

UNIT 3

- Memory Management
- Function Of Memory Management
- Memory Management System
- Allocation Methods Or Techniques
- Swapping.
- Paging.
- Segmentation.
- Virtual Memory Management.
- Demand Paging.
- Process Creation.
- Page Replacement.
- Allocation Of frames.
- Thrashing.

Memory Management

- Definition:-

Memory management is nothing but to keep process in a memory i.e. share memory.

Why of memory management ?

1. Increases CPU utilization.
2. Improve response time.
3. Selection of algorithm depends on many factor. (Hardware)
4. Sub Dividing memory to accommodate to multiple process.

Function Of Memory Management

- To keep track of all memory location allocated to which process and how much.
- To decide memory allocation policy i.e. which process should get how much memory when and where.
- To use various techniques and algorithms to allocate and de-allocate memory location.

Memory Management System

- ☐ **Contiguous, Real memory management system:-**
 - a. Single continuous memory allocation.**
 - b. Partitions:**
 - 1. Fixed partitions (static)**
 - 2. Variable partitions (dynamic)**
- ☐ **Non contiguous, Real memory management system:**
 - a. Paging.**
 - b. Segmentation.**
- ☐ **Non contiguous, Virtual memory management system:**
 - a. Virtual Memory**
 - b. Demand paging**

Allocation Methods Or Techniques:-

- The direct access nature of the disk allow us to store many files on same disk. The main problem is now to allocate a space to these files so that disk. Space is efficiently utilized & files can be quickly accessed. there are three methods or techniques to allocate space.
 - 1.Contiguous memory allocation.
 - 2.Link allocation.
 - 3.Index allocation.

Contiguous Memory Allocation:

- To execute a program in early computer system, OS had to find enough contiguous main memory to accommodate the entire program. If the program was larger than available memory, the system could not execute it is called as contiguous memory allocation.

This is a method of assigning memory such that all of the addresses in the process entire address space are adjacent to one another. It required each file to occupy a set of contiguous (adjoining) addresses on the disk. Contiguous allocation of a file is defined by the disk address of the first block & its length.

FILE	START	SIZE
F1	2	3
F2	12	3
F3	22	3
F4	6	4

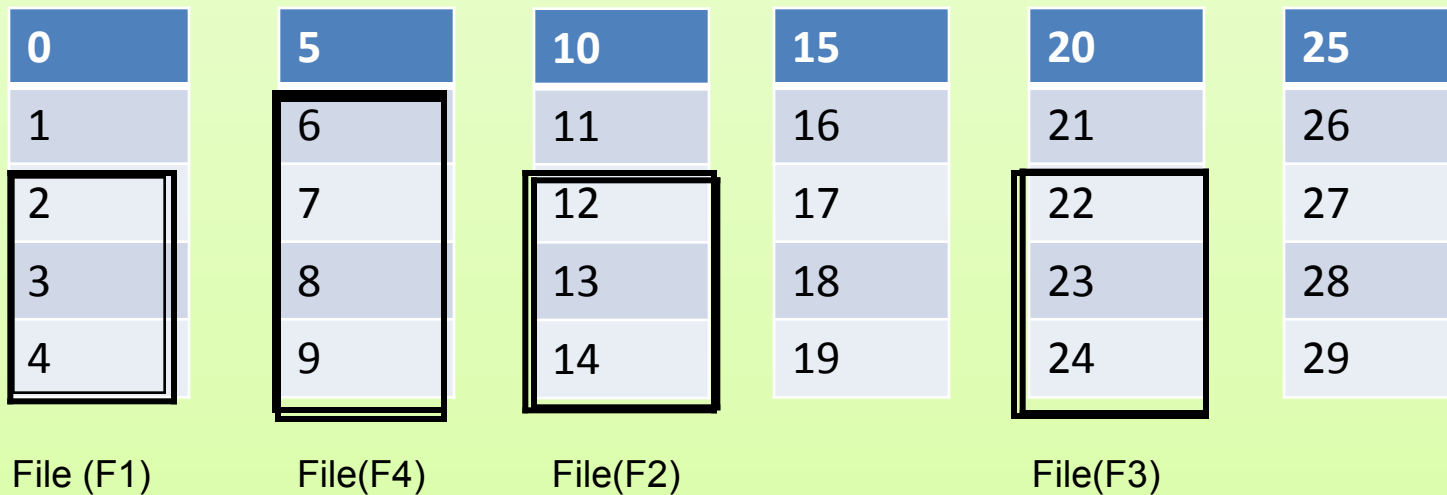


Fig. Contiguous Memory Allocation

Non Contiguous Memory Allocation

- A program is divided into block or segments that the system may place in non adjacent dots in a main memory. This allow making use of unused gap in the memory.

There are two types of non contiguous memory allocation:-

1. Linked allocation.
2. Index allocation.

Linked Allocation:

- Each file is linked list of disk block. The disk block may be scattered anywhere on the disk. The directory contain a pointer to the first and last block of a file.

