Digital Fundamentals and Architecture Assignment

Least Recently Used - Cache Replacement Algorithm

Submitted By,

Jaganath Syam

RMCA, R.No34

16759

Cache Replacement Algorithm

A cache is a small, fast memory used to store recently accessed data.
When the cache becomes full and a new item needs to be stored, a cache replacement algorithm decides which existing item to remove.

Least Recently Used

LRU replacement algorithm removes the entry that has not been used for the longest period of time.
ie, Most Recently Used → keep it, Least Recently Used → Remove it First

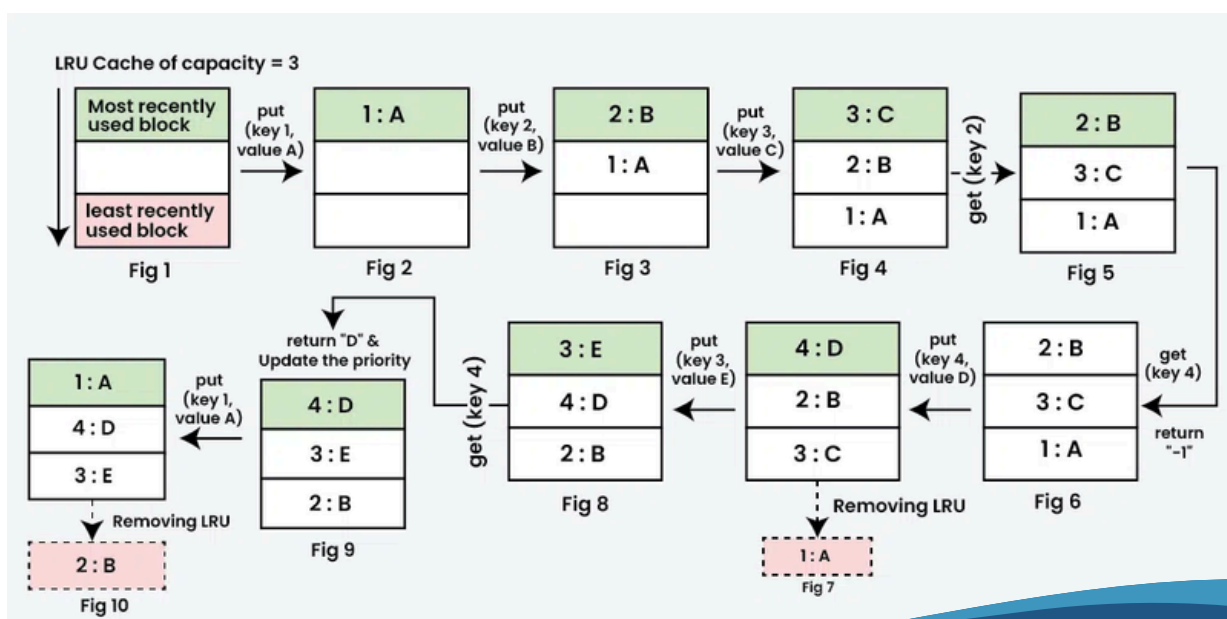cache entries arranged like this, [MRU...............LRU]

- If the page is already in cache, move it to the front [MRU]
- If the page is not in cache,
    - If the cache is full, remove the last page [LRU]
    - Insert the new page at the front.

Advantages of LRU

- Good performance in real world scenarios.
- Follows temporal locality- recently items get reused.
- Easy to implement with list or stack.
- Better than FIFO for most workloads

Disadvantages of LRU

- Requires extra hardware / cost for fast tracking of usage.
- Slightly slower than FIFO.
- Not ideal for workloads where old pages are suddenly reused.

Program Implementation In Python

```python
cache = ["A", "B", "C"]
print(cache)

new = "D"
print(f"{new} is the new cache element")

# LRU = last element, so remove it
lru = cache.pop()
cache.append(new)

print(f"{cache} is the new cache since {lru} is least recently
used")
```

Output

```
PS C:\Users\jagan\Desktop\df> & C:/Users/jagan/AppData/Local/Programs/
c:/Users/jagan/Desktop/df/lru.py
['A', 'B', 'C']
D is the new cache element
['A', 'B', 'D'] is the new cache since C is least recently used
PS C:\Users\jagan\Desktop\df>
```

Git Log

```
jagan@DESKTOP-8905HPS MINGW64 ~/Desktop/df (lru-jagan)
$ git log
commit b0afc7d61b8f0022014f0ce4efa1206d13b02ff0 (HEAD -> lru-jagan, origin/lru-jagan)
Author: viper004 <jagannathsyam2004@gmail.com>
Date:   Wed Dec 10 23:32:32 2025 +0530

    .

commit 2288856835ae347a81e304723a85e6ccd5ccf34d
Author: viper004 <jagannathsyam2004@gmail.com>
Date:   Thu Dec 4 23:52:26 2025 +0530

    Reduced LOC

commit 9df9b42ecde24749886890c0fcb900d63954b2e4
Author: viper004 <jagannathsyam2004@gmail.com>
Date:   Thu Dec 4 23:48:40 2025 +0530

    Initial Commit on lru branch

commit 2f9e4dc3d836b14f32a1cbcebcec758030e4e7c5
Author: viper004 <jagannathsyam2004@gmail.com>
Date:   Thu Dec 4 23:47:09 2025 +0530

    Initial Commit on lru branch

commit c6b191cb394b1bc3ee51e6eceddad3958099114b (origin/directmapping-Heins, origin/HEAD)
Author: Heins Devasia <heinsdevasia@gmail.com>
Date:   Thu Dec 4 23:17:00 2025 +0530

    Add direct mapping representation

jagan@DESKTOP-8905HPS MINGW64 ~/Desktop/df (lru-jagan)
```