Unit 3

* Memory management.

→ Memory management is one of the major resources in multi-programming operating system.
→ Memory management scheme is basically concerned with allocation and dellocation of physical memory to users and system processes
→ A process cannot be activated until some finite amount of main memory is allocated to it.

• A typical Memory management scheme has following functions:

1. keeping track of all memory locations whether they are allocate or free.
2. Deciding allocation policy.
3. Dellocation policy.
4. Protecting each ~~resource~~ process from each other by isolating disjoint memory space.
5. providing sharing of memory space between two or more processes.

• The memory management broadly divided into two categories
1. Contiguous Memory.
2. Non-Contiguous Memory.

1. Contiguous Memory.
→ In Contiguous Memory allocation, the program is ~~load~~ lodded in Contiguous memory location.
→ When the process complete its execution, its memory is freed out and return to free pool.
→ Memory partitioned may be static or dynamic

2. Non-Contiguous Memory allocation.

→ In this allocation, a single logical process is divided into different chunks and each chunk may be loaded at different locations.

→ If the chunks are of different sizes, then the memory management scheme is called segmentation.

→ If the chunks are of same sizes, then the memory management scheme is called paging.

* Main memory

→ Main memory is basically a collection of registers, each identified by unique address.

→ Main memory communicate with CPU / I O devices through two important registers : MAR and MBR.

→ MAR stands for memory Address ~~Buffer~~ Register, which is used to store ~~data~~ the memory address.

→ MBR stands for memory Buffer Register, that stores content of memory location identified by MAR.

* Secondary Storage

→ Secondary storage is used to store large amount of data.

→ In a secondary storage, where the address generated by CPU is different than that of main storage.

→ Examples : Hard disks, floppy disks, magnetic Disk, Magnetic tape etc.

* Magnetic Disk

→ It stores large amount of data. The Disk is Coated with magnetic material.

→ Each disk platter is divided into tracks ~~and sectors~~ and. Each track is divided into sectors.

→ Each ~~to~~ surface has hundreds of tracks and thousands of sectors.

→ There is one read/write head for each surface.

* Magnetic Tape.

→ Magnetic Tape is flexible tape Coated with Magnetic Oxide material.

→ On magnetic tape, Data is Stored in one-character ~~bit~~ at a time.

→ Each ~~bit~~ character is represented by combination of 7 and 9 bit.

→ It is referred as sequential access drive because data is accessed in strictly sequential fashion.

* optical Disk.

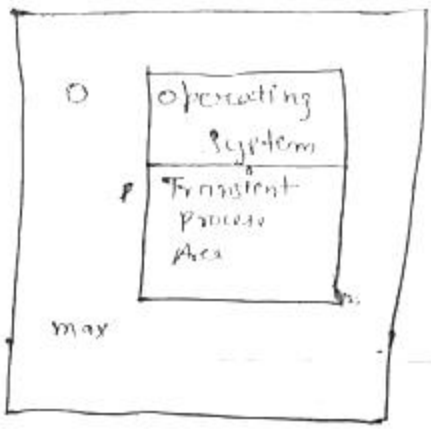
→ the CD is known as Non-erasable disk that Can store more than 60 minutes audio on one side.

→ Types of optical Disks :

- CD
- CD-ROM
- CD-I
- DVI
- ~~WORO~~ WORM
- Erasable optical Disk.

* Single Contiguous memory management Scheme.

→ In Single Contiguous MMS, the main memory is divided into two main Categories as shown in fig. One of them is permanently Occupied by the resident portion of operating System and the remaining main memory is allocated to user processes



→ In Single Contiguous mms, when a process gets loaded, the operating System keeps track of first and last location available for allocation ~~of~~ to the requesting process.

→ The first location is commonly the one immediately resident portion of operating system, say 'p'.

→ The last location is determined by total capacity of main memory in that particular System, say max.

1. <u>Protection</u>

→ The protection in Single Contiguous is much simpler. The user should not be allowed to tamper the operating System code; otherwise the system may crash.

→ The protection can be achieved in two ways -

a) Protection bits.

b) Fence Registers.

2. Sharing

→ It is very simple and easy to implement.

