ECE 344: Operating Systems
Lecture 22

Clock Page Replacement

1.0.1

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November 1/2, 2021

Clock Algorithm

Data structures:

- Keeps a circular list of pages in memory
- Uses a reference bit for each page in memory (light grey in next slides)
- Has a “hand” (iterator) pointing to the last element examined

Algorithm, to insert a new page:

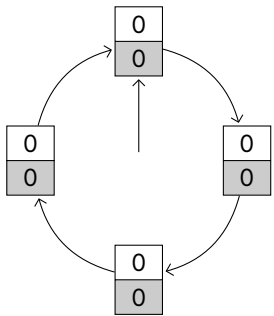
- Check the hand’s reference bit, if it’s 0 then place the page and advance hand
- If the reference bit is 1, set it to 0, advance the hand, and repeat

For page accesses, set the reference bit to 1

Clock Example (with Diagram)

Assume our physical memory can only hold 4 pages, and we access the following:

1 2 3 4 5 2 3 1 2 3 (all of the pages are initially on disk)



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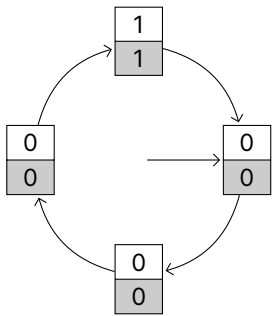

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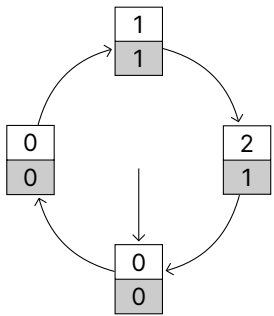
1 2



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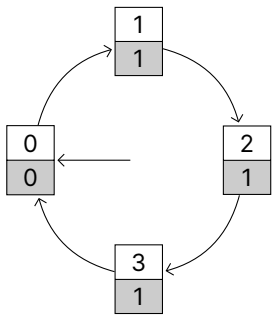

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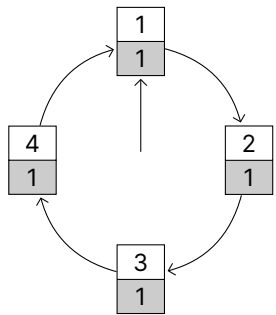

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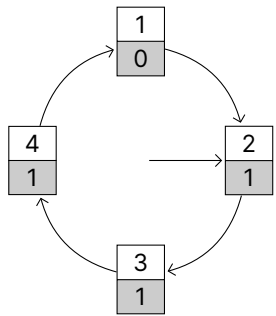

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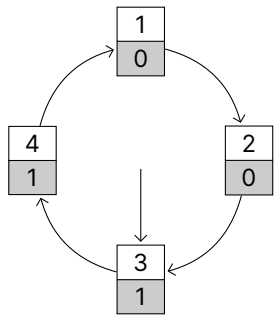

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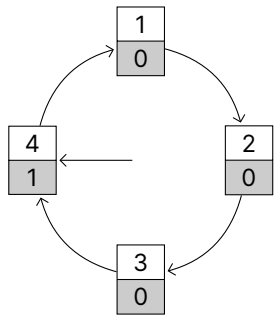

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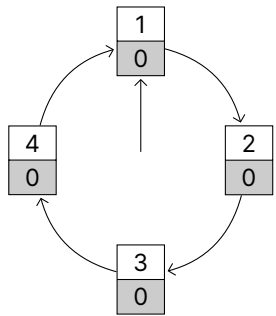

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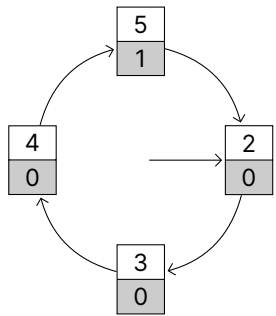

Clock Example (with Diagram)

