleted



```
>>> a = [-1, 1, 66.25, 333, 333, 1234.5]
>>> del a[0]
>>> a
[1, 66.25, 333, 333, 1234.5]
>>> del a[2:4]
>>> a
[1, 66.25, 1234.5]
>>> del a[:]
>>> a
[]
```

# Tuples

- Tuple
  - A number of values separated by commas
  - Immutable
    - Cannot assign values to individual items  of a tuple
    - However tuples can contain mutable objects such as lists



```
>>> t = 12345, 54321, 'hello!'
>>> t[0]
12345
>>> t
(12345, 54321, 'hello!')
>>> # Tuples may be nested:
... u = t, (1, 2, 3, 4, 5)
>>> u
((12345, 54321, 'hello!'), (1, 2, 3, 4, 5))
```

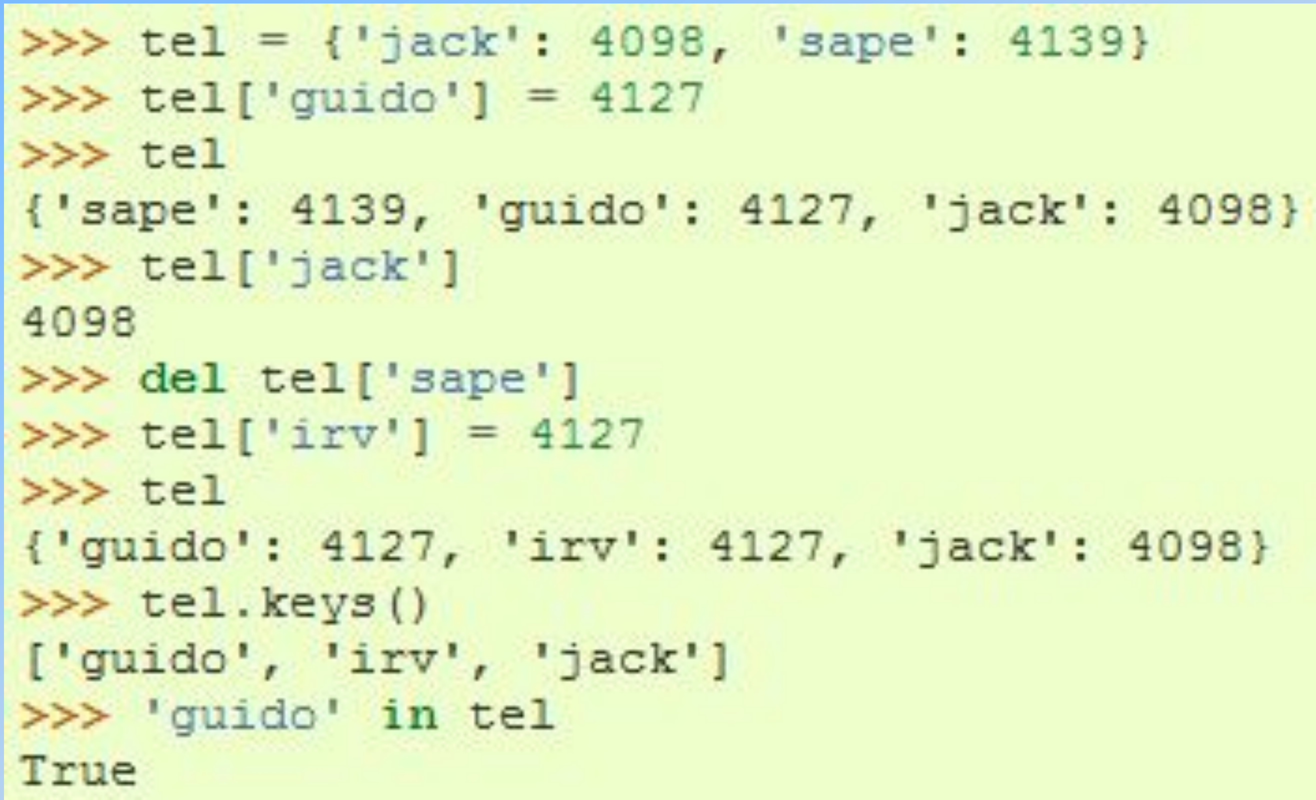
  - Single items must be defined using a comma
    - Singleton = ‘hello’,

