Chapter - 3 (20) (1 Num) (1 Theory)

Memory Management

1) Memory Management. (Not asked in exam)

Ans: Memory management is the functionality of an operating system which handles or manages primary memory and moves process back and forth between main memory and ~~disk~~ secondary memory during execution.

→ It keeps track of each and every memory location.

→ It decides which process ~~gets~~ will get memory at what time.

→ It tracks whenever some memory gets freed.

2) Define Swapping.

→ A process needs to be in a main memory for execution. But sometimes there is not enough main memory to hold all the currently active processes. So excess process are kept on disk.

→ Swapping is a mechanism in which a process can be swapped temporarily out of ~~primary~~ main memory to secondary memory (disk) and make that memory available to other processes.

→ At some later time, the system swaps back the process from the secondary storage to main memory.

→ Swapping is also known as technique for memory ~~compaction~~.

3) Differentiate logical address with physical address.

Logical address	Physical address
1) It is virtual address generated by CPU	1) The physical address is a location in a memory unit.
2) The user can view the logical address of a program.	2) The user can never view the physical address of a program.
3) The user uses the logical address to access the physical address.	3) The user cannot directly access physical address.
4) The logical address is generated by the CPU.	4) Physical address is computed by MMU.

4) Memory allocation (Numerical)

→ it is a process by which computer programs are assigned memory or space. It is of three types:-

1) First fit → the first hole that is big enough is allocated to program.
2) Best fit → The smallest hole that is big enough is allocated to the program.
3) Worst fit → The largest hole that is big enough is allocated to program.
4) Next fit → same as first fit but only looks for next hole.

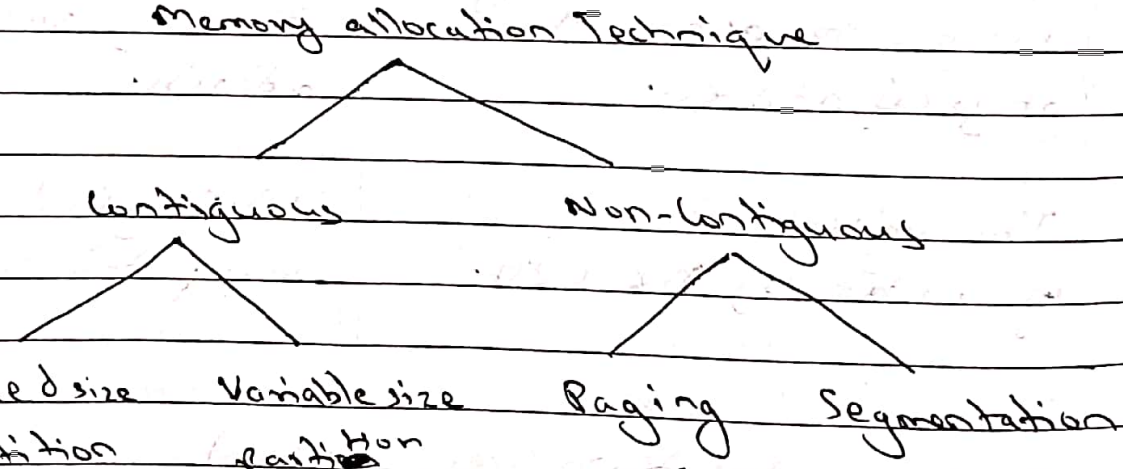
14) Describe different memory allocation techniques in memory management.

or

Explain contiguous and non-contiguous memory allocation scheme with their advantages and disadvantages.

→ The different memory allocation techniques in memory management are:-

1) Contiguous memory allocation
2) Non-Contiguous memory allocation



1) Contiguous

→ Contiguous memory allocation allocates consecutive blocks of memory to a file/process.

→ It includes different types of partition.

i) fixed size partion
ii) Variable size partition

Advantages

- It executes quickly in comparision to non-contiguous memory allocation
- It is easy to be controlled by the operating system.

Disadvantages

- There is internal fragmentation
- Memory gets wasted

- Non-contiguous memory Allocation
- In this type of allocation, separate blocks of memory are allocated to a file/process
- It includes paging and segmentation.

Advantages

- No memory is wasted.

Disadvantages

- It executes slowly in comparision to contiguous memory allocation.
- It is difficult to be controlled by the operating system.
- External fragmentation occurs in this type of allocation.

5) Explain about fixed partition and variable partition

Ans: fixed partition

⇒ In this fixed sized partition, the system divides memory into fixed size partition.

⇒ i.e no of partitions are fixed in memory

⇒ size of each partition may be same or different.

