

1 Implementation

For this lab, you will implement a **linked hash set that remembers the order of insertion**. The documentation for the classes you will write, and the source code for the `Set` class, are provided in the following link:

<https://www.cs.rit.edu/~csci603/Labs/07-LinkedHashSet/code.zip>

Your data structure design is required to look like the diagram in Figure 1. That is, you build a **chained hash table with keys only, no values, and the entry nodes have two additional references: *previous* and *link* (next) node links**. This means that the ordering is done using the technique of a doubly linked list that overlays on top of the existing nodes needed for the bucket chains.

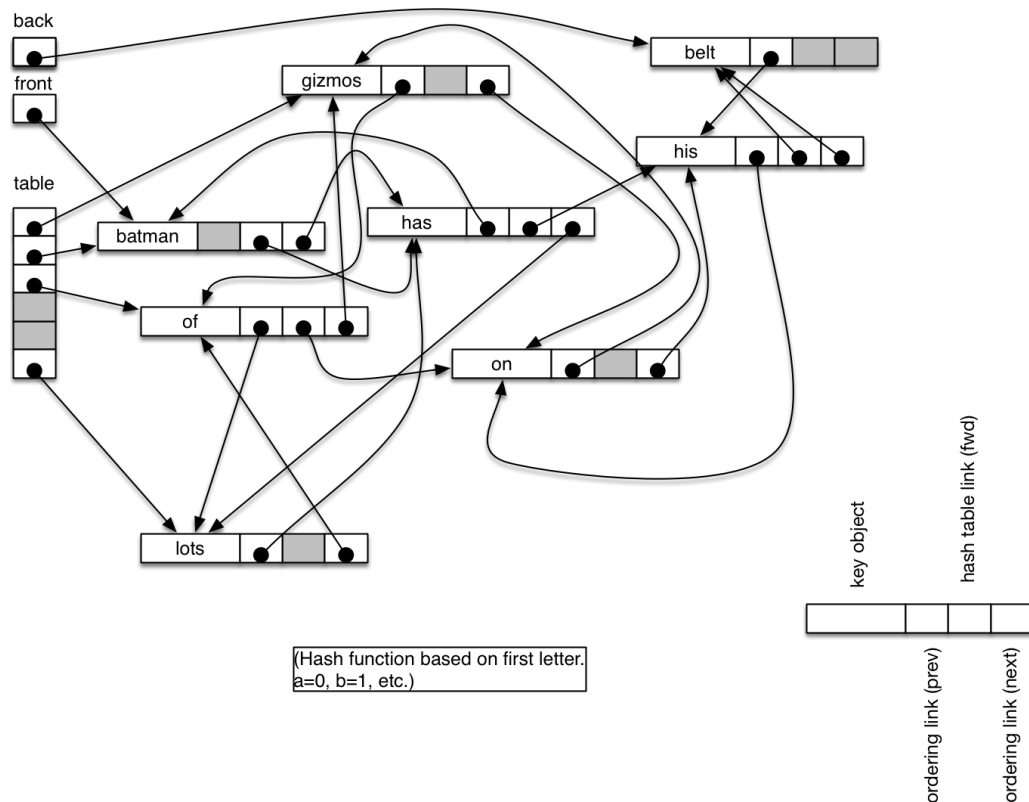


Figure 1: The linked hash table design. Structure shown is developed from entering the following words to the set: batman has lots of gizmos on his belt

Note that you have to write an **iterator for your set** (instead of the `keys()` method you saw in lecture for the dictionaries). The file `sample_iter.py` contains examples to show you how to do it. There are many online resources as well.

1.1 Design Constraints

Methods running time:

1. The `add`, `contains`, `remove` and methods should all run in $O(1)$ time (assuming not much clustering due to excessive collisions). This means `no linear searches` besides the small chains of entries at specific "bucket" locations in the hash table.
2. The `len` method must run in $O(1)$.
3. The iterator, `str`, and `repr` methods are of course linear.

You are not allowed to use dictionaries or any built-in data structure from the Python library except for the `list` to implement the basic hash table. The data elements must be stored using `linked nodes`.

Basically you need to follow the design exemplified in **Figure 2**.

Here is the suggested order of implementation of all the `LinkedHashSet` methods:

- `__init__` and `__len__` methods
- `__str__` and `__repr__` methods
- `__iter__` method
- `contains` method
- `add` method
- `remove` method

1.2 Testing

You must construct at least 3 additional non-trivial test cases and add them to the provided `tests.py` file. Each test must be distinct from the others in terms of what it demonstrates.

There is the beginning of a test program file available for you to use for adding test functions.

2 Grading

- 20% Problem Solving
- 20% Design
- 40% Functionality:
 - 6% `contains`
 - 10% `add`
 - 10% `remove`
 - 6% iterator
 - 8% constructor and others
- 15% Testing: (5% each)
- 5% Style: Proper commenting of modules, classes and methods (e.g. using docstring's).

3 Submission

Create a ZIP file named Lab7.zip that contains all your source code (**linkedhashset.py**, **tests.py**). Submit the ZIP file to the MyCourses assignment before the due date (if you submit another format, such as 7-Zip, WinRAR, or Tar, you will not receive credit for this lab).