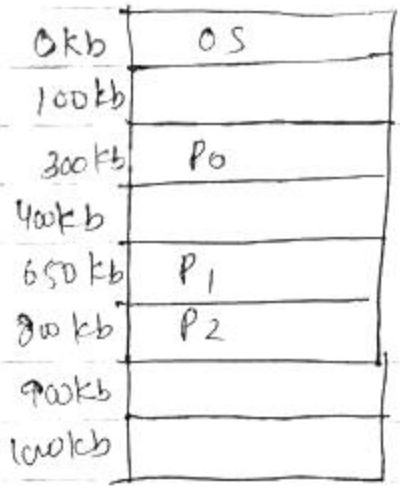
→ The utilization to both processor and memory reduces due to lack of support of multiprogramming.

→ It has fast access time and very little time-complexity.

* Static partitioned Memory Management Scheme.

In static partitioned MMS, the main memory is divided into various sections called partition at the time of system generation. The number and size of partition (individual) are usually determined during the system generation process. But once they are created, they cannot be changed. One partition hold only one process at a time.

Ex→ let there are seven partition, out of which one is occupied by the operating system and three are occupied by process P_0, P_1, P_2. The remaining three process is indicated as free and thus available for allocation.



→ The wasting of memory within a partition due to difference in size of partition and size of resident process within it called Internal fragmentation.

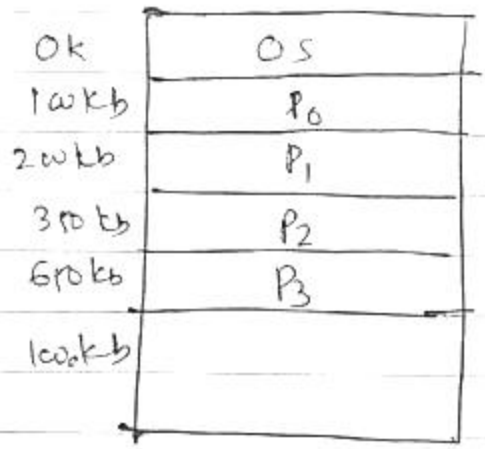
* Dynamic partitioned memory management Scheme.

→ Static partitioned memory management Scheme Suffers two Serious drawbacks - Internal fragmentation and fixed no. of partitions. The Second drawback put restriction on the degree of multi-programming. This problem is overcome by defining the partition dynamically to fit the need of each requesting process.

→ Dynamic partition are not made at the time of System generation.

→ In dynamic partitioning, neither size nor number of partitions are fixed.

Ex →



→ In Dynamic partitioned MMS, the wasting of memory between partition, due to Scattering of free partition is Called External fragmentation.

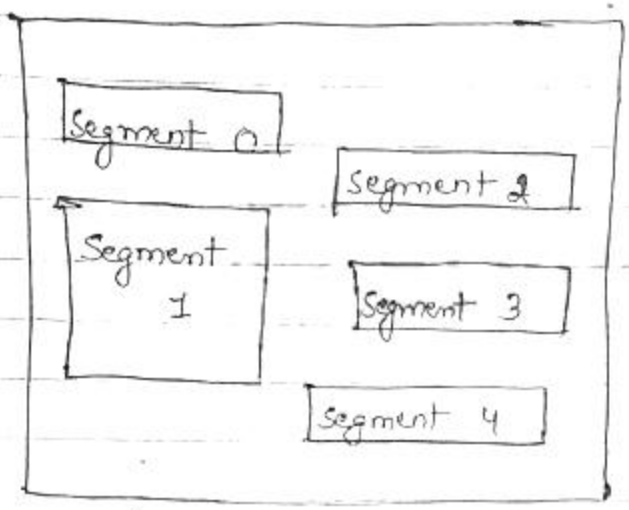
* Non- Contiguous Memory management Scheme.

1. Segmentation.

→ Segmentation is non-Contiguous Memory Management Scheme in which a Single process is divided Into Variable Sizes of logically ~~divi~~ releated Information Called Segmentation.

→ It additionaly provide dynamic relocation, protection and sharing.

Ex



Logical Address space.

	Base address	limit
0	500	600
1	2500	800
2	1500	400
3	4000	200
4	3800	400

Segment Table

* Advantages:

→ No Internal fragmentation.
→ provides dynamic linking and loading of procedures.
→ provides protection and sharing.
→ provides facility for dynamic growth of segments.
→ Consumes less space in comparison to page table mapping.