⇒ If there is some wastage inside fixed partition scheme then it is called internal fragmentation.

Example: let us make 8 partition in a memory

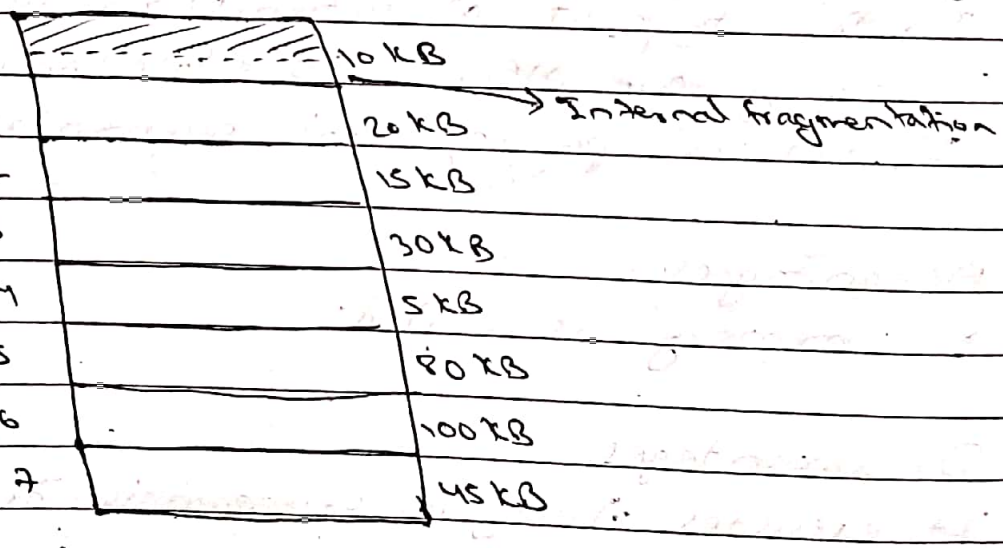


fig: Main memory

⇒ let us suppose a process with 5KB is loaded in main memory. Here still 5KB space is available but we cannot load any other process here.

⇒ ~~This wastage of memory~~ It is called internal fragmentation of memory. It will result in memory wastage.

Variable Partition (dynamic partition)

→ It is a part of contiguous memory allocation and it overcomes the limitation/problem of fixed partition.

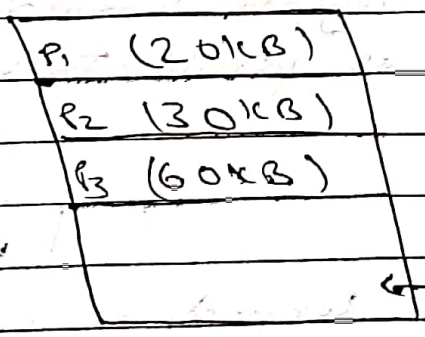
→ In this, the main memory is not divided into partition.

→ Here, the process is allocated exactly the amount of memory needed. (i.e process is allocated a chunk of free memory that is big enough to fit it)

→ The space which is left is considered as the free space which can be further used by other process.

→ External fragmentation may occur

Example: let P_1=20KB, P_2=30KB, P_3=60KB P_4=100KB



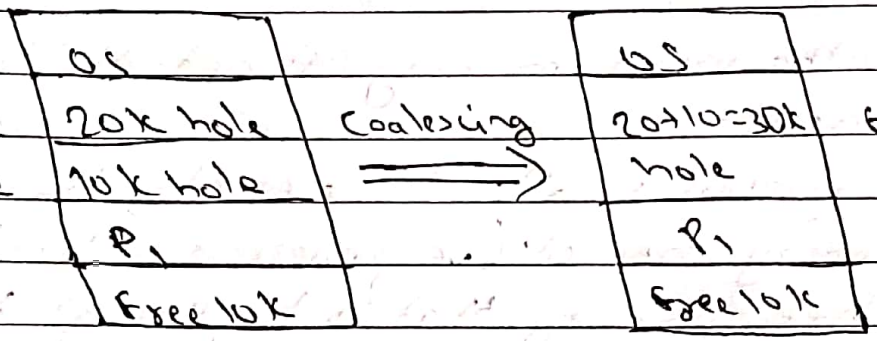
let size of main memory is 190KB

→ Here, P_1, P_2 & P_3 are allocated but P_4 is not allocated because there is not big enough space for it.

→ The remaining memory of 80KB is external fragmentation.

