Sets and Maps

Haitham A. El-Ghareeb

October 21, 2019

Faculty of Computers and Information Sciences
Mansoura University
Egypt
helghareeb@mans.edu.eg

Contacts

- https://www.haitham.ws
- https://youtube.com/helghareeb
- https://www.github.com/helghareeb
- http://eg.linkedin.com/in/helghareeb
- helghareeb@mans.edu.eg

Set

Sets

- A common container used in programming
- Unlike the Bag ADT:
  - stores unique values
  - represents the mathematical set structure

Set

The Set ADT

The Set ADT

- A **set** is a container that stores a collection of unique values over a given comparable domain.
- The stored values have no particular ordering

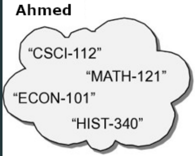
Set()	equals(Set)
length()	is_subset_of(Set)
contains(element)	union(Set)
add(element)	intersect(Set)
remove(element)	difference(Set)

Set

Using the Set ADT

Using the Set ADT

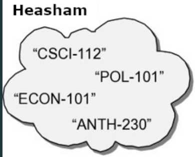
- Two sets containing the current courses for two students



```
a_courses = Set()
a_courses.add( "CSCI-112" )
a_courses.add( "MATH-121" )
a_courses.add( "HIST-340" )
a_courses.add( "ECON-101" )
```

Using the Set ADT

- Two sets containing the current courses for two students



```
h_courses = Set()
h_courses.add( "POL-101" )
h_courses.add( "ANTH-230" )
h_courses.add( "CSCI-112" )
h_courses.add( "ECON-101" )
```

Using the Set ADT

- Determine if two students are taking
  1. all of the same courses or
  2. any of the same courses

```
if a_courses == h_courses :
    print("Ahmed and Hesham are taking the same courses.")
else :
    sameCourses = a_courses.intersect( h_courses )
if len(sameCourses) == 0 :
    print("Ahmed and Hesham are not taking any of the same courses.")
else :
    print("Ahmed and Hesham are taking some of the same courses:")
```

Using the Set ADT

```
for course in sameCourses :
    print( course )
```

Using the Set ADT

- How can we determine which courses Ahmed is taking that Hesham is not taking?

```
uniqueCourses = a_courses.difference( h_courses )
```

Set

Which Data Structure?

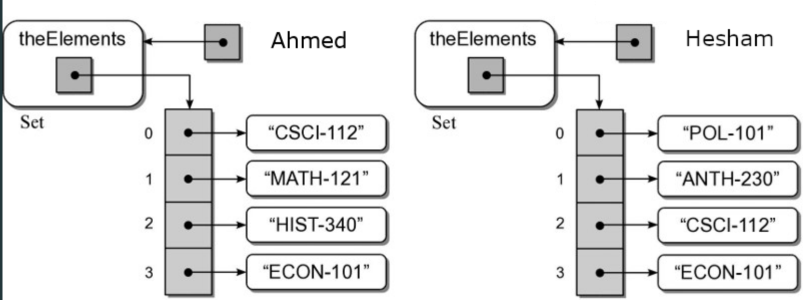
Set: Which Data Structure?

- Evaluate each DS/ADT option
  - dictionary
  - array
  - list
- Criteria
  - Storage Requirements
  - Necessary access and manipulation functionality

Set: Which Data Structure?

- Dictionary
  - stores unique elements (key/value pairs)
  - will waste space
- Array
  - can store unique elements
  - lacks the functionality
- List
  - can store unique elements
  - provides the functionality

Set: List Implementation



Python Testing

Python Testing

Automated vs. Manual Testing

Manual Testing

- You make the scenario
- You write code to test the code validity
- You run the test code
- Later,
- You change the source code
- You write new test code to test the code validity
- You rerun all the code by yourself

Exploratory Testing

- form of manual testing
- form of testing that is done without a plan
- You’re just exploring the application

Python Testing

Automated Testing

Automated Testing

- the execution of your test plan
  - the parts of your application you want to test
  - the order in which you want to test them
  - and the expected responses
- by a script instead of a human

Python Testing

Integration Test vs. Unit Test

Integration Test

- Testing multiple components
- Think of all the things that need to work correctly in order for a simple task to give the right result
- These components are like the parts to your application, all of those classes, functions, and modules you've written.
- A major challenge with integration testing is when an integration test doesn't give the right result
- It's very hard to diagnose the issue without being able to isolate which part of the system is failing

Unit Test

- is a smaller test, one that checks that a single component operates in the right way
- helps you to isolate what is broken in your application and fix it faster

Choosing a Test Runner

Choosing a Test Runner

- There are many test runners available for Python
- The one built into the Python standard library is called unittest
- The principles of unittest are easily portable to other frameworks
- The three most popular test runners are:
    - unittest
    - nose or nose2
    - pytest

Choosing a Test Runner

Python unittest

Python unittest

- unittest has been built into the Python standard library since version 2.1
- You'll probably see it in commercial Python applications and open-source projects
- unittest contains both a testing framework and a test runner
- unittest has some important requirements for writing and executing tests

unittest Requirements

unittest requires that:

1. You put your tests into classes as methods
2. You use a series of special assertion methods in the unittest.TestCase class instead of the built-in assert statement

Python unittest Steps

To build a unittest test case, you would have to:

1. Import unittest from the standard library
2. Create a class called TestSomeThing that inherits from the TestCase class
3. Convert the test functions into methods by adding self as the first argument
4. Change the assertions to use the self.assertZZZ() method on the TestCase class
5. Change the command-line entry point to call unittest.main()

Summary

Summary

- The Set ADT
- Different Data Structures / ADT
- Python Testing
- Unit Testing using unittest

https://www.haitham.ws