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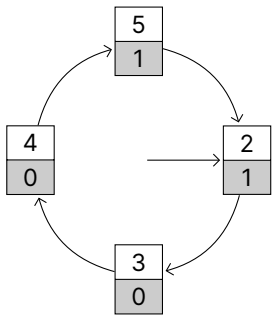

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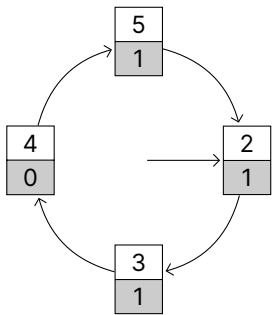

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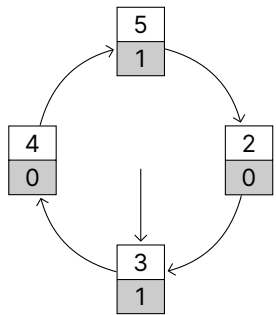

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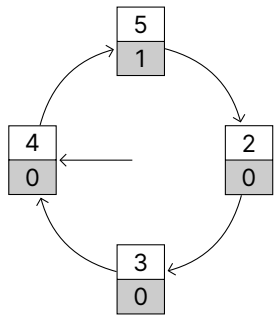

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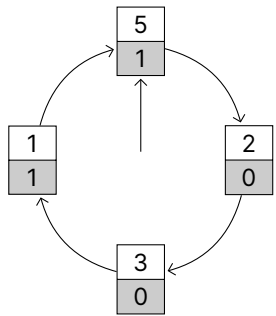

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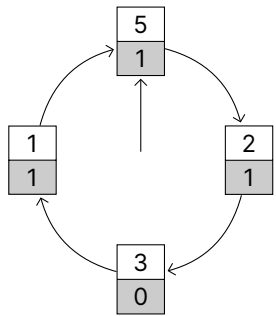

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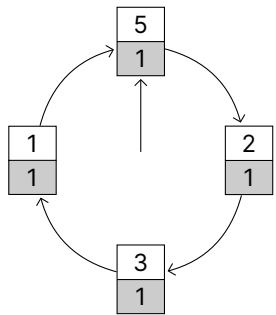

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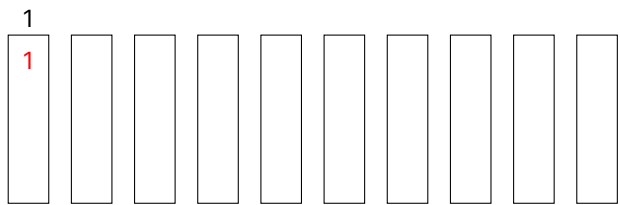

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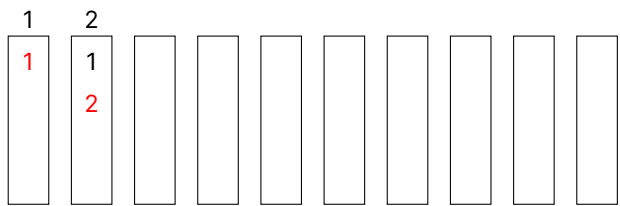

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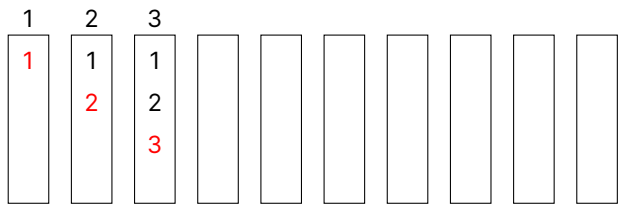

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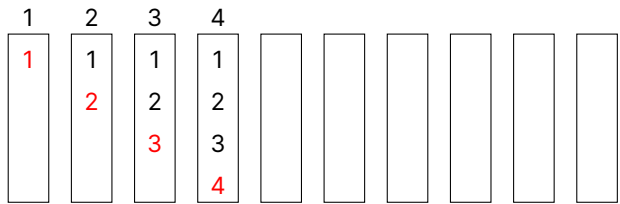