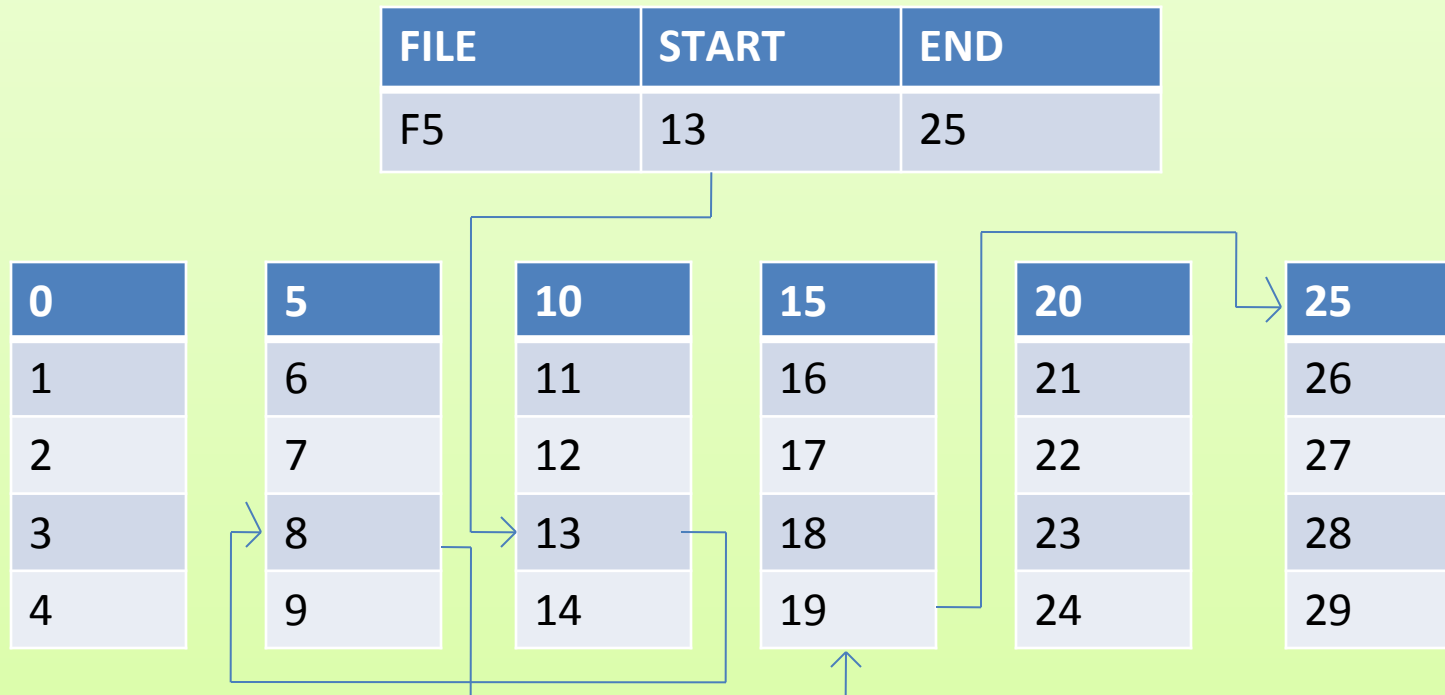


Fig. Linked Allocation

Index Allocation:

- All pointers brought together in one location called index block. Each file has its own index block which is an array of disk block address. The directory contain address of index block.

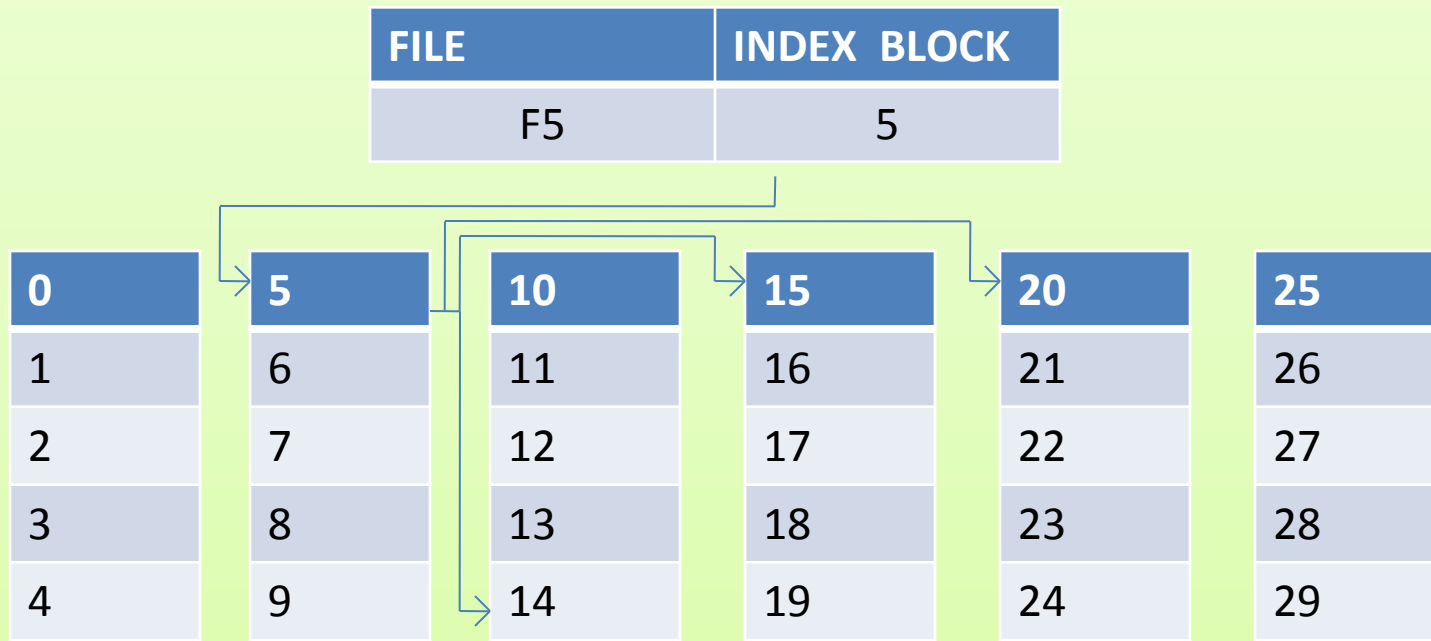


Fig. Index Allocation.

Swapping

- Definition:-

Method of copying a process memory content to secondary stage, removing the process from the memory & allocating the free memory to free process.

