COMP1021
Introduction to Computer Science

Dictionaries

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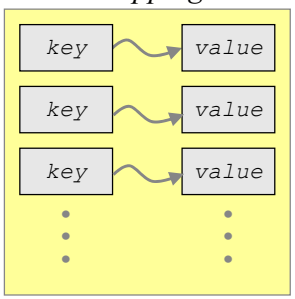
Outcomes

- After completing this presentation, you are expected to be able to:
  1. Explain the difference between a dictionary and a list (or a tuple)
  2. Create and use a dictionary in Python

A Dictionary

- A *dictionary* contains pairs of *key* and *value*
- One key-value pair forms one entry in the dictionary
- Almost anything can be used as a key such as a number, a string or a tuple
- Almost anything can be used as a value such as a number, a string or a list

Mapping

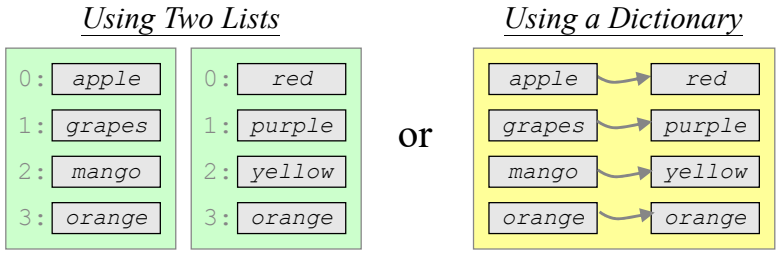


Accessing the Content

- A mapping structure is similar to a list or a tuple but the mapping structure gives a more flexible indexing of data
- For a list `[ ]` or a tuple `( )`
  or a string (which is a kind of a list for text only):
  - You access the data using integer indices only
    i.e. `x[0]`, `x[45]`, and so on
- For a mapping:
  - You access the data by using keys,
    (which can be *almost* any kind of data type)

A Dictionary May be Better Than a List

- For example, to create a mapping of four fruits and their colours, you could do this:



- Possibly, two lists might be required (left)
- However, only one dictionary would be required (right), which is more suitable for this particular purpose

An Example Dictionary

- Let us use a dictionary to store the position and size of some heads in this picture:

Creating a Dictionary

- You can create a dictionary using a list of key and value pairs, like this:

The name of the dictionary

```
heads = {"David":   (589, 106, 48, 63),
         "Gibson":  (474, 102, 44, 58),
         "Jogesh":  (438, 146, 45, 60),
         "Paul":    (522, 162, 55, 68)}
```

A dictionary uses braces { }

x position *y position* *width* *height*

- In this example the key is a string, and the value is a tuple

Retrieving Items

- You can use the key as an index to retrieve an item from a dictionary:

```
where_is_paul = heads["Paul"]
```

- After running the above code, `where_is_paul` contains a tuple of 4 numbers, i.e.

```
(522, 162, 55, 68)
```

Changing Items

- Items in a dictionary can be modified whenever you want, for example:

```
heads["David"] = (588, 104, 48, 57)
```

- After running the above line of code, the value for David will be changed from:

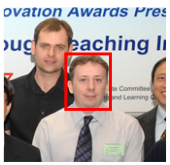
```
(589, 106, 48, 63)
```

to:

```
(588, 104, 48, 57)
```


Inserting and Deleting Items

- You can insert or delete an item in a dictionary any time you want to
  - To insert a new item in the dictionary, simply assign a value to a new key:



```
heads["Sean"] = (628, 146, 46, 58)
```

  - To delete an item, use the `del` keyword to delete a particular key and its value:

```
del heads["Paul"]
```

Paul Chu used to run HKUST but he left, so let's dump him from our database

Dictionary Traversal

- 'Traversal' means 'going through each item'
- You can use `.items()` to access all dictionary content
- For example, to print the location of all heads you can use this code:

```
for key, value in heads.items():
    print(key, value)
```


Example Result of Dictionary Traversal

- The output of the code in the previous slide is:

```
Paul (522, 162, 55, 68)
Gibson (474, 102, 44, 58)
Jogesh (438, 146, 45, 60)
David (588, 104, 48, 57)
```

- Note that when you use this kind of loop to look at the dictionary content you will not be able to delete a dictionary pair in the middle of the loop

Before Python Version 3.6

- It's not possible to know what the order of items, i.e. the keys, is in a dictionary
- For example, when we made the dictionary, the input order of the keys was:

  "David", "Gibson", "Jogesh", and "Paul"
- Surprisingly, the output order is different:

  "Paul", "Gibson", "Jogesh" and "David"

```
Paul (522, 16
Gibson (474,
Jogesh (438,
David (588, 1
```


Python Version 3.6 and Higher

- If you run the code a couple of slides ago in Python 3.6 or higher, you will see this result:

```
David (588, 104, 48, 57)
Gibson (474, 102, 44, 58)
Jogesh (438, 146, 45, 60)
Paul (522, 162, 55, 68)
```

- As you can see, the input order of the dictionary content has been preserved
- This happens from Python version 3.6 onwards

Getting the Keys Only

```
Paul
Gibson
Jogesh
David
```

- Possibly, you only want to consider the keys
- To do that you can use `.keys()` like this:

```
for key in heads.keys():
    print(key)
```

- Alternatively, you can use the dictionary in the loop directly to get the keys, like this:

```
for key in heads:
    print(key)
```


Getting the Values and Others

- To only consider the values, you can use `.values()` like this:

```
(522, 162, 55, 68)
(474, 102, 44, 58)
(438, 146, 45, 60)
(589, 106, 48, 63)
```

```
for value in heads.values():
    print(value)
```

- To check if a key is in the dictionary you can use the `in` operator:

```
if "David" in heads:
    print("he is there!")
```

```
he is there!
```

You Cannot Use a List as a Key

- Although almost anything can be used as a key in a dictionary, you cannot use a list as a key, e.g.:

```
>>> heads = { [474, 102, 44, 58]: "Gibson" }
Traceback (most recent call last):
  File "<pyshell#3>", line 1, in <module>
    heads = { [474, 102, 44, 58]: "Gibson" }
TypeError: unhashable type: 'list'
>>>
```

- If you want to put a collection as a key, you will need to use a tuple

```
>>> heads = { (474, 102, 44, 55): "Gibson" }
>>> print(heads)
{(474, 102, 44, 55): 'Gibson'}
>>>
```