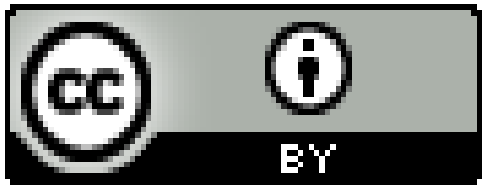
Python

Strings



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Indexed exactly like lists

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Indexed exactly like lists

```
name = 'Darwin'
print name[0], name[-1]
```

```
D n
```

`for` iterates through characters

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```
name = 'Darwin'
for c in name:
    print c
```

```
D
a
r
w
i
n
```

Use either ' or " (as long as they match)

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```
print 'Alan', "Turing"
```
Alan Turing

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Strings are the same no matter how they're created

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```
print 'Alan', "Turing"
```
Alan Turing

Strings are the same no matter how they're created

```
print 'Alan' == "Alan"
```
True

Strings are compared character by character from left to right

Strings are compared character by character

from left to right

```
print 'a' < 'b'
```

True

Strings are compared character by character

from left to right

print 'a' < 'b'

True

print 'ab' < 'abc'

True

Strings are compared character by character

from left to right

print 'a' < 'b'
True
print 'ab' < 'abc'
True
print '1' < '9'
True

Strings are compared character by character from left to right

```
print 'a' < 'b'
True
print 'ab' < 'abc'
True
print '1' < '9'
True
print '100' < '9'
True
```

Strings are compared character by character

from left to right

```
print 'a' < 'b'
True
print 'ab' < 'abc'
True
print '1' < '9'
True
print '100' < '9'
True
print 'A' < 'a'
True
```

Strings are *immutable* : cannot be changed in place

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```
name = 'Darwin'
name[0] = 'C'
```

TypeError: 'str' object does not support item assignment

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Immutability improves performance

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name = 'Darwin'
name[0] = 'C'
```

TypeError: 'str' object does not support item assignment

Immutability improves performance

Use + to concatenate strings

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```
name = 'Charles' + ' ' + 'Darwin'
print name
```

Charles Darwin

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```
name = 'Charles' + ' ' + 'Darwin'
print name
```
Charles Darwin

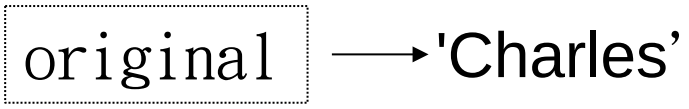
Concatenation always produces a new string

Use + to concatenate strings

```
name = 'Charles' + ' ' + 'Darwin'
print name
```
Charles Darwin

Concatenation always produces a new string

```
original = 'Charles'
```

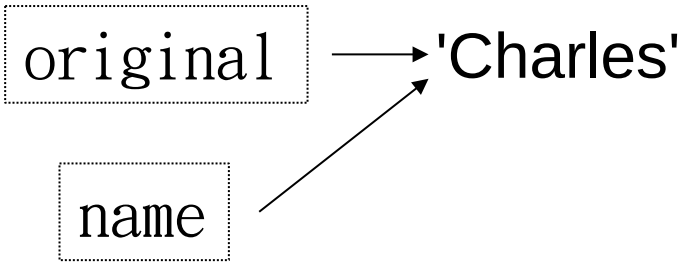


Use + to concatenate strings

```
name = 'Charles' + ' ' + 'Darwin'
print name
```
Charles Darwin

Concatenation always produces a new string

```
original = 'Charles'
name = original
```

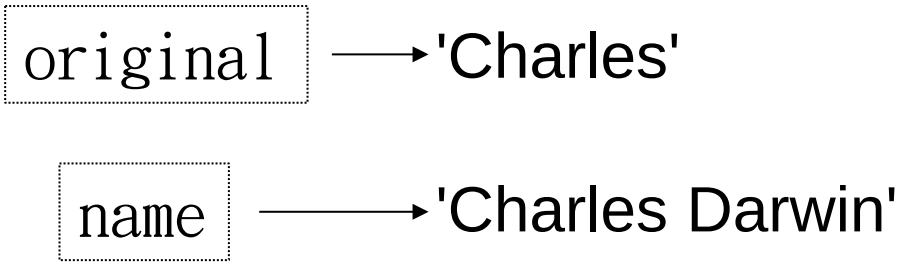


Use + to concatenate strings

```
name = 'Charles' + ' ' + 'Darwin'
print name
```
Charles Darwin

Concatenation always produces a new string

```
original = 'Charles'
name = original
name += ' Darwin'
```



Strings are often formatted with +…

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```
print 'reagant: ' + str(reagant_id) + ' produced ' + \
    str(percentage_yield) + '% yield'
```

Strings are often formatted with +…

```
print 'reagant: ' + str(reagant_id) + ' produced ' + \
    str(percentage_yield) + '% yield'
```

There's a better way...