There are two process in swapping:-

1. Swap in
2. Swap out

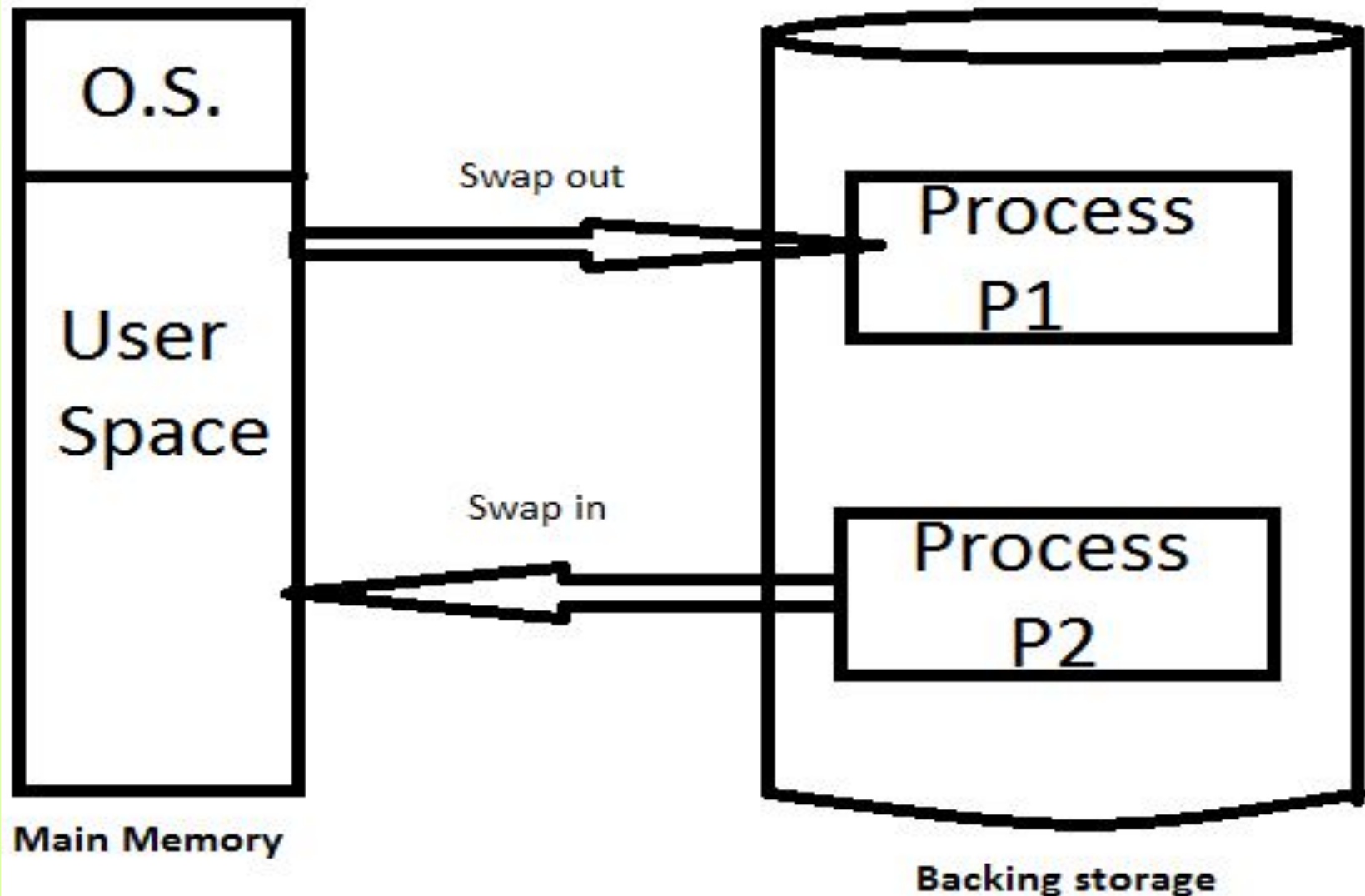
- **Swap in:-**

“When process executed from disk to main memory.”

