Data Structures I : Implementation of lists



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Cocktail of the day: Cosmopolitan



Disclaimer: Keep alcohol out of the hands of minors.





Cocktail of the day: Cosmopolitan

- 40 ml Vodka
- 15 ml Cointreau
- 15 ml Lime juice
- 30 ml Cranberry juice

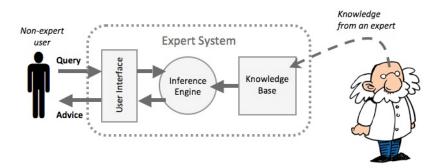


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Expert systems use trees



https://www.youtube.com/watch?v=uWEahgy3Iyc







Review: Lists

- Insertion in an array is slow (O(n)); insertion in a linked list is fast (O(1)).
- \blacksquare Random access in an array is fast (O(1)); random access
- Backward traversal of Singly-linked lists is slow ($O(n^2)$);







Review: Lists

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- \blacksquare Random access in an array is fast (O(1)); random access in a linked list is slow (O(n)).
- Backward traversal of Singly-linked lists is slow $(O(n^2))$;







Review: Lists

- Insertion in an array is slow (O(n)); insertion in a linked list is fast (O(1)).
- \blacksquare Random access in an array is fast (O(1)); random access in a linked list is slow (O(n)).
- Backward traversal of Singly-linked lists is slow $(O(n^2))$; for Doubly-linked lists and arrays is fast (O(n)).







Beware of references!

Binky pointer fun! http://www.cs.stanford.edu/cslibrary/ PointerFunJavaBig.avi









```
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```

```
class Link {
  public int data; //data
  public Link next; //ref. to next link
  public Link(int data); //constructor
}
```





Implementation of Singly-linked lists

```
class LinkedList
private Link first;
public void LinkedList(); // constructor
public void insertFirst(int data);
Taken from [Laf98].
```



- int size()

- 4 void deleteLast()
- 5 void insertLast(int data)
- 6 boolean contains(int data)

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- 1 int size()
- void insertFirst(int data)
- 4 void deleteLast()
- 5 void insertLast(int data)
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- 1 int size()
- void insertFirst(int data)
- void deleteFirst()
- void deleteLast()
- void insertLast(int data)
- 6 boolean contains(int data)
- 7 int get(int index)...

Taken from [Laf98].







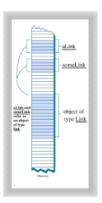


Figure: Links and references in memory. Taken from [Laf98].









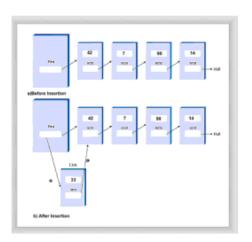


Figure: Inserting a new link. Taken from [Laf98].





Delete a link

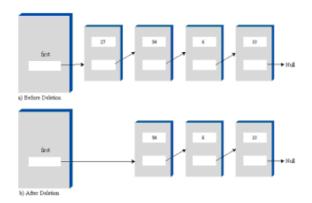


Figure: Deleting a link. Taken from [Laf98].



Simulator of a Linked list



http://visualgo.net/list.html







- 1 int size()
- void insertFirst(int data)
- void deleteFirst()
- void deleteLast()
- void insertLast(int data)
- 6 boolean contains(int data)
- int get(int index)...

Taken from [Laf98].





Implementation of Array Lists

```
class ArrayList
private int index;
private int[] data;
public void ArrayList(); // constructor
public void insertFirst(int data);
```



Methods for class ArrayList

- 1 int size()
- void insertFirst(int data)
- void deleteFirst()
- void deleteLast()
- void insertLast(int data)
- 6 boolean contains(int data)
- int get(int index)...

Taken from [Laf98].









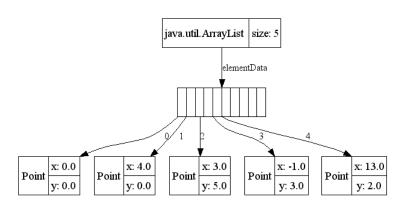


Figure: Representation of an ArrayList. Taken from http://2.bp.blogspot.com/



ArrayList's operations

Array List Data Structure

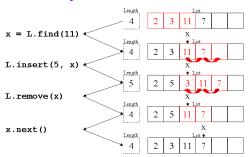


Figure: ArrayList's operations. Taken from http://courses.cs.washington.edu/.









Applet to simulate an Array list



http://www.cs.armstrong.edu/liang/animation/web/ ArrayList.html



Methods for class ArrayList

- 1 int size()
- void insertFirst(int data)
- void deleteFirst()
- void deleteLast()
- void insertLast(int data)
- 6 boolean contains(int data)
- int get(int index)...

Taken from [Laf98].



Complexity analysis

	insertFirst	insert(i)	deleteFirst	delete(i)	get(i)
ArrayList	O(n)	O(n)	O(n)	O(n)	O(1)
LinkedList	O(1)	O(n)	O(1)	O(n)	O(n)

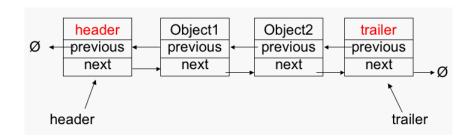
Table: Complexity analysis of the operations of LinkedList and ArrayList.

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Implementation of Doubly-linked Lists



For more details, please check

■ Robert Lafore. Data Structures and Algorithms in Java. Chapter 5.

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Quiz questions

- Methods for both Linked List and Array List are the same, but implementations are different.
- Linked List is more efficient for insertion and ArrayList is







Quiz questions

- Methods for both Linked List and Array List are the same, but implementations are different.
- Linked List is more efficient for insertion and ArrayList is more efficient for random access.





References

- Please learn how to reference images, trademarks, videos and fragments of code.
- Avoid plagiarism



Figure: Figure about plagiarism, University of Malta [Uni09]













Robert Lafore.

Data Structures and Algorithms in Java.

QUE; 1 edition (8 November 2002), 1998.



University of Malta.

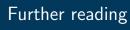
Plagarism — The act of presenting another's work or ideas as your own, 2009.

[Online; accessed 29-November-2013].











- Linked Lists
 - Robert Lafore. Data Structures and Algorithms in Java. Chapter 3.









