

[CS 220] JSON

Department of Computer Sciences
University of Wisconsin-Madison

Readings:

Chapter 16 of Sweigart book

Worksheet practice with nesting

Learning Objectives

JSON:

- interpret data format
- differences with Python syntax
- deserialize data from JSON files to use in Python program (read)
- serialize data into JSON files for long term storage (write)

Read: Sweigart Ch 16

<https://automatetheboringstuff.com/2e/chapter16/>

“JSON and APIs” to the end


Python Data Structures and File Formats

Python

```
[  
  ["name", "x", "y"],  
  ["alice", 100, 150],  
  ["bob", -10, 80]  
]
```

list of lists

File



```
name,x,y  
alice,100,150  
bob,-10,80
```

CSV file

**We can use CSV files to store
data we would want in lists of lists**

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]
```

list of lists

File

```
name,x,y  
alice,100,150  
bob,-10,80
```

CSV file



```
{  
  "alice": {  
    "age": 40,  
    "scores": [10,20,19]},  
  "bob": {  
    "age": 45,  
    "scores": [15,23,17,15]}  
}
```

dict of dicts



?

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  "bob": {  
    "age": 45,  
    "scores": [15,23,17,15]}  
}
```

dict of dicts

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  "alice": {  
    "age": 40,  
    "scores": [10,20,19]},  
  "bob": {  
    "age": 45,  
    "scores": [15,23,17,15]}  
}
```

JSON file



Python Data Structures and File Formats

Python

File

JSON files look almost identical to Python code for data structures!

```
[  
  ["name", "x", "y"],  
  ["alice", 100, 150],  
  ["bob", -10, 80]  
]
```

list of lists

```
name,x,y  
alice,100,150  
bob,-10,80
```

CSV file

dicts use curly braces

```
{  
  "alice": {  
    "age": 40,  
    "scores": [10,20,19]},  
  "bob": {  
    "age": 45,  
    "scores": [15,23,17,15]}  
}
```

dict of dicts

```
{  
  "alice": {  
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    "scores": [10,20,19]},  
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]
```

```
name,x,y  
alice,100,150  
bob,-10,80
```

CSV file

list of lists

keys are separated from values with a colon

```
{  
  "alice": {  
    "age": 40,  
    "scores": [10,20,19]},  
  "bob": {  
    "age": 45,  
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}
```

dict of dicts

```
{  
  "alice": {  
    "age": 40,  
    "scores": [10,20,19]},  
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JSON file

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[  
  ["name", "x", "y"],  
  ["alice", 100, 150],  
  ["bob", -10, 80]  
]
```

list of lists

lists use square brackets

```
{  
  "alice": {  
    "age": 40,  
    "scores": [10, 20, 19]},  
  "bob": {  
    "age": 45,  
    "scores": [15, 23, 17, 15]}  
}
```

dict of dicts

```
name,x,y  
alice,100,150  
bob,-10,80
```

CSV file

```
{  
  "alice": {  
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JSON file

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  ["name", "x", "y"],  
  ["alice", 100, 150],  
  ["bob", -10, 80]  
]
```

list of lists

```
name,x,y  
alice,100,150  
bob,-10,80
```

CSV file

strings are in quotes

```
{  
  "alice": {  
    "age": 40,  
    "scores": [10,20,19]},  
  "bob": {  
    "age": 45,  
    "scores": [15,23,17,15]}  
}
```

dict of dicts

```
{  
  "alice": {  
    "age": 40,  
    "scores": [10,20,19]},  
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JSON file

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  ["name", "x", "y"],  
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]
```

list of lists

```
name,x,y  
alice,100,150  
bob,-10,80
```

CSV file

integers look like integers

```
{  
  "alice": {  
    "age": 40,  
    "scores": [10,20,19]},  
  "bob": {  
    "age": 45,  
    "scores": [15,23,17,15]}  
}
```

dict of dicts

```
{  
  "alice": {  
    "age": 40,  
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}
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JSON file

JSON

Stands for **JavaScript Object Notation**

- JavaScript is a language for web development
- JSON was developed for JavaScript programs to store/share data
- JSON looks like Python code because JavaScript is similar to Python

Minor JavaScript vs. Python differences:

| | Python | JSON |
|----------|--------------------------|--------------------------|
| Booleans | True, False | true, false |
| No value | None | null |
| Quotes | Single (') or double (") | Only double (") |
| Commas | Extra allowed: [1,2,] | No extra: [1,2] |
| Keys | Any type: {3: "three"} | Str only: {"3": "three"} |

remember these!