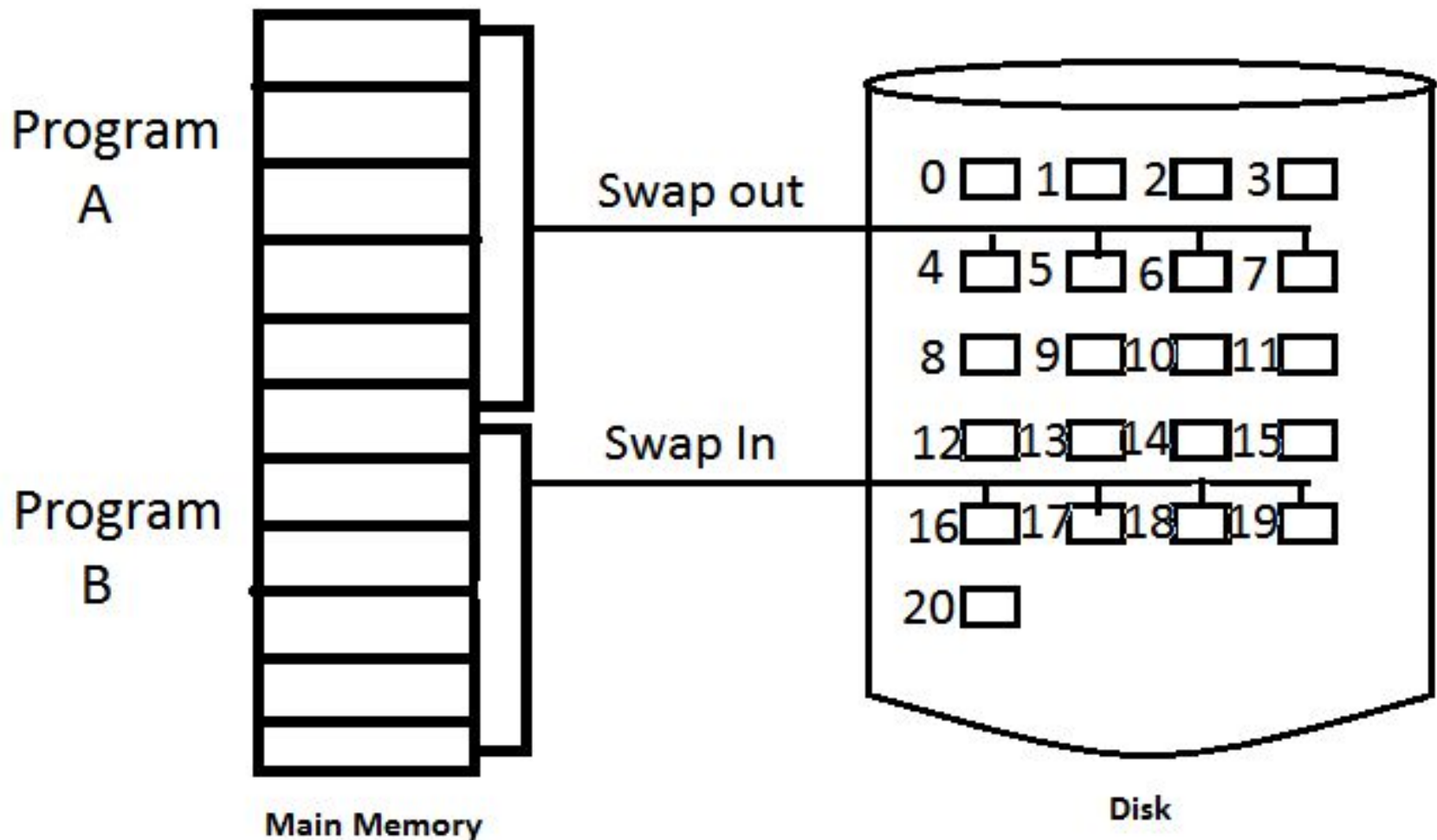
- **Swap out:-**

“When process executed from main memory to disk .”

Swapping of two process using disk as backing stores



Transfer of paged memory to contiguous disk space



Paging

- Paging is a Physical division of program.
- Paging have Fix size.
- Paging has page size, page frame & page map table.
- Paging permits a programs memory to be non contiguous.
- Paging can solve the problem using external fragmentation.

Paging

Page 0
page1
page2
page3

**Logical
memory**

page no P#	page frame
0	1
1	4
2	7
3	3

**Page map table
(PMT)**

page frame	
0	
1	page 0
2	
3	page 3
4	page 1
5	
6	
7	page 2

Physical memory

Partition

Definition:-

“Partition is making small section of memory to allow multiprogramming & make memory management easy.”

Two type of partition:-

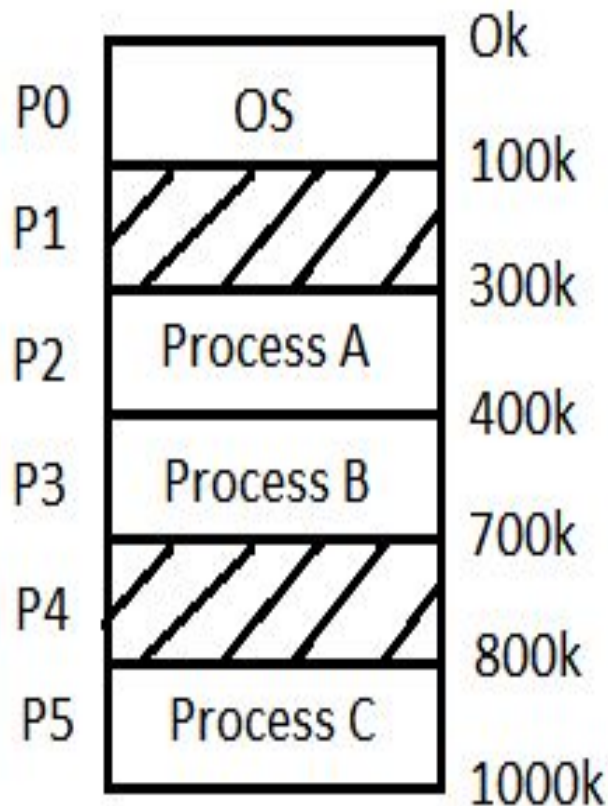
1.Fix Partition

2.Variable Partition

Fix Partition

- It is also called as Static Partition.
- Size Can not be change.
- Partition is Fix at the time of system generation.
- At the time of fix partition it will create
PDT(Partition Description Table).
- It cant be created at run time.

