PAGE REPLACEMENT ALGORITHMS

Fourth class

Operating system lab5

Memory Management : Paging

- Paging is a method of writing and reading data from a secondary storage(Drive) for use in primary storage(RAM), because random access memory operates much faster than disk memory.

- When a computer runs out of RAM(finished), the operating system (OS) will move pages of memory over to the computer's hard disk to free up RAM for other processes. This ensures that the operating system will never run out of memory and crash.

How Does It Work?

- The OS reads data from blocks called pages, all of which have identical size.

- In order to do so, the OS first needs for back to the page table which is used by virtual memory to store the mapping between virtual addresses and physical addresses.

- Every time the OS is translating from logical to physical, it requires a look up in the page table, which is stored in RAM.

- When all page frames are in use, the operating system must select a page frame to reuse for the page the program now needs.
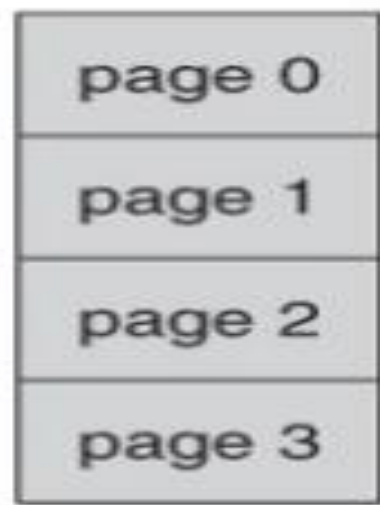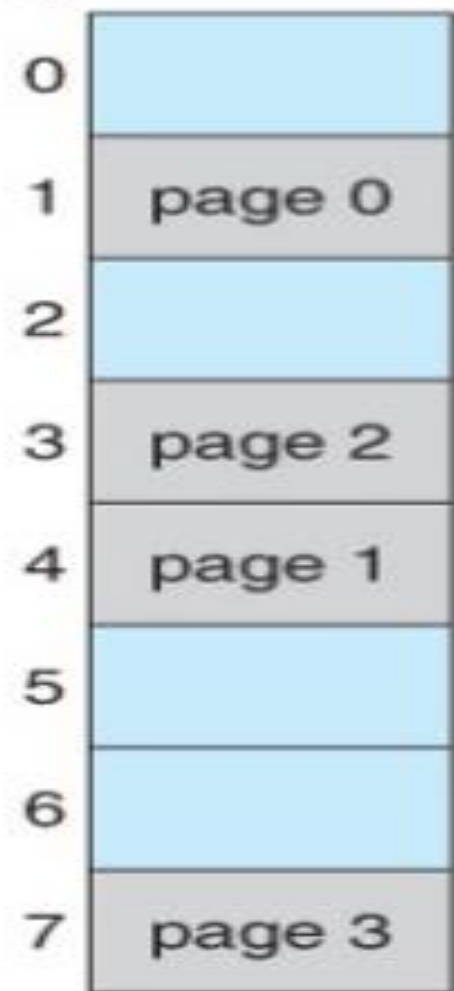
Aspects of virtual memory

