CS & IT ENGINEERING

Operating System

Memory Management

Lecture - 01

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Recap of Previous Lecture

Topic Banker's Resource Request Algorithm

Topic Deadlock Detection

Topic Recovery from Deadlock

Topics to be Covered

Topic Memory Management

Topic Memory Management Technique

Topic Contiguous Memory Management Technique

1. Module of OS

1. Memory allocation ⇒ Allocate mem. to a new arriving process

2. Memory deallocation ⇒ Deallocate mem. from completed process

3. Memory protection ⇒ A process while running can access only that memory which is allocated to it.

1. Maximum Utilization of space $\longrightarrow$ minimum _wastage of space_
   $\longrightarrow$ fragmentation

2. Ability to run larger programs with limited space
   $\longrightarrow$ using virtual memory

→ for mem. allocation to a process.

| Contiguous | Non-contiguous |

Contiguous →

Entire process must be stored on consecutive mem. locations

Type

Fixed partition contiguous mmt

Variable partition Contiguous mmt

Non-contiguous →

A process is divided into multiple parts and each part can be stored anywhere in memory.

Types

☆ Paging

Segmentation

- Entire process should be stored on consecutive memory locations

The memory is divided into fixed no. of partitions; and each partition can be used to accommodate exactly one process.

example:- memory

```
          OS

150 MB  |      |
120 MB  |_____|
250 MB  |_____|
100 MB  |_____|
75 MB   |_____|
```

Degree of multiprogramming is limited due to no. of partitions.

Assume a new process P1 with size 130 MB arrives and it is allocated in memory in partition of size 150 MB.
⇓
20 MB space wastage inside partition ⇒ Internal fragmentation

Internal Fragmentation :-

when space allocated to a process is more than it's required space, then the extra allocated space is wasted and that wastage of space is known as Internal fragmentation

1. **First