Fix Partition & Partition Description Table

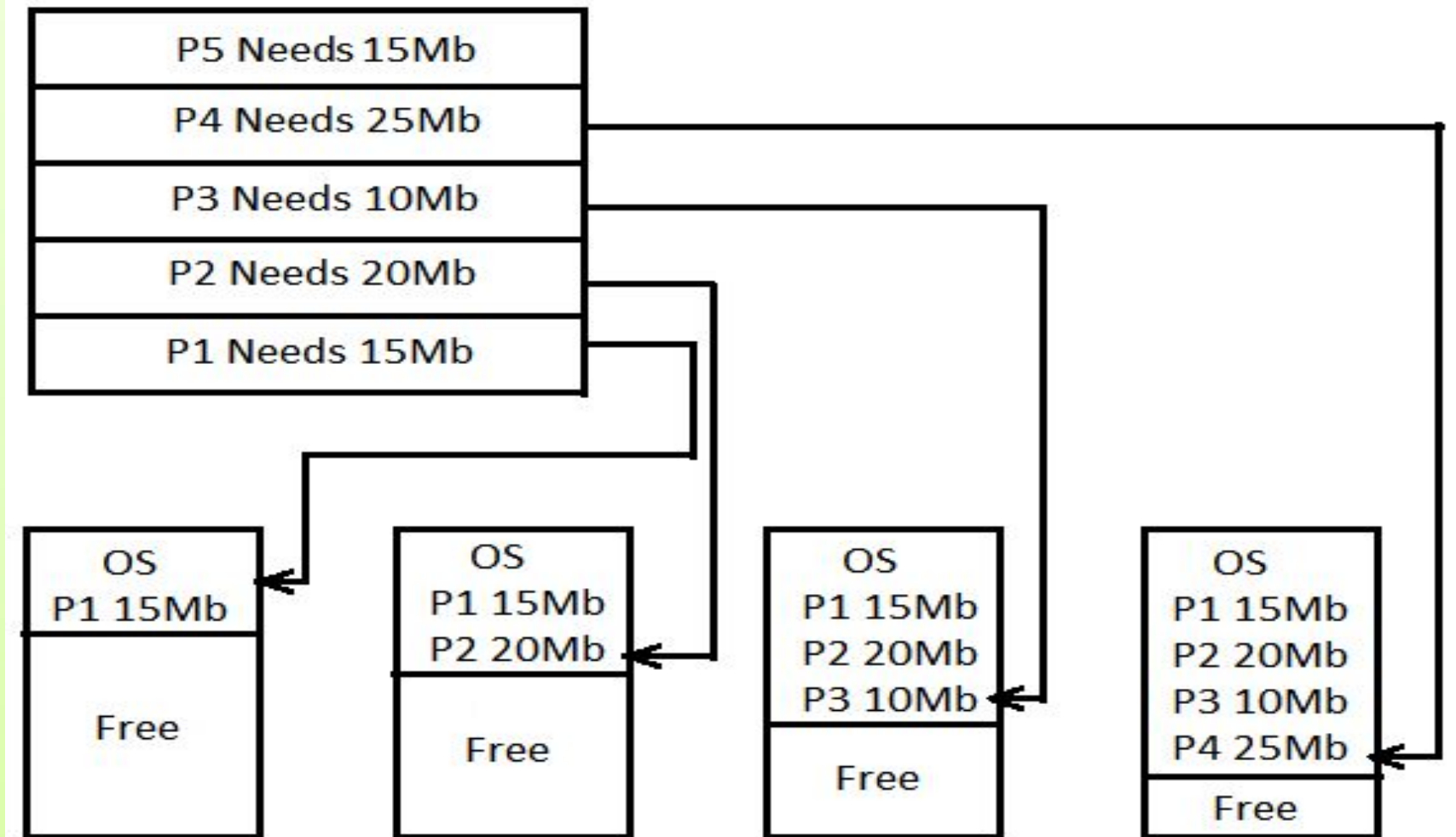


Partition ID	Partition		
	Stating address	Size	Status
0	0	100k	ALLC
1	100k	200k	FREE
2	300k	100k	ALLC
3	400k	300k	ALLC
4	700k	100k	FREE
5	800k	200k	ALLC

Variable Partition

- It is also called as Dynamic partition.
- Size are Variant.
- Partition dose not define at the time of system generation.
- As partition size is Variable so any specific table is generated.
- Partition create at run time by OS.

Variable Partition



Segmentation

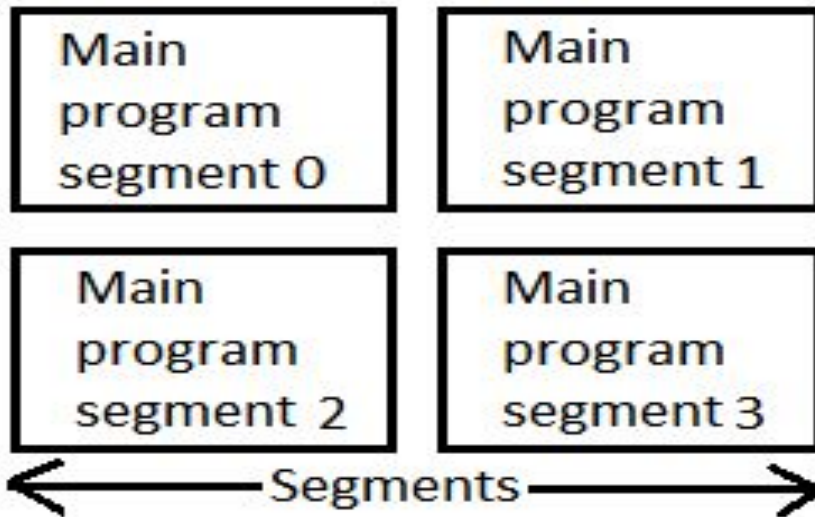
- It is similar to paging.
- Each program in executable form can be considered as consisting of segment
- It can be created originated using code segment, Data segment and Stack segment.

Features of Segmentation

- It is logical division of program and they are normally of variable size.
- It is memory management scheme which support user view of memory.
- Each segment has number and length.
- Each program is in executable form can be considered to consisting of different segment code, data and stack.

