**What is Cache Software?**

In computing a **cache**  is a component that stores data so future requests for that data can be served faster; the data stored in a cache might be the result of an earlier computation, or the duplicate of data stored elsewhere. A *cache hit* occurs when the requested data can be found in a cache, while a *cache miss* occurs when it cannot. Cache hits are served by reading data from the cache, which is faster than re - computing a result or reading from a slower data store; thus, the more requests can be served from the cache, the faster the system performs.

To be cost-effective and to enable efficient use of data, caches are relatively small. Nevertheless, caches have proven themselves in many areas of computing because access patterns in typical computer applications exhibit the locality of reference. Moreover, access patterns exhibit temporal locality if data is requested again that has been recently requested already, while spatial locality refers to requests for data physically stored close to data that has been already requested.

**Interface/API Of A Cache:**

The interface of API of a Cache consists of the following:

1. get(key): to get the value for a given key from the cache.

2. put(key, value): puts key and associated value in the cache.

3. Size(): size of the cache.

**What Are The Cache Eviction Algorithms?**

Bélády's Algorithm

Least Recently Used (LRU)

Most Recently Used (MRU)

Pseudo- LRU (PLRU)

Random Replacement (RR)

Segmented LRU (SLRU)

2-way set associative

Direct-mapped cache

Least-Frequently Used (LFU)

Low Inter Reference Recency Set (LIRS)

Adaptive Replacement Cache (ARC)

Clock With Adaptive Replacement (CAR)

**FIFO Cache:**

In **‘First In First Out’** approach, OS selects the page which is oldest in cache and swaps that it with new page.

**LRU Cache:**

In **‘Least Recently Used’** approach, OS selects the page which was not accessed for longest period of time.

**LFU Cache:**

In **‘Least Frequently Used’** approach, OS selects the page which is accessed least number of time till a given point of time.

**Implementation Details Of Cache Algorithms:**

**LRU**

Use a doubly-linked list in combination with a HashMap.

The HashMap should provide value lookup by key for your cache, in O(1) time.

The HashMap should also contain a pointer to the corresponding node in the doubly-linked list so that when a key is accessed, the corresponding node in the linked list can be deleted from its current position and moved to the tail, which is the position for the most recently seen node.

If you see a new element you haven't seen before (that is not in your HashMap), you add it to both the HashMap and the tail of the linked list.

The linked list allows you to see which element expires next in O(1) time, and if the list exceeds the number of elements you want to cache, you delete the next-expiring element from both the linked list and the HashMap.   
All operations are in O(1) time (expected time, in the case of the HashMap).

**FIFO**

The FIFO cache algorithm is the most primitive type of algorithm. In this algorithm the element is evicted based on the manner in which it is inserted.

Singly Linked List is used for this purpose.

**LFU**

LFU cache eviction scheme is useful for an HTTP caching network proxy for example, where we want the least frequently used items to be removed from the cache.

The goal here is for the LFU cache algorithm to have a runtime complexity of O(1) for all of its operations, which include insertion, access and deletion (eviction).

Doubly linked lists are used in this algorithm. One for the access frequency and each node in that list contains a list with the elements of same access frequency. Let say we have five elements in our cache. Two have been accessed one time and three have been accessed two times. In that case, the access frequency list has two nodes (frequency = 1 and frequency = 2). The first frequency node has two nodes in its list and the second frequency node has three nodes in its list.

**Data Structures Used For Each Cache Type:**

**LRU:**

Doubly Linked List

**FIFO:**

Singly Linked List

**LFU:**

Doubly Linked List