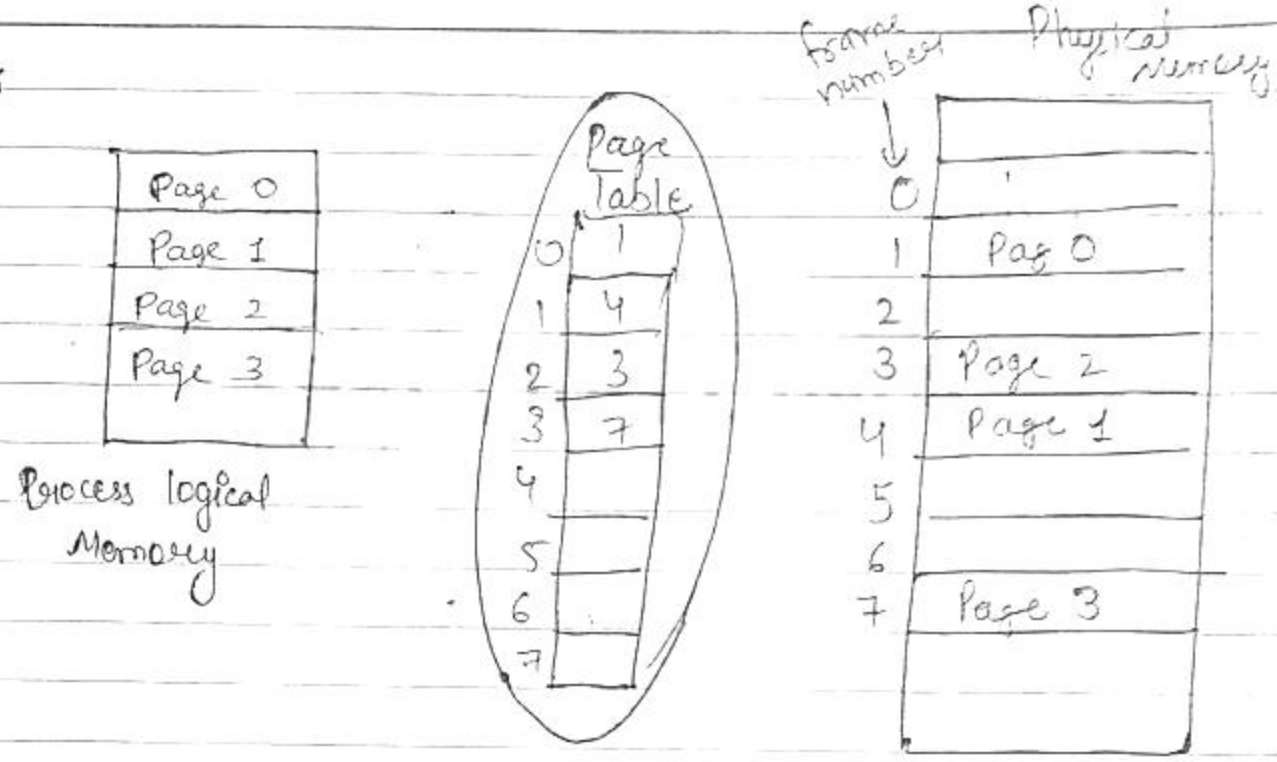
* Disadvantage:

→ External fragmentation Occur.

* Paging

→ paging is a memory management scheme in which the logical or Virtual address is divided into equal sized pages and the physical memory is also divided into equal sized page frames.

Ex



- Advantages.

1. Allocation of Memory is cheap and Easy.
2. Eliminates External fragmentation.
3. Allows demand paging and prepaging.
4. More efficient swapping.

- Disadvantages.

1. Longer memory access time
2. Internal fragmentation
3. Improve using multi-level page tables and Variable page sizes.

* page Allocation policy:

The Allocation policy in Virtual memory system deals with the amount of physical memory to be allocated to each active process. If too more pages allocated to a process then page fault frequency may be reduced but It certainly ~~redu~~ decrease the degree of multiprogramming. If too few pages are allocated to a process then the page fault frequency and turnaround time may be Intolerable.

They are of two types:

1) Equal Allocation.
2) proportional Allocation

* page Replacement policy:

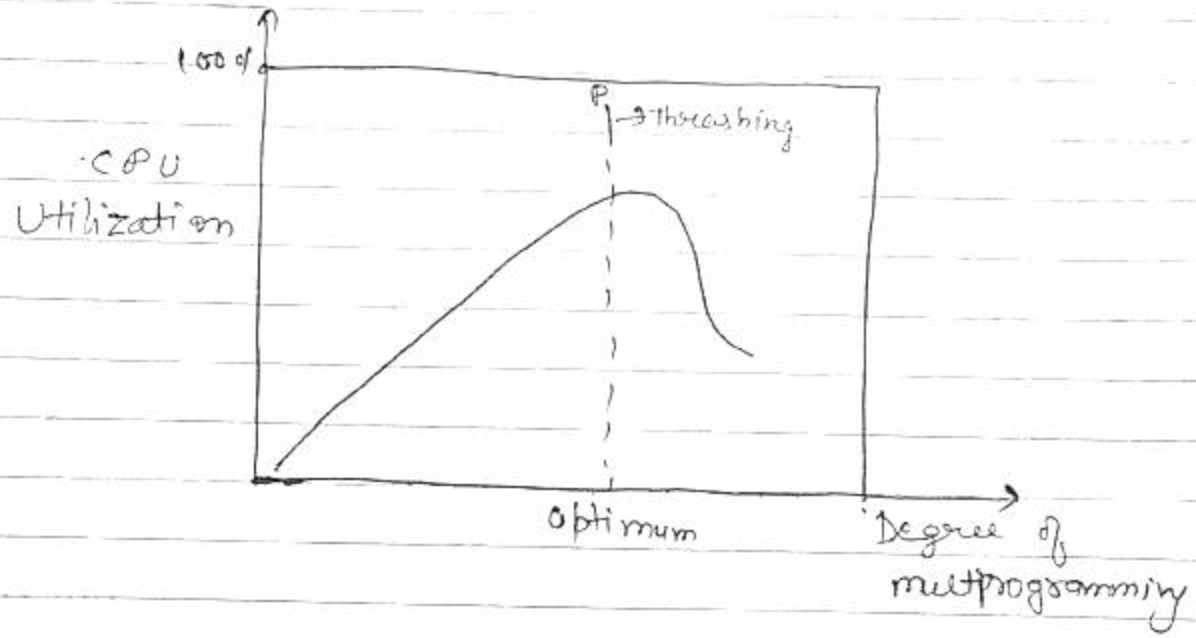
page Replacement algorithm decides which memory pages to page Out, Sometimes Called Swapped Out, or write to disk, when a page of memory needs to be allocated. page replacement happens when a requested page is not in memory (page fault). and a free page cannot used to satisfy the allocation.

Several page replacement policy:

1. FIFO (First-In First Out)
2. Least Recently used.
3. optimal
4. Approximation

* Thrashing.

In Virtual memory management System, thrashing is a condition in which Excessive paging operations are taking place. A System that is thrashing can be perceived as either a very slow system or one that has come to a halt



* Virtual Memory.

In Virtual Memory Management scheme, only a portion of logical address space may actually loaded in the main memory. The Basic Idea of Virtual memory is to Execute partially loaded programs.

* Demand paging.

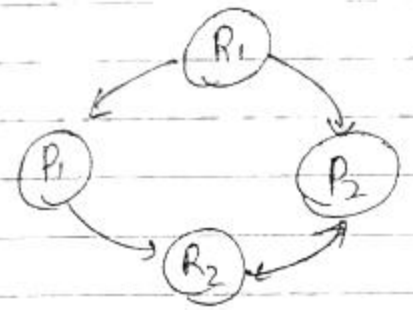
Demand paging is referred when not all of a process's page are in the RAM, then the Operating system brings the missing pages from the disk into RAM.

* Overlays.
Overlays are used to Enable a process to be a larger than the amount of memory allocated to it. The Basic Idea of this is that only Instructions and data that are needed at any given time are kept In memory.

* page fault ~~or~~ frequency.
It is a type of Exception raised by Computer Hardware when a running program access by a memory page that is not currently mapped by the memory management Unit into Initial address space of process.

Unit-V

* Deadlock
→ Deadlock refers to a special Condition in which two or more processes are each waiting for another to release a resource, or more than two ~~re~~ processes are waiting for resources In Circular chain.



There are four necessary Condition for a deadlock to Occur, known as Coffman conditions.

I) Mutual Exclusion
II) Hold and wait
III) No preemption
IV) Circular wait

1. Mutual Exclusion ⇒ A resource cannot be used by more than one process at a time.

2. Hold and Wait ⇒ process already holding resources may request new resources.

3. No preemption ⇒ Only a process holding a resource may release it.

4. Circular wait ⇒ Two or more processes form a circular chain where each process waits for a resource that the next process in chain hold.

- Deadlock can occur in system when all four conditions hold true

* Banker's Algorithm is used for Deadlock avoidance. It is a resource allocation ~~designet~~ developed by Edsger Dijkstra that tests for safety by simulating the allocation of predetermined maximum possible amount of all resources and then makes an 'S-state' check to test for ---".

* Process
process is defined as program in Execution.

* process state transition