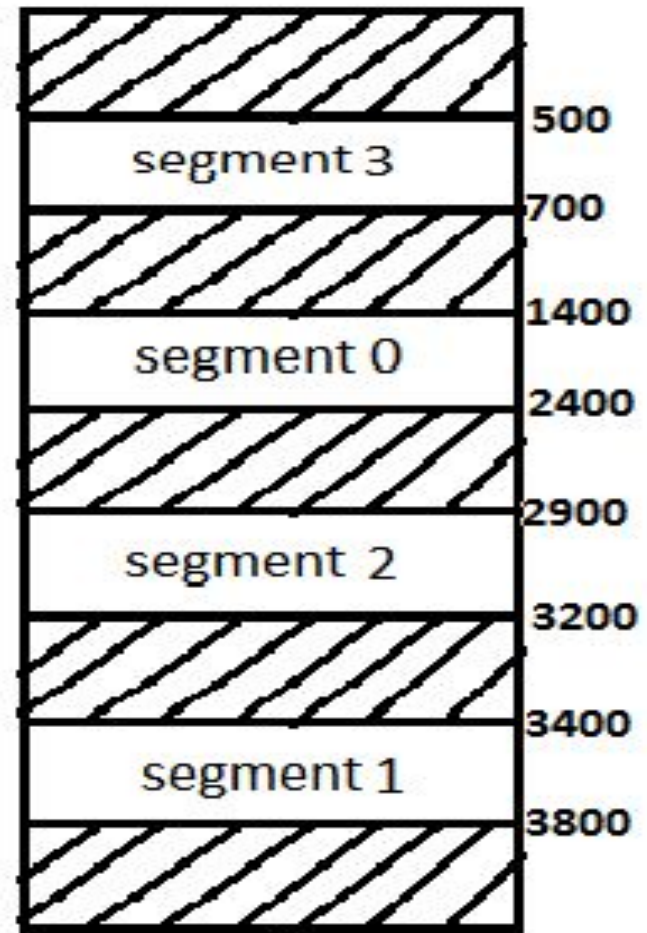
-
- An application programmer does not necessarily have to declared different segment in program.
 - The various segment in program are not defined explicitly then compiler dose it own.
 - Job of complier :
 - a) Recognize different segments in a program
 - b) Number thought segment
 - c) Define segment table

Segmentation Model



Segment #	Limit	Base
0	1000	1400
1	400	3400
2	300	2900
3	200	500

Segment Map Table(SMT)



Physical Memory

Difference

Paging

- It is physical division of program.
- It has fix size .
- it has page size, page frame & page map table.
- It permits a programs memory to be non contiguous.
- It can solve the problem using external fragmentation.

Segmentation

- It is logical division of program.
- It has variable size.
- Each segmentation has number & size.
- It is a memory management scheme which support user view of memory.
- External fragmentation cant be solve by segmentation.

Virtual Memory

- Memory management techniques is that keep many process in memory to allow multiprogramming.
- It is technique which allow the execution of process that may not be completely in the memory some part of it can be on disk.
- It can be implemented by Paging & Segmentation.
- Easy to implement but when physical memory is full then no. process hold at any time.
- Virtual Memory related with following concept,

-
- I. Locality Of Reference.**
 - II. Page Fault.**
 - III. Working**
 - IV. Page Replacement Policy.**
 - V. Dirty Page.**
 - VI. Demand Paging.**

Demand Paging

- pages are loaded in a memory only when it is demanded.
- If a process is created with no of pages is in a main memory . When the process is dispatched, initially the program counter load address of first instruction.
- The drawback of demand paging is that , when any page is not in use , it will remain in main memory.

