Dynamic Set

* Mathematical sets are unchanging
* Sets used in computers can grow or shrink i.e. they are DYNMIC

Elements {

Key,

SatelliteData

}

Key data

The key is needed for the operation of the tree. Everything else isn't

Satellite data

Refers to any "payload" data which you want to store in your data structure and which is not part of the structure of the data structure. It can be anything you want. It can be a single value, a large collection of values, or a pointer to some other location that holds the value

Example

Node {

Node next; // key

int value; // satellite data

}

Queries operations

* Search(S, K)
* Minimum(S)
* Maximum(S)
* Successor(S, x)
* Predecessor(S, x)

In which, S is a Dynamic Set, K is the key and x is satellite data

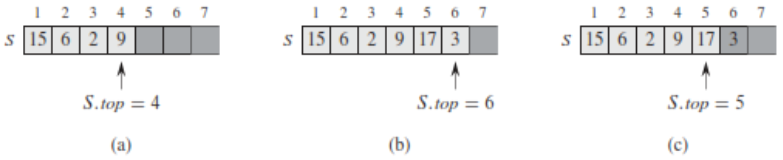
Modifying operations

Insert(S, x)

Delete(S, x)

Stack

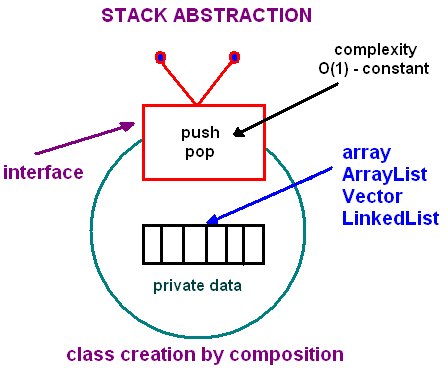
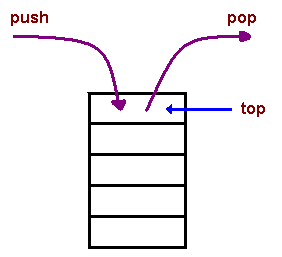
LIFO - Last In First Out



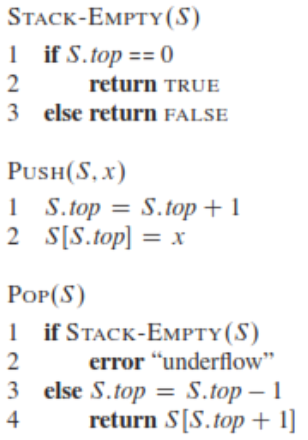
a) S has 4 elements and the top element is 9

b) After called PUSH(S, 17) and PUSH(S, 3)

c) After called POP(S)



Pseudo code



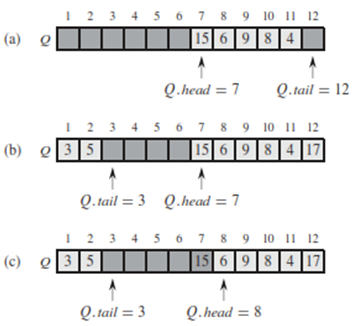
See more

lec8.MySimpleStack.java

https://www.cs.cmu.edu/~adamchik/15-121/lectures/Stacks%20and%20Queues/Stacks%20and%20Queues.html

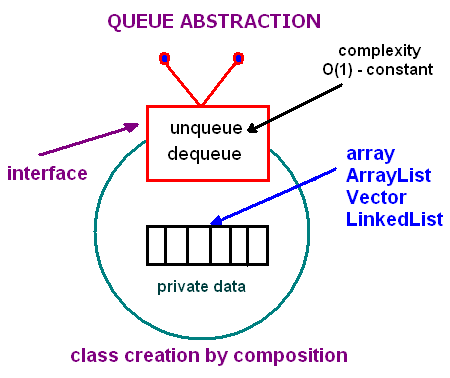
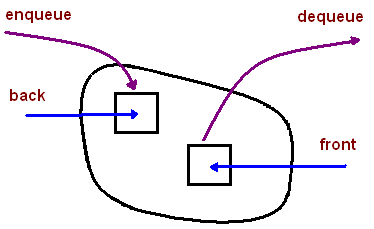
Queue