# Sets

- An unordered collection with no duplicate elements
- Basket = [‘apple’, ‘orange’, ‘apple’, ‘pear’]
- Fruit = set(basket)
- Fruit
  - Set([‘orange’, ‘apple’, ‘pear’])

# Dictionaries

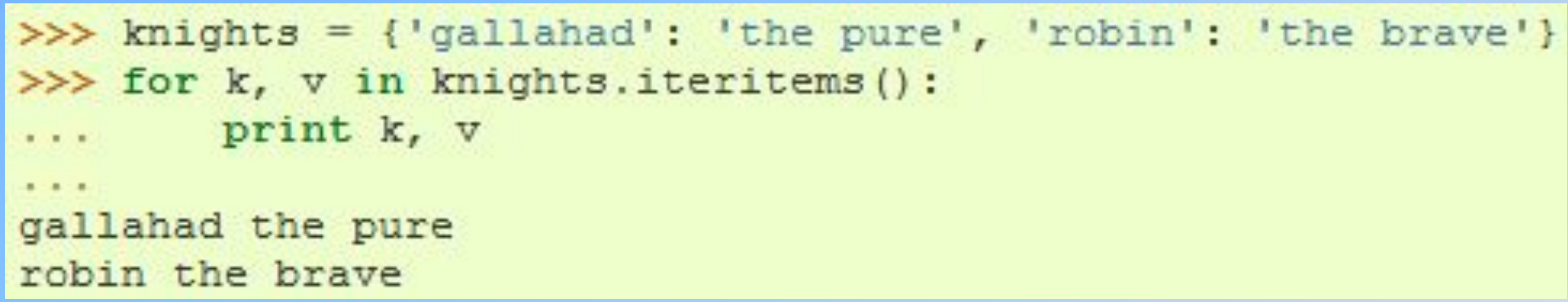
- Indexed by keys
  - This can be any immutable type (strings, numbers…)
  - Tuples can be used if they contain only immutable objects



```
>>> tel = {'jack': 4098, 'sape': 4139}
>>> tel['guido'] = 4127
>>> tel
{'sape': 4139, 'guido': 4127, 'jack': 4098}
>>> tel['jack']
4098
>>> del tel['sape']
>>> tel['irv'] = 4127
>>> tel
{'guido': 4127, 'irv': 4127, 'jack': 4098}
>>> tel.keys()
['guido', 'irv', 'jack']
>>> 'guido' in tel
True
```

# Looping Techniques

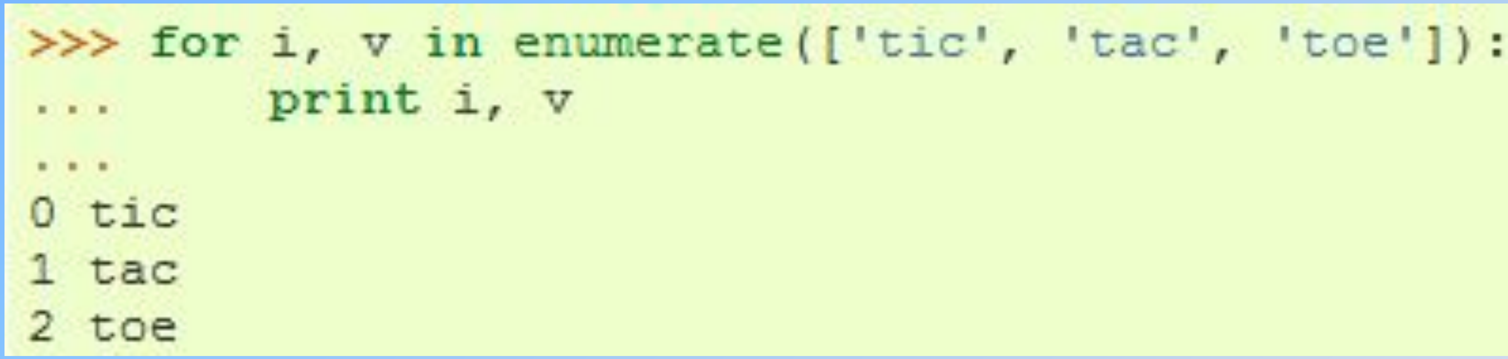
- Iteritems():
  - for retrieving key and values through a dictionary



```
>>> knights = {'gallahad': 'the pure', 'robin': 'the brave'}
>>> for k, v in knights.iteritems():
...     print k, v
...
gallahad the pure
robin the brave
```