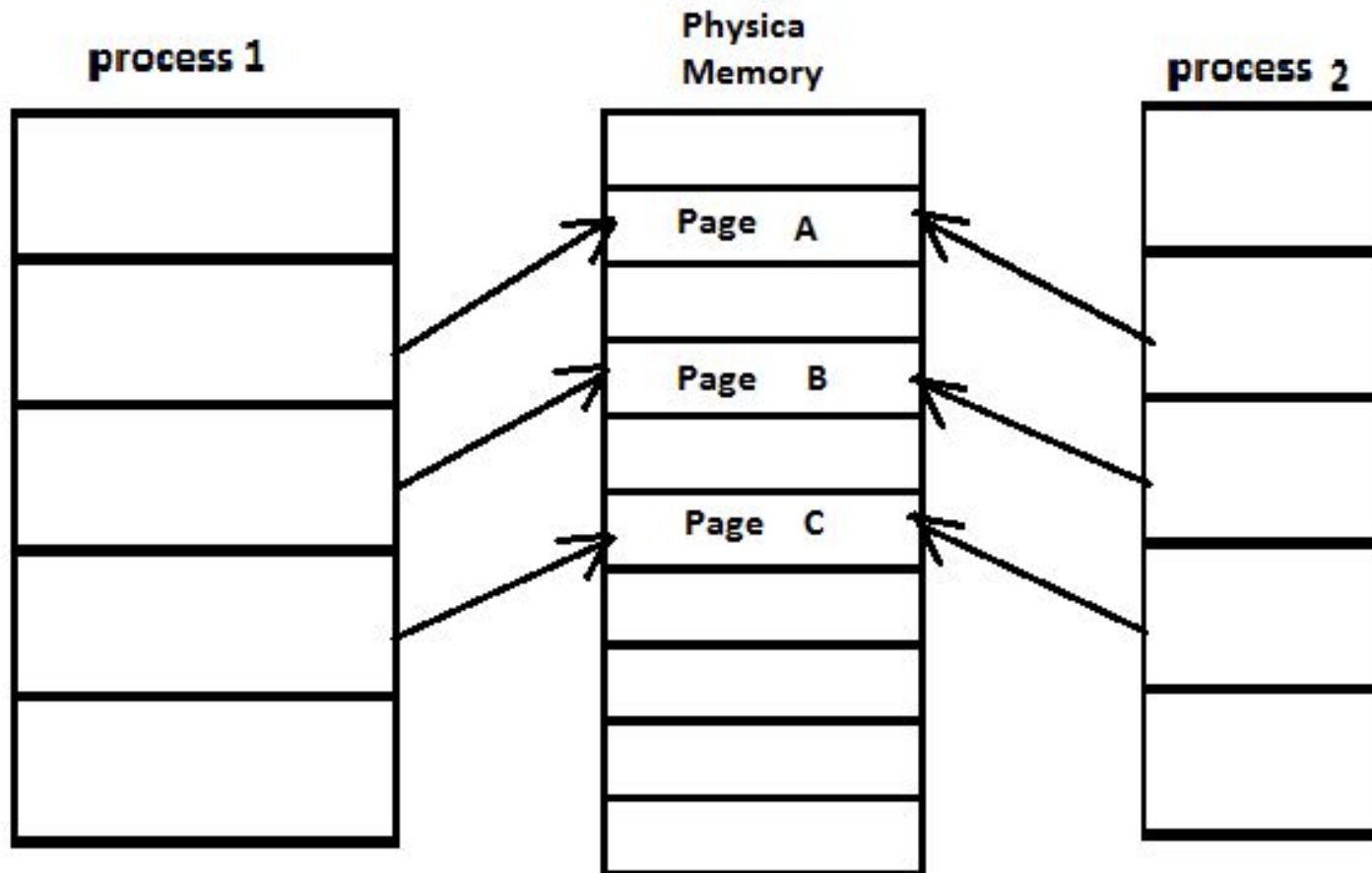
Process Creation

- Process may spawn a new process. If it does , the creating process is called as Parent process.
- The created process is called as Child process.
- Each child process is created by exactly one parent process.
- In process creation we use to function..

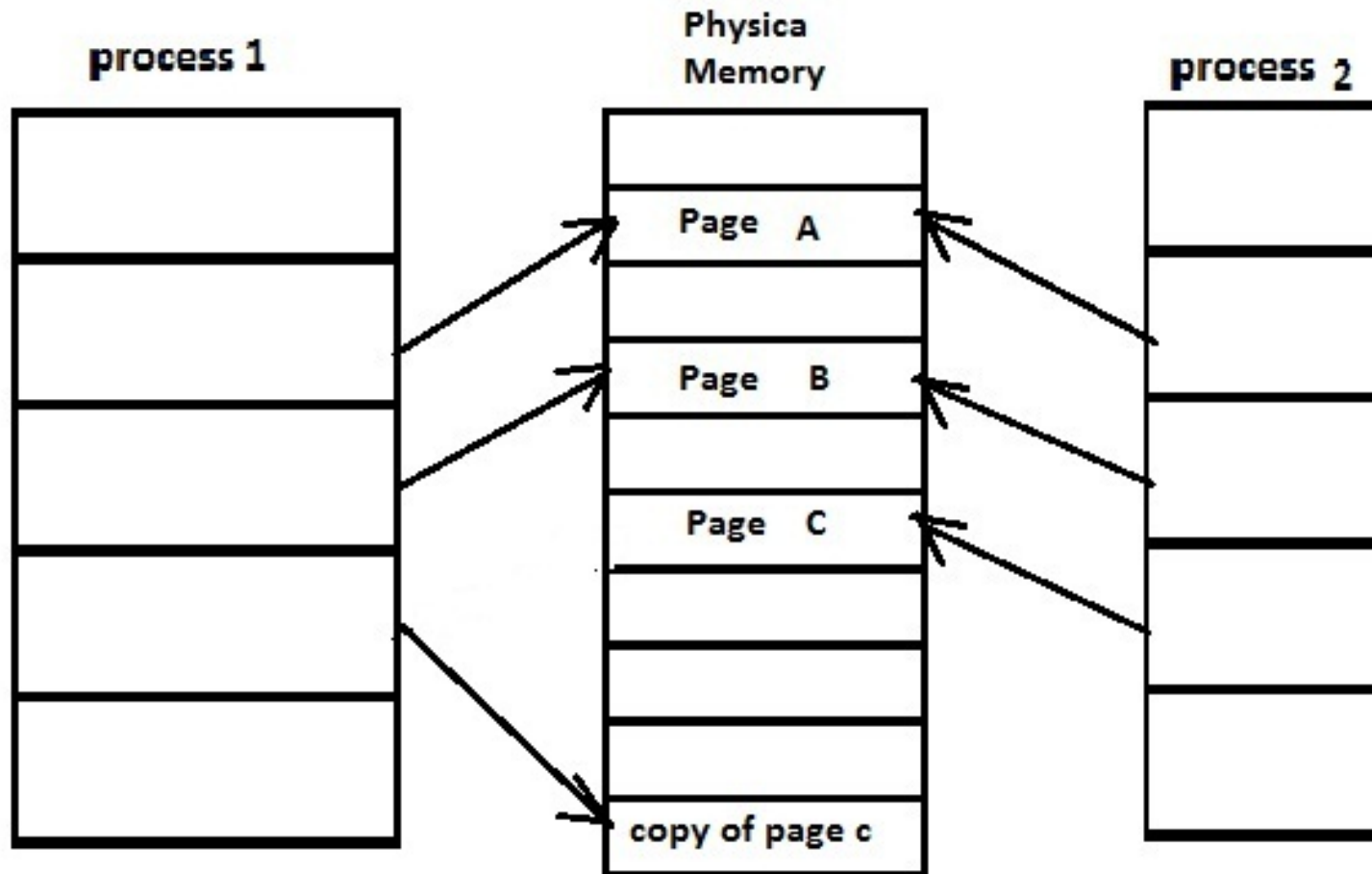
1. Fork()

2. Exec()

Before process Creation



After Process Creation



Page Replacement

- A strategy that determines which page is replace to provide space for an incoming page.
- Page replacement strategies attempt to optimize performance by predicting future page usage.
- Page replacement completes the separation between Logical & Physical memory.