16) Explain Coalesing and Compaction

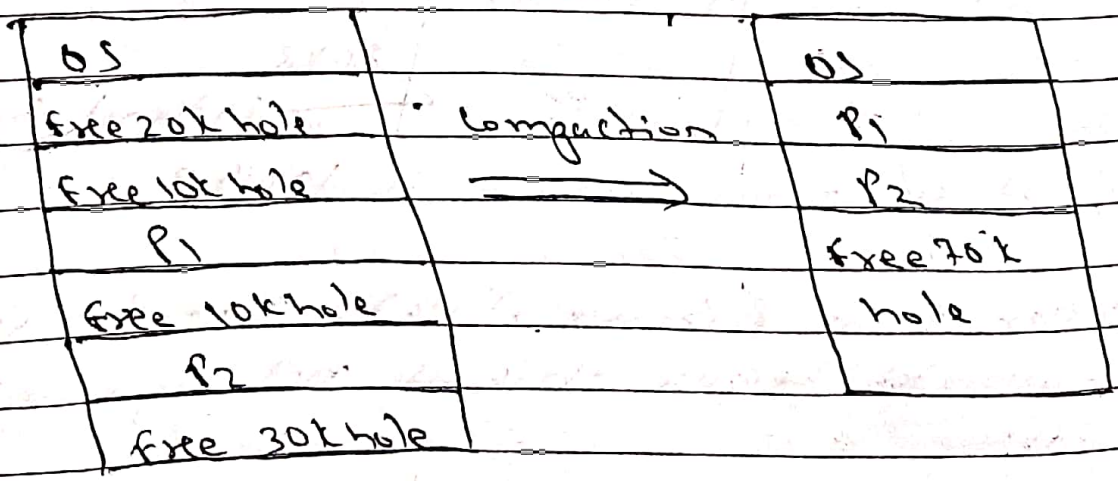
Ans: The process of merging two adjacent holes to form a single larger hole is called coalesing.



Compaction

→ Even when hole coalesle, no individual hole may be large enough to hold the job, even if free space is available which is not adjacent.

→ It is possible to combine all holes even if they are not adjacent. They are combined and moved downward as far as possible. This technique is called compaction.



1.) What are internal and external fragmentation.

Ans: As process is loaded and removed from memory, the free memory space is broken into little pieces. It happens after sometimes that processes cannot be allocated to memory blocks considering their small size and memory blocks remain unused.

→ This problem is known as fragmentation.

→ There are two types of fragmentation.

1) Internal fragmentation.
2) External fragmentation

Internal fragmentation	External fragmentation
1) It occurs when memory is divided into fixed-sized partitions	1. It occurs when memory is divided into variable size partitions based on the size of processes.
2) The difference between allocated and required memory by a process is called internal fragmentation.	2) Unused memory spaces between the non-contiguous memory fragments that are too small to serve a new process are called external fragmentation.
3) It occurs with fixed partition and paging.	3) It occurs with variable partition and segmentation.
4) It's solution is the best-fit partition method	4) It's solution is compaction & paging.
5) It occurs in worst fit memory allocation method.	5) It occurs in best fit and first fit memory allocation method.

// 8) Differentiate between paging and segmentation

Ans:

// Paging

→ Paging is basically a memory management technique in the operating system.

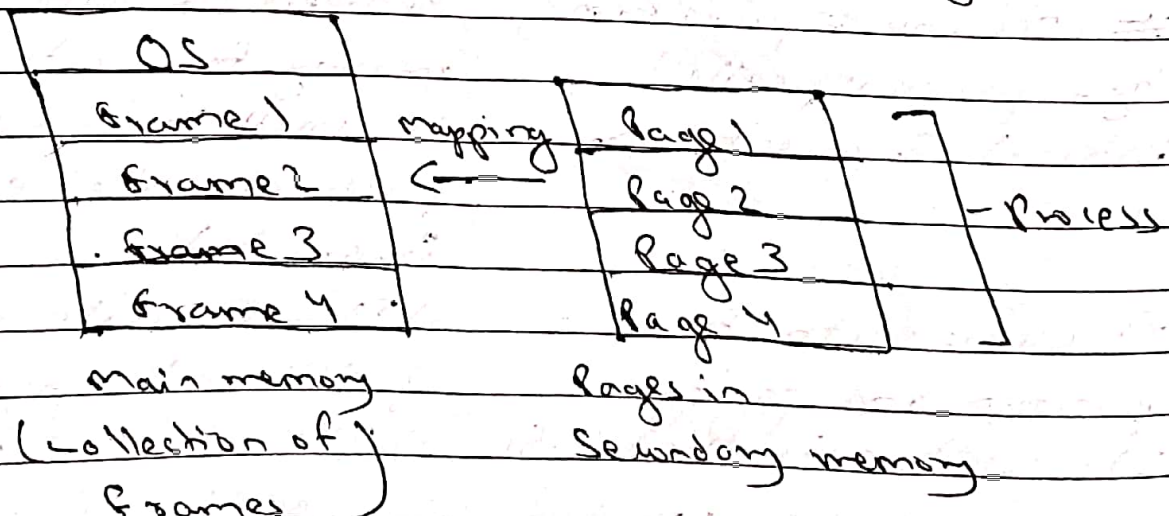
→ It is used for non-contagious memory allocation.

