

460. LFU Cache

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Design and implement a data structure for a Least Frequently Used (LFU) cache.

Implement the `LFUCache` class:

- `LFUCache(int capacity)` Initializes the object with the `capacity` of the data structure.
- `int get(int key)` Gets the value of the `key` if the `key` exists in the cache. Otherwise, returns `-1`.
- `void put(int key, int value)` Update the value of the `key` if present, or inserts the `key` if not already present. When the cache reaches its `capacity`, it should invalidate and remove the **least frequently used** key before inserting a new item. For this problem, when there is a **tie** (i.e., two or more keys with the same frequency), the **least recently used** `key` would be invalidated.

To determine the least frequently used key, a **use counter** is maintained for each key in the cache. The key with the smallest **use counter** is the least frequently used key.

When a key is first inserted into the cache, its **use counter** is set to `1` (due to the `put` operation). The **use counter** for a key in the cache is incremented either a `get` or `put` operation is called on it.

The functions `get` and `put` must each run in $O(1)$ average time complexity.

Constraints:

- $0 \leq \text{capacity} \leq 10^4$
- $0 \leq \text{key} \leq 10^5$
- $0 \leq \text{value} \leq 10^9$
- At most $2 * 10^5$ calls will be made to `get` and `put`.

Example 1:

Input
["LFUCache", "put", "put", "get", "put", "get", "get", "put", "get", "get", "get"]
[[2], [1, 1], [2, 2], [1], [3, 3], [2], [3], [4, 4], [1], [3], [4]]
Output
[null, null, null, 1, null, -1, 3, null, -1, 3, 4]

Explanation
// cnt(x) = the use counter for key x
// cache=[] will show the last used order for tiebreakers (leftmost element is most recent)
LFUCache lfu = new LFUCache(2);
lfu.put(1, 1); // cache=[1,_], cnt(1)=1
lfu.put(2, 2); // cache=[2,1], cnt(2)=1, cnt(1)=1
lfu.get(1); // return 1
 // cache=[1,2], cnt(2)=1, cnt(1)=2
lfu.put(3, 3); // 2 is the LFU key because cnt(2)=1 is the smallest, invalidate 2.
 // cache=[3,1], cnt(3)=1, cnt(1)=2
lfu.get(2); // return -1 (not found)
lfu.get(3); // return 3
 // cache=[3,1], cnt(3)=2, cnt(1)=2
lfu.put(4, 4); // Both 1 and 3 have the same cnt, but 1 is LRU, invalidate 1.
 // cache=[4,3], cnt(4)=1, cnt(3)=2
lfu.get(1); // return -1 (not found)
lfu.get(3); // return 3
 // cache=[3,4], cnt(4)=1, cnt(3)=3
lfu.get(4); // return 4
 // cache=[4,3], cnt(4)=2, cnt(3)=3

LFU Cached → Least Frequently Used Cache

Cache Capacity : 2

Constraint In Time Complexity

- put(k,v) $\rightarrow O(1)$
- get(k) $\rightarrow O(1)$