FIFO – First In First Out

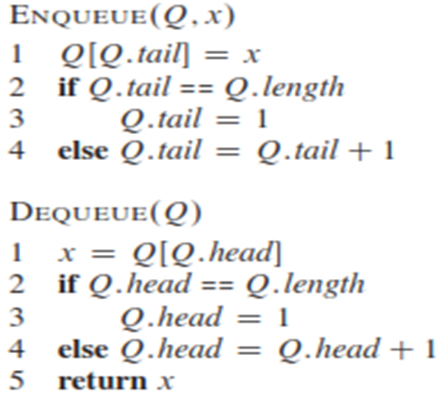


Q [1…12]

1. Queue has 5 elements from 7…11
2. Call enqueuer(17), enqueuer(3) and enqueuer(5)
3. Calls dequeue(Q), returns the value 15 at the head of the queue. New head has value 6



Pseudo code



See more

lec8.ArrayQueue.java

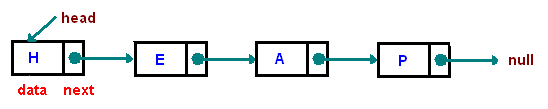
<https://www.cs.cmu.edu/~adamchik/15-121/lectures/Stacks%20and%20Queues/Stacks%20and%20Queues.html>

Linked List

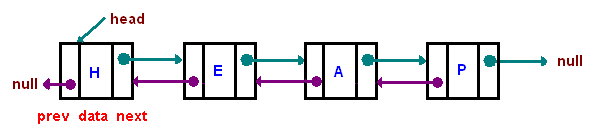
One disadvantage of using arrays to store data is that arrays are static structures and therefore cannot be easily extended or reduced to fit the data set. Arrays are also expensive to maintain new insertions and deletions.

One disadvantage of a linked list against an array is that it does not allow direct access to the individual elements

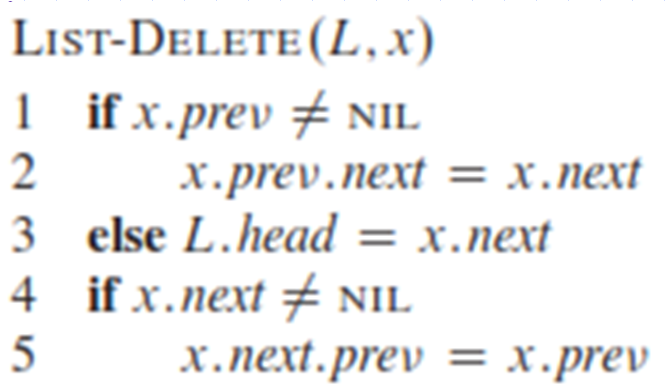
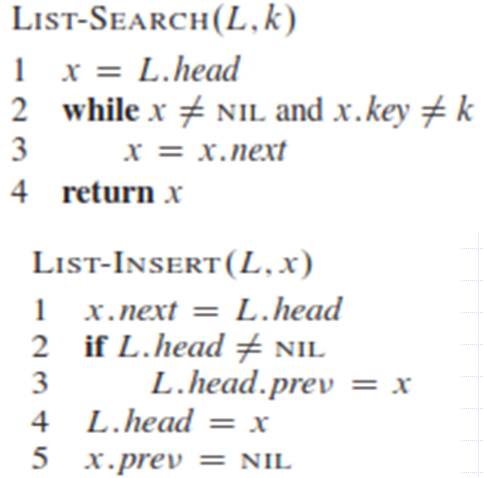
Singly Linked List



Doubly Linked List

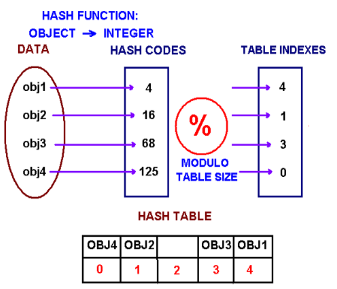


Pseudo code



Hashing

The problem at hands is to speed up searching if we know in advance the index at which that value is located in the array. With this magic function our search is reduced to just one probe, giving us a constant runtime O(1). Such a function is called a hash function. A hash function is a function which when given a key, generates an address in the table.



In the above image, create an array of size M *(= 5 in this case)*. Choose a hash function h that is a mapping from objects into integers 0, 1...M-1. Put these objects into an array at indexes computed via the hash function index = h(object). Such array is called a hash table.

A hash function that returns a unique hash number is called a universal hash function which properties as below:

* It always returns a number for an object.
* Two equal objects will always have the same number
* Two unequal objects not always have different numbers