Accessing arguments by position

```
>>> '{0}, {1}, {2}'.format('a', 'b', 'c')
'a, b, c'

>>> '{}, {}, {}'.format('a', 'b', 'c') # Py2.7+
'a, b, c'

>>> '{2}, {1}, {0}'.format('a', 'b', 'c')
'c, b, a'
```

Accessing arguments by name

```
>>> 'Coordinates: {latitude},
    {longitude}'.format(latitude='37.24N',
     longitude='-115.81W')
'Coordinates: 37.24N, -115.81W'
```

Lots more examples here:

https://docs.python.org/2/library/string.html#format-examples

Use ":" in the format string to specify:

```
output = 'reagant: {:d}'.format(123)
print output
```

reagant: 123

Use ":" in the format string to specify:

```
output = 'reagant: {:d}'.format(123)
print output
```

reagant: 123

```
percentage_yield = 12.3
print 'yield: {:6.2f}'.format(percentage_yield)
```

yield: 12.30

Use "{{" for "{" and "}}" for "}"

```
output = 'reagant: {{ {:d} }}'.format(123)
print output
```

reagant: { 123 }

You will also see (in older python code):

```
print 'reagant: %d' % 123
```
reagant: 123

```
print 'Name: %s; weight: %.2fkg' % ('Bert', 122)
```
Name: Bert; weight: 122.00kg

This is an alternative approach to string formatting that is now discouraged. ☺

Use \n to represent a newline character

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Use \' for single quote, \" for double quote

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Use \' for single quote, \" for double quote

```
print 'There isn\'t time\nto do it right.'
```

```
There isn't time
to do it right.
```

Use \n to represent a newline character

Use \' for single quote, \" for double quote

```
print 'There isn\'t time\nto do it right.'
```

There isn't time
to do it right.

```
print "But you said,\n\"There is time to do it over.\""
```

But you said,
"There is time to do it over."

Use \\ for a literal \ character

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print 'Most mathematicians write a\\b instead of a%b.'
Most mathematicians write a\b instead of a%b.

Use \\ for a literal \ character

```
print 'Most mathematicians write a\\b instead of a%b.'
```

Most mathematicians write a\b instead of a%b.

Common pattern with *escape sequences*

Use \\ for a literal \ character

```
print 'Most mathematicians write a\\b instead of a%b.'
```

```
Most mathematicians write a\b instead of a%b.
```

Common pattern with *escape sequences*

- Use a character to mean "what follows is special"

Use \\ for a literal \ character

```
print 'Most mathematicians write a\\b instead of a%b.'
```

Most mathematicians write a\b instead of a%b.

Common pattern with *escape sequences*

- Use a character to mean "what follows is special"
- Double it up to mean "that character itself"

Use triple quotes (either kind) for multi-line strings

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```
quote = """We can only see
a short distance ahead,
but we can see plenty there
that needs to be done."""
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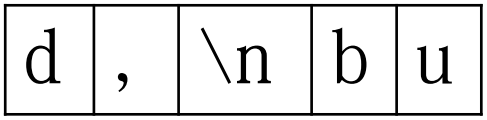

Use triple quotes (either kind) for multi-line strings

```
quote = """We can only see
a short distance ahead,
but we can see plenty there
that needs to be done."""

quote = "We can only see\na short distance ahead\n" + \
    "but we can see plenty there\nthat needs to be done."
```

Strings have methods

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```
name = 'newTON'
print name.capitalize(), name.upper(), name.lower(), name
```

Newton NEWTON newton newTON

Strings have methods

```
name = 'newTON'
print name.capitalize(), name.upper(), name.lower()
```

Newton NEWTON newton

```
dna = 'acggtggtcac'
print dna.count('g'), dna.count('x')
```

4 0

Strings have methods

```
name = 'newTON'
print name.capitalize(), name.upper(), name.lower()
```

Newton NEWTON newton

```
dna = 'acggtggtcac'
print dna.count('g'), dna.count('x')
```

4 0

```
print dna.find('t'), dna.find('t', 5), dna.find('x')
```

4 7 -1

Strings have methods

```
name = 'newTON'
print name.capitalize(), name.upper(), name.lower()
Newton NEWTON newton
dna = 'acggtggtcac'
print dna.count('g'), dna.count('x')
4 0
print dna.find('t'), dna.find('t', 5), dna.find('x')
4 7 -1
print dna.replace('t', 'x'), dna
acggxggxcac acggtggtcac
```

Strings have methods

```
name = 'newTON'
print name.capitalize(), name.upper(), name.lower()
```
Newton NEWTON newton
```
dna = 'acggtggtcac'
print dna.count('g'), dna.count('x')
```
4 0
```
print dna.find('t'), dna.find('t', 5), dna.find('x')
```
4 7 -1
```
print dna.replace('t', 'x')
```
acggxggxcac acggtggtcac
```
print dna.replace('gt', '')
```
acggcac

Can chain method calls together

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```
element = 'cesium'
print element.upper().center(10, '.')
```

Can chain method calls together

```
element = 'cesium'
print element.upper().center(10, '.')
```

convert to upper case

Can chain method calls together

```
element = 'cesium'
print element.upper().center(10, '.')
```

center in a field

10 characters wide

Can chain method calls together

```
element = 'cesium'
print element.upper().center(10, '.')
```

```
..CESIUM..
```

The power of **regular expressions**

When programming in any language you will want to know about *regular expressions* – for advanced string/text processing. In Python use the “re” library. Example uses are:

`/<([A-Z][A-Z0-9]*)\b[^>]*>(.*?)</\1>/` Matches the opening and closing pair of any HTML tag; captures tag name and content.

`/b[aeiou]+t/` Matches "bat" and "bit" etc, but also "boot" and "boat“.

`/(\[0-9]{1,3})\.(\[0-9]{1,3})\.(\[0-9]{1,3})\.(\[0-9]{1,3})/`
Matches any IP address ((e.g. 66.70.7.154) and captures the each number for re-use.

See: https://docs.python.org/2/howto/regex.html