- There are two main aspects of virtual memory, Frame allocation and Page Replacement.
- It is very important to have the optimal frame allocation and page replacement algorithm.
- Frame allocation is all about how many frames are to be allocated to the process while the page replacement is all about determining the page number which needs to be replaced in order to make space for the requested page.
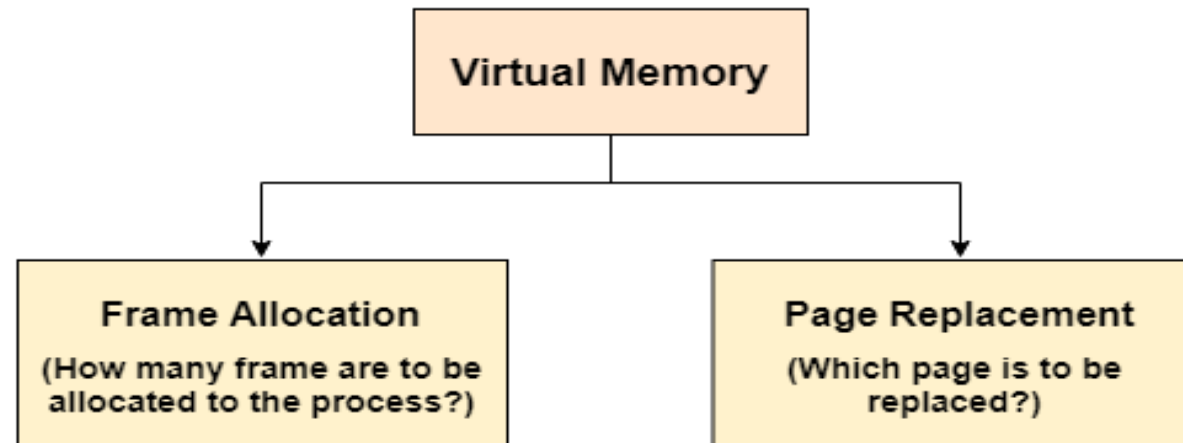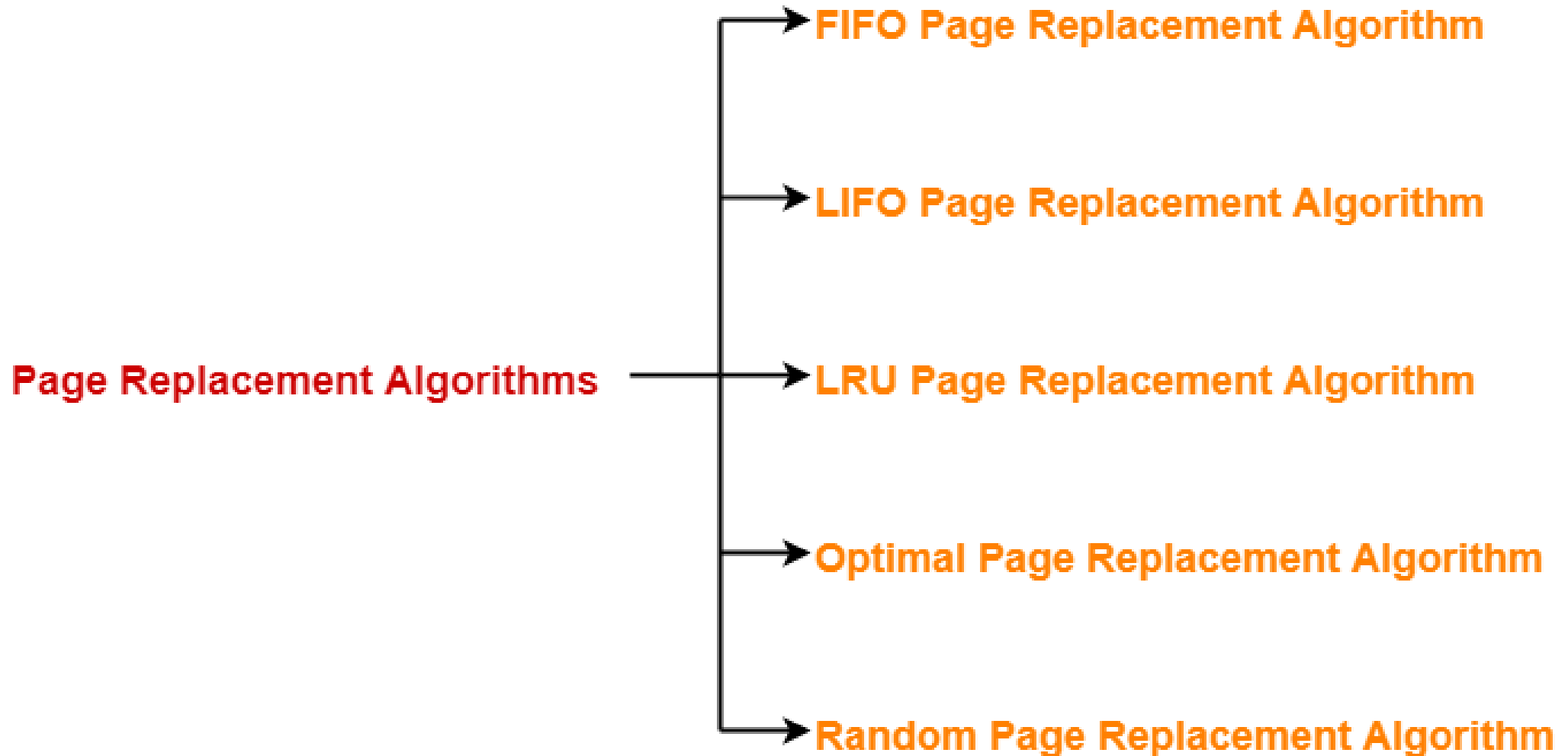
Page Replacement Algorithms

- In a computer operating system that uses paging for virtual memory management, page replacement algorithms decide which memory pages to page out, sometimes called swap out, or write to disk.

- when a page of memory needs to be allocated. Page replacement happens when a requested page is not in memory (page fault) and a free page cannot be used to satisfy the allocation, either because there are none, or because the number of free pages is lower than some threshold.

- When the page that was selected for replacement and paged out is referenced again it has to be paged in (read in from disk), and this involves waiting for I/O completion.

- This determines the quality of the page replacement algorithm: the **less time waiting for page-ins**, the better the algorithm.

- A page replacement algorithm looks at the:

1. Limited information about accesses to the pages provided by hardware,.

2. And tries to guess which pages should be replaced to minimize the total number of page misses.

3. While balancing this with the costs (primary storage and processor time) of the algorithm itself.

Types of Page Replacement Algorithms

Page Replacement Algorithms

→ FIFO Page Replacement Algorithm

→ LIFO Page Replacement Algorithm

→ LRU Page Replacement Algorithm

→ Optimal Page Replacement Algorithm

→ Random Page Replacement Algorithm

Example (Optimal Page Replacement Algorithm)

- Optimal Page Replacement algorithm → this algorithm replaces the page which will not be referred for so long in future.

7	0	1	2	0	3	0	4	2	3	0	3	2	1	2	0	1	7	0	1
7	7	7	2	2	2	2	2	2	2	2	2	2	2	2	2	2	7	7	7
	0	0	0	0	0	4	4	4	0	0	0	0	0	0	0	0	0	0	0
		1	1	1	3	3	3	3	3	3	3	1	1	1	1	1	1	1	1