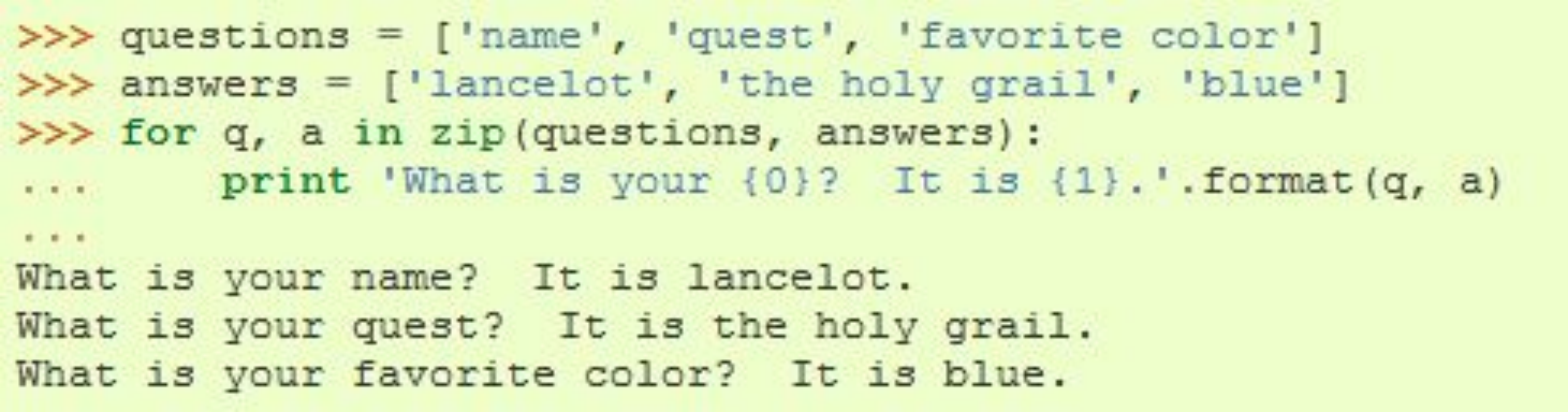
# Looping Techniques

- Enumerate():
  - for the position index and values in a sequence



```
>>> for i, v in enumerate(['tic', 'tac', 'toe']):
...     print i, v
...
0 tic
1 tac
2 toe
```

- Zip():
  - for looping over two or more sequences



```
>>> questions = ['name', 'quest', 'favorite color']
>>> answers = ['lancelot', 'the holy grail', 'blue']
>>> for q, a in zip(questions, answers):
...     print 'What is your {0}?  It is {1}.'.format(q, a)
...
What is your name?  It is lancelot.
What is your quest?  It is the holy grail.
What is your favorite color?  It is blue.
```

# Comparisons

- Operators “in” and “not in” can be used to see if an item exists in a sequence
- Comparisons can be chained
  - a < b == c
    - This tests whether a is less than b and that b equals c