Basic Page Replacement

1. Find the location of the desired page on the disk.
2. Find a free frame.
 - a) If there is free frame , use it.
 - b) If there is no free frame, use a page replacement algorithm to select victim frame.
 - c) Write the victim frame to the disk change the page & frame tables accordingly.
3. Read the desired page into the newly freed frame, change the page & arrange table.
4. Restart the user process.

Frame

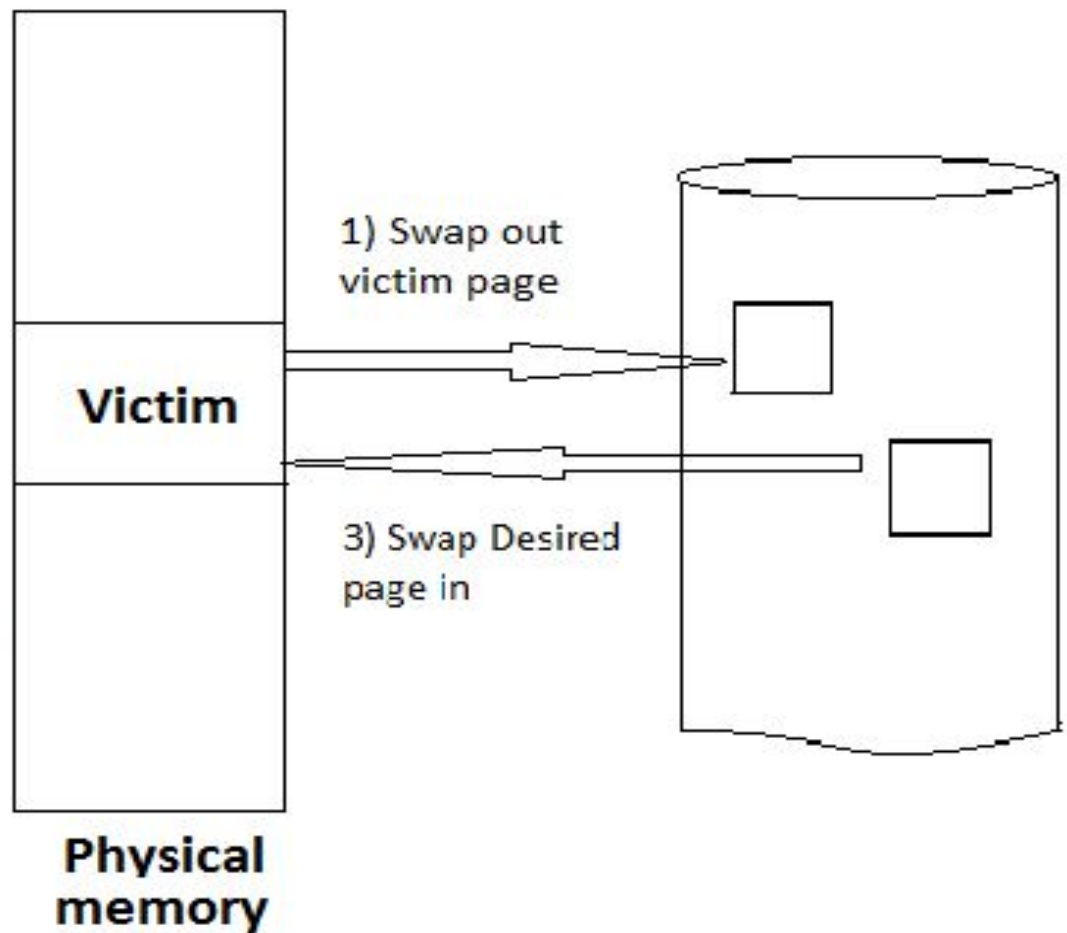


o	i
f	v

Page Table

2) Change to invalid

4) reset page table for new page



Page Removal Algorithm

1) FIFO (First In First Out)

The process which come first will go first.

2) LRU (Least Recently Used)

It replace the page that has spent the longest time in memory without being referenced.

3) MRU (Most Recently Used)

It replace that page when it experiences page fault when referencing non-contiguous page.

Allocation Of Frame

Definition:-

It we have multiple process in memory, we must decide how many frames to allocate to each process is called allocation of frame.

- Each process is allocated with frame.
- When the all frames are engage then the page replacement algorithm is use and new frame inserted a suspend process transferred in secondary memory.
- When the frames are free the OS allocates those frames can be used support user paging.
- Some frame reserve on the free frame list all time thus when a page fault occur that page is swapped by another page.

- Fork():-

Fork() system call spawn a child process and allocates to that process a copy of it's parent's resources.

- Exec():-

Exec() system call loaded a process instructions & data into it's address space from a file.

Instead, we can use a technique known as copy-on-write page, which works by allowing the parent & child process initially to share the same pages. Copy-on-write is a common technique used by several operating system including Windows xp, Linux, solaris.

Thrashing

Definition:-

If a process does not have enough for its working set it is called as Thrashing.

- When the number of frames are allocated to low priority process by this the CPU utilization gets low ,then thrashing arise.

Assignment Questions on UNIT-3

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- | | |
|--|---|
| Q.1. What is Memory Management ? Explain | 4 |
| Q.2. What is Paging ? Explain | 4 |
| Q.3. What is Segmentation ? Explain | 4 |
| Q.4. What is Partitioning? Explain with Fixed Size variable. | 4 |
| Q.5. What is Partitioning? Explain with variable partitioning. | 4 |
| Q.6. What is Page Replacement? Explain. With FIFO | 4 |
| Q.7. What is Thrashing? Explain. | 4 |
| Q.8. What is Virtual Memory ? Explain. | 4 |
| Q.9. What is Demand Paging? Explain. | 4 |
| Q.10. Write difference between Paging and Segmentation. | 5 |