

Dictionaries

A dictionary is a set of key-value pairs. Dictionaries are very useful in programming, because they can store and look up values by key (rather than by index number).

Manager:

Recorder:

Presenter:

Reflector:

Content Learning Objectives

After completing this activity, students should be able to:

- Discuss benefits of POGIL for student learning.
- Create a dictionary of strings and look up values by key.
- Represent complex data using nested dictionaries and lists.

Process Skill Goals

During the activity, students should make progress toward:

- Developing an algorithm for traversing a real data set. (Problem Solving)



Model 1 Keys and Values

In Python, a *dictionary* stores “key: value” pairs. In the following assignment, the key:value pairs are separated by commas and wrapped in curly braces. For example:

```
elements = {'C': 'carbon', 'H': 'hydrogen', 'O': 'oxygen', 'N': 'nitrogen'}
```

Key	Value
'C'	'carbon'
'H'	'hydrogen'
'O'	'oxygen'
'N'	'nitrogen'

In contrast to sequence types, a dictionary is a *mapping* type. Values are referenced by *keys*, rather than by consecutive integer indexes.

Type the `elements` dictionary above into a Python Shell, and then complete the following table to explore how it works.

Python code	Shell output
<code>type(elements)</code>	
<code>elements.keys()</code>	
<code>elements.values()</code>	
<code>elements['C']</code>	
<code>atom = 'N'</code>	
<code>elements[atom]</code>	
<code>elements[N]</code>	
<code>elements['nitrogen']</code>	
<code>elements[1]</code>	
<code>len(elements)</code>	
<code>elements['B'] = 'boron'</code>	
<code>elements.items()</code>	

Questions (15 min)

Start time:

7. List all the keys stored in the `elements` dictionary after completing the table.

8. What is the data type of the keys in the elements dictionary?

9. Explain the reason for the error after entering each of the following lines:

a) `elements[N]`

b) `elements['nitrogen']`

c) `elements[1]`

10. Ignoring the "dict_items()" part, describe the contents and type of data returned by the `items()` method.

11. Write a Python expression that creates a dictionary for the seven days of the week, i.e., Sun=1, Mon=2, Tue=3, etc. Assign the dictionary to the variable `dow`.

12. If you assign two different values to the same key (i.e., two assignment statements with one value each), which value is stored in the dictionary? Justify your answer with an example.

13. Another way to store the data in Model 1 is to use two lists:

```
keys = ['C', 'H', 'O', 'N']  
vals = ['carbon', 'hydrogen', 'oxygen', 'nitrogen']
```

What is a disadvantage of this approach? Explain your reasoning.

Model 2 Nested Dictionaries

Containers can be nested in arbitrary ways. For example, the following data could be described as a “dictionary of dictionaries of integers and lists of strings”.

Enter the following code into a Python Shell, and complete the table. If the output is longer than one line, summarize it with a few words.

```
movies = {
    "Casablanca": {
        "year": 1942,
        "genres": ["Drama", "Romance", "War"],
    },
    "Star Wars": {
        "year": 1977,
        "genres": ["Action", "Adventure", "Fantasy"],
    },
    "Groundhog Day": {
        "year": 1993,
        "genres": ["Comedy", "Fantasy", "Romance"],
    },
}
```

Python code	Shell output
movies	
movies["Casablanca"]	
movies["Casablanca"]["year"]	
movies["Casablanca"]["genres"]	
type(movies)	
type(movies["Casablanca"])	
type(movies["Casablanca"]["year"])	
type(movies["Casablanca"]["genres"])	
len(movies)	
len(movies["Casablanca"])	
len(movies["Casablanca"]["year"])	
len(movies["Casablanca"]["genres"])	
for key in movies: print(key)	
for key, val in movies.items(): print(key, val)	

Questions (15 min)

Start time:

14. Explain the `TypeError` you encountered.

15. In the expression `movies["Casablanca"]["genres"]`, describe the purpose of the strings `"Casablanca"` and `"genres"`.

16. When iterating a dictionary using a `for` loop (i.e., `for x in movies`), what gets assigned to the variable?

17. What is wrong with the following code that attempts to `print` each movie?

```
for i in range(len(movies)):
    print(movies[i])
```

18. Write nested loops that output every *genre* found under the `movies` dictionary. You should have nine total lines of output.

19. Each movie in Model 2 has a title, a year, and three genres.

- Is it necessary that all movies have the same format?
- Name one advantage of storing data in the same format:
- Show how you would represent The LEGO Movie (2014) with a runtime of 100 min and the plot keywords "construction worker" and "good cop bad cop".