Reading JSON Files

Python Program

Analysis Code
`data["cindy"] → 15`

dict `{"alice":10, "bob":12,
"cindy":15}`

Parsing Code

What does this look like?

JSON file saved somewhere

```
{  
  "alice": 10,  
  "bob": 12,  
  "cindy": 15  
}
```

Reading JSON Files

```
import json
```

```
def read_json(path):  
    with open(path, encoding="utf-8") as f:  
        return json.load(f) # dict, list, etc
```

CTRL

+

C

*don't need to understand
this snippet yet*

what about writing new files?

JSON file saved somewhere

```
{  
  "alice": 10,  
  "bob": 12,  
  "cindy": 15  
}
```

Python Program

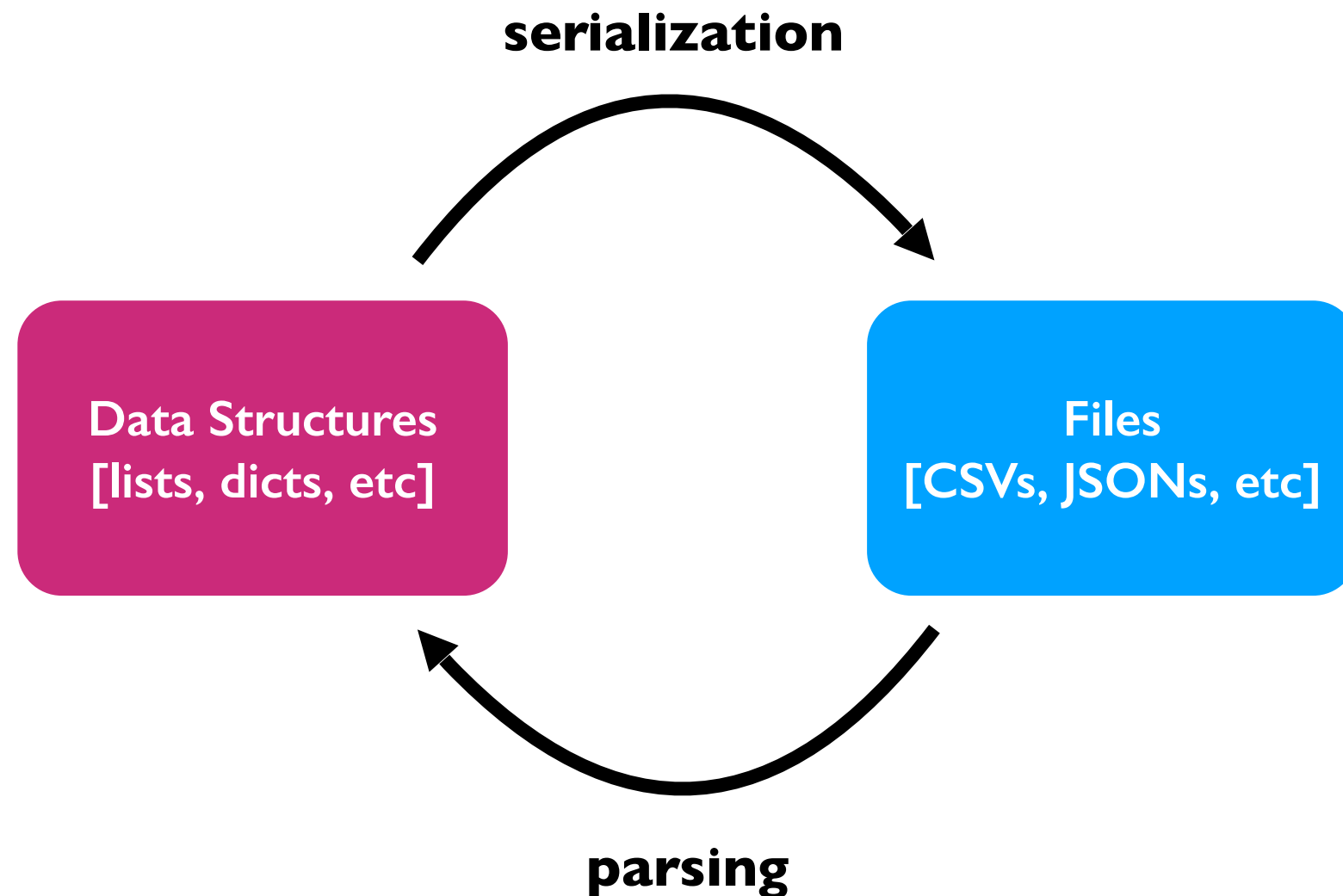
Analysis Code

```
data["cindy"] → 15
```

