

Python

Input and Output - Working with files

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And read data from them?

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How to save data to files?

And read data from them?

Python's solution looks very much like C's

- A file is a sequence of bytes
- But it's often more useful to treat it as a sequence of lines

Sample data file: "haiku.txt"

*Three things are certain:
Death, taxes, and lost data.
Guess which has occurred.*

*Errors have occurred.
We won't tell you where or why.
Lazy programmers.*

*With searching comes loss
and the presence of absence:
"My Thesis" not found.*

*A crash reduces
your expensive computer
to a simple stone.*

How many characters in a file?

How many ~~characters~~ in a file?
bytes

How many ~~characters~~ in a file?

bytes ← Assume 1-to-1 for now

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Assume 1-to-1 for now

Revisit later

How many characters in a file?

```
with open('haiku.txt', 'r') as reader:  
    data = reader.read()
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How many characters in a file?

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with open('haiku.txt', 'r') as reader:  
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Create a file object



How many characters in a file?

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with open('haiku.txt', 'r') as reader:  
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```

File to connect to

How many characters in a file?

```
with open('haiku.txt', 'r') as reader:  
    data = reader.read()
```

To read

How many characters in a file?

```
with open('haiku.txt', 'r') as reader:  
    data = reader.read()
```

Now holds file object

How many characters in a file?

```
with open('haiku.txt', 'r') as reader:  
    data = reader.read()
```

Read entire content
of file into a string

How many characters in a file?

```
with open('haiku.txt', 'r') as reader:  
    data = reader.read()
```

Now has a copy of
all the bytes that were
in the file

How many characters in a file?

```
with open('haiku.txt', 'r') as reader:  
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```

Why don't we need to *close* the file?

Since Python now uses the "with" statement we can trust the file will be automatically closed when we leave the context of the "with" (indented) block.

How many characters in a file?

```
with open('haiku.txt', 'r') as reader:  
    data = reader.read()
```

```
print(len(data))
```

Report how many
characters were read

How many characters in a file?

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with open('haiku.txt', 'r') as reader:  
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Report how many
~~characters~~ were read
bytes

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293

If the file might be large, better to read in chunks

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```
with open('haiku.txt', 'r') as reader:
    data = reader.read(64)
    while data != '':
        print(len(data))
        data = reader.read(64)
    print(len(data))
```

If the file might be large, better to read in chunks

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with open('haiku.txt', 'r') as reader:  
    data = reader.read(64)  
    while data != '':  
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Read (at most) 64 bytes

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data = reader.read(64)
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while data != '':
```

```
print(len(data))
```

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data = reader.read(64)
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Read (at most) 64 bytes

Or the empty string

if there is no more data

If the file might be large, better to read in chunks

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with open('haiku.txt', 'r') as reader:  
    data = reader.read(64)  
    while data != '':  
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        data = reader.read(64)  
    print(len(data))
```

Keep looping as long as
the last read returned
some data

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    data = reader.read(64)  
    while data != '':  
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        data = reader.read(64)  
    print(len(data))
```

Do something with
the data

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```

(Try to) reload

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    data = reader.read(64)  
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```

Should be 0 (or the loop
would still be running)

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37

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Don't do this unless

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0

Don't do this unless the file really
might be very large (or infinite)

More common to read one line at a time

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```
with open('haiku.txt', 'r') as reader:
    line = reader.readline()
    total = 0
    count = 0
    while line != '':
        count += 1
        total += len(line)
        line = reader.readline()

print('average', float(total) / float(count))
```

More common to read one line at a time

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with open('haiku.txt', 'r') as reader:
```

```
    line = reader.readline()
```

```
    total = 0
```

```
    count = 0
```

```
    while line != '':
```

```
        count += 1
```

```
        total += len(line)
```

```
        line = reader.readline()
```

← Read a single line

```
print('average', float(total) / float(count))
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More common to read one line at a time

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with open('haiku.txt', 'r') as reader:  
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    while line != '':  
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        total += len(line)  
        line = reader.readline()  
  
print('average', float(total) / float(count))
```