→ It is a fixed size partitioning method where OS retrieves process from the secondary storage to main memory in the form of pages.

→ The partition of secondary memory area unit is known as pages and partitions of main memory unit areas is known as frames.

→ In paging, both main memory and secondary memory is divided into equal fixed size partitions.

→ i.e The size of frame is kept the same as that of a page to have optimum utilization of main memory and to avoid external fragmentation.



Segmentation

→ Segmentation is another non-contiguous memory allocation scheme in which each job is divided into several segments of different sizes.

→ Segmentation method works almost similarly to paging, the only difference between the two is that segments are of variable length whereas, in the paging method, pages are always of fixed size.

→ A program segment includes the program's main function, data structures, utility functions etc.

→ Information related to each segment is stored in a ~~segment~~ table known as segment table.

→ Segment table generally occupies less ~~space~~ space as compared to the paging table.

Note:
In exam directly write differences.

	Paging	Segmentation
1)	In this, memory is partitioned into fixed-sized blocks known as pages.	1) In this, memory is partitioned into variable-sized blocks known as segments.
2)	For paging operating system is accountable.	2) For segmentation compiler is accountable.
3)	This technique may lead to internal fragmentation.	3) This technique may lead to external fragmentation.
4)	In paging, hardware decides the page size.	4) The segment size is specified by the user.
5)	It is faster in terms of memory access....	5) It is slower than paging.
6)	Page table stores page data.	6) Segmentation table stores segmentation data.
7)	Paging is invisible to the user	7) Segmentation is visible to the user.
8)	In paging, a programmer cannot efficiently handle data structure.	8) It can efficiently handle data structure.
9)	It is ~~easy~~ hard to apply protection	9) It is easy to apply protection.
10)	Paging doesn't facilitate any sharing of procedures.	10) Segmentation allows for the sharing of procedures.

9) Describe how paging leads to internal fragmentation.

Ans: The page is of fixed size but it may happen that the process doesnot acquire the entire block size which will generate the internal fragmentation in memory.

(i.e page has fixed size, but process may request more or less space.)

→ Say a page is 32 units and a process requests 20 units. Here, 12 units is not used and is considered internal fragmentation.

10) Demand Paging

Ans: Demand paging is a method where ~~the~~ pages should only be brought into memory if the executing process demands them.

→ This is often referred to as lazy evaluation as only those pages demanded by the process are swapped from secondary storage to main memory.

→ Those pages that are never accessed are thus never loaded into the physical memory.

11) Thrashing

→ Thrashing is caused by under allocation of the minimum number of pages required by a process, forcing it to continuously page fault.

→ In this condition, excessive paging operations are taking place.

→ System is spending a major portion of its time in servicing the page faults, but the actual processing done is very negligible.

→ A system that is thrashing can be perceived as either a very slow system or one that has come to a halt.

→ It degrades the performance of a system.

12) What is Page fault?

Ans: If the demanded page is not present in main memory then page fault occurs.

→ Whenever page fault occurs, then the required page has to be fetched from the secondary memory into the main memory.

13) Is page fault good for OS?

⇒ It is not good for OS because it takes time for OS to fetch the page from secondary memory to main memory.

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13) Explain different types of page replacement algorithm.

1) FIFO (First in first out)
2) LRU (Least Recently Used)
3) Optimal Page Replacement
4) Second Chance Page Replacement Algorithm
5) MRU (Most Recently Used)
6) MFU (Most Frequently Used)

14) Explain TLB.

or

How TLB improves the performance of Paging during memory mapping

Ans: The major disadvantage of paging is
1) Size of page table can be very big and therefore it wastes main memory.
2) CPU will take more time to read a single word from the main memory.

→ Translation lookaside Buffer (TLB) is a solution that tries to reduce the effective access time.
→ TLB can be defined as a memory cache which can be used to reduce the time taken to access the page table again and again.
→ It is a memory cache which is closer to the CPU and the time taken by the CPU to access TLB is lesser than that taken to access main memory.

→ TLB consists of two columns
1) Page Number
2) Frame Number

Page Number	Frame Number

Fig: Translation Lookaside Buffer