Parsing Code

What does this look like?

Data Structures and Files



why not just have data structures?

because our data needs to live somewhere when our programs aren't running

why not just have files?

slow, and Python doesn't understand structure until it is parsed

Writing JSON Files

Python Program

Code
`data["cindy"] = 15`

dict `{"cindy": 15}`

Serialization Code

What does this look like?

JSON file saved somewhere

```
{  
  "cindy": 15  
}
```


Writing JSON Files

```
import json

# data is a dict, list, etc
def write_json(path, data):
    with open(path, 'w', encoding="utf-8") as f:
        json.dump(data, f, indent=2)
```

CTRL

+

C

*don't need to understand
this snippet yet*

Python Program

Code

```
data["cindy"] = 15
```

dict

```
{"cindy": 15}
```

Serialization Code

What does this look like?

JSON file saved somewhere

```
{
  "cindy": 15
}
```

Example: Sum of numbers (simple JSON)

Goal: count the numbers in a list saved as a JSON file

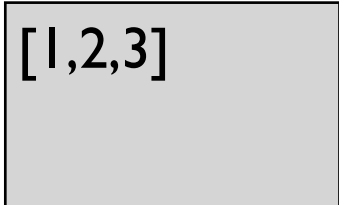
Input:

- Location of the JSON file

Output:

- The sum

Example: **fileA.json** output 6



```
[1,2,3]
```

Example: Score Tracker

Goal: record scores (save across runs) and print average

Input:

- A **name** and a **score** to record

Output:

- Running average for that person

Example:

"Enter player name and score": **alice 10**

Alice Avg: 10

"Enter player name and score": **alice 20**

Alice Avg: 15

"Enter player name and score": **bob 13**

Bob Avg: 13

Example – Exploring kiva.json

Goal: explore a real-world JSON file

kiva.json

```
{
  "data": {
    "lend": {
      "loans": {
        "values": [
          {
            "name": "Polikseni",
            "description": "Polikseni is 70 years old and married. She and her husband are both retired and their main income is a retirement pension of $106 a month for Polikseni and disability income for her husband of $289 a month. <br /><br />Polikseni's husband, even though disabled, works in a very small shop as a watchmaker on short hours, just to provide additional income for his family and to feel useful. Polikseni's husband needs constant medical treatment due to his health problems. She requested another loan, which she will use to continue paying for the therapy her husband needs. With a part of the loan, she is going to pay the remainder of the previous loan.",
            "loanAmount": "1325.00",
            "geocode": {
              "city": "Korce",
              "country": {
                "name": "Albania",
                "region": "Eastern Europe",
                "fundsLentInCountry": 9051250
              }
            }
          }, ...
        ]
      }
    }
  }
}
```

Challenge - Demo 4: Prime Cache

Goal: find number of primes less than N, cache previous return vals

Input:

- An integer N

Output:

- How many primes are less than that number

Challenge - Demo 5: Upper Autocomplete

Goal: record scores (save across runs) and print average

Input:

- A complete phrase
- A partial phrase ending with a *

Output:

- The upper case version of it
- Options to autocomplete

autocomplete must work
across multiple runs

Example:

```
msg: hi
HI
msg: hello
HELLO
msg: h*
1: hi
2: hello
select: 1
HI
```