Keep looping until
no more lines in file

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with open('haiku.txt', 'r') as reader:  
    line = reader.readline()  
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    while line != '':  
        count += 1  
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(Try to) reload

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        count += 1
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        line = reader.readline()

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average 19.533333333333335
```


Often more convenient to read all lines at once

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```
with open('haiku.txt', 'r') as reader:
    contents = reader.readlines()
    total = 0
    count = 0
    for line in contents:
        count += 1
        total += len(line)

print('average', float(total) / float(count))
```

Often more convenient to read all lines at once

```
with open('haiku.txt', 'r') as reader:  
    contents = reader.readlines()  
    total = 0  
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    for line in contents:  
        count += 1  
        total += len(line)  
  
print('average', float(total) / float(count))
```

All lines in file
as list of strings

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    contents = reader.readlines()  
    total = 0  
    count = 0  
    for line in contents:  
        count += 1  
        total += len(line)  
  
print('average', float(total) / float(count))
```

Loop over lines
with for

Often more convenient to read all lines at once

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with open('haiku.txt', 'r') as reader:
    contents = reader.readlines()
    total = 0
    count = 0
    for line in contents:
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"Read lines as list" + "loop over list" is common idiom

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    total = 0
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"Read lines as list" + "loop over list" is common idiom

So Python provides "loop over lines in file"

```
with open('haiku.txt', 'r') as reader:
```

```
    total = 0
```

```
    count = 0
```

```
    for line in reader:
```

```
        count += 1
```

```
        total += len(line)
```

Assign lines of text in file
to loop variable one by one

```
print('average', float(total) / float(count))
```

"Read lines as list" + "loop over list" is common idiom

So Python provides "loop over lines in file"

```
with open('haiku.txt', 'r') as reader:
    total = 0
    count = 0
    for line in reader:
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        total += len(line)

    print('average', float(total) / float(count))
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average 19.533333333333335

Put data in a file using `write` or `writelines`

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```
with open('temp.txt', 'w') as writer:  
    writer.write('elements')  
    writer.writelines(['He', 'Ne', 'Ar', 'Kr'])
```

Put data in a file using `write` or `writelines`

```
with open('temp.txt', 'w') as writer:  
    writer.write('elements')  
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Same function

Put data in a file using `write` or `writelines`

```
with open('temp.txt', 'w') as writer:  
    writer.write('elements')  
    writer.writelines(['He', 'Ne', 'Ar', 'Kr'])
```

File to write to
(is created if it doesn't
exist)

Put data in a file using `write` or `writelines`

```
with open('temp.txt', 'w') as writer:  
    writer.write('elements')  
    writer.writelines(['He', 'Ne', 'Ar', 'Kr'])
```

For writing instead
of reading

Put data in a file using `write` or `writelines`

```
with open('temp.txt', 'w') as writer:  
    writer.write('elements')  
    writer.writelines(['He', 'Ne', 'Ar', 'Kr'])
```

Write a single string

Put data in a file using `write` or `writelines`

```
with open('temp.txt', 'w') as writer:  
    writer.write('elements')  
    writer.writelines(['He', 'Ne', 'Ar', 'Kr'])
```

Write each string
in a list as a line

Put data in a file using `write` or `writelines`

```
with open('temp.txt', 'w') as writer:  
    writer.write('elements')  
    writer.writelines(['He', 'Ne', 'Ar', 'Kr'])
```

elementsHeNeArKr

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with open('temp.txt', 'w') as writer:  
    writer.write('elements')  
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```

elementsHeNeArKr

Python only writes what you tell it to

Put data in a file using `write` or `writelines`

```
with open('temp.txt', 'w') as writer:  
    writer.write('elements\n')  
    writer.writelines(['He\n', 'Ne\n', 'Ar\n', 'Kr\n'])
```

Have to provide end-of-line characters yourself

Put data in a file using `write` or `writelines`

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with open('temp.txt', 'w') as writer:  
    writer.write('elements\n')  
    writer.writelines(['He\n', 'Ne\n', 'Ar\n', 'Kr\n'])
```

elements

He

Ne

Ar

Kr