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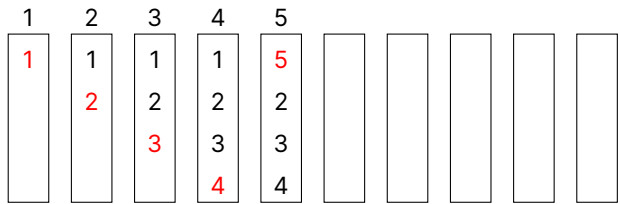

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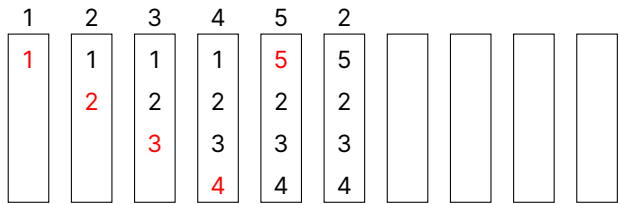

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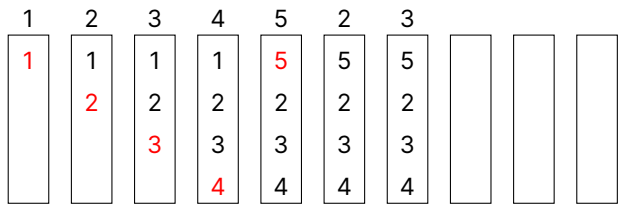

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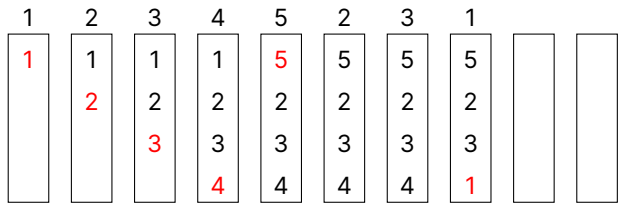

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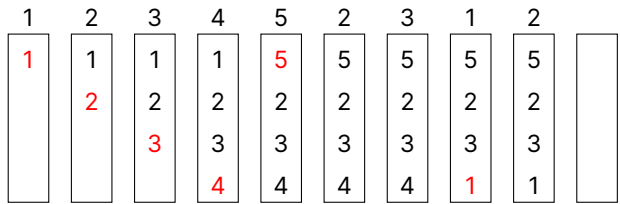

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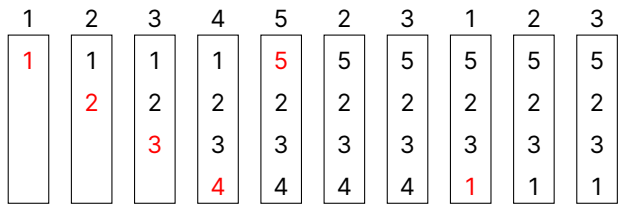

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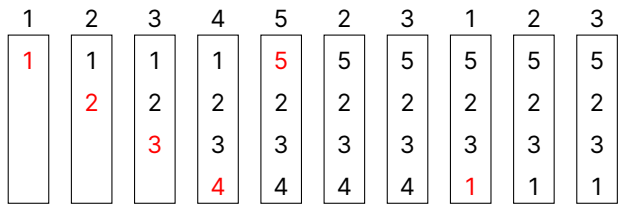

6 page faults

For Performance You May Choose to Disable Swapping

Memory is cheap, and has quite high capacity

- You'd rather know you need more memory than run slowly
  - Linux runs an OOM (out of memory) killer, that SIGKILLs the memory hog

Larger page sizes allow for speedups (2 MiB or 1 GiB page size)

- Trade more fragmentation for more TLB coverage

The Clock Algorithm is an Approximation of LRU

Data structures:

- Keeps a circular list of pages in memory
- Uses a reference bit for each page in memory (light grey in next slides)
- Has a “hand” (iterator) pointing to the last element examined

Algorithm, to insert a new page:

- Check the hand’s reference bit, if it’s 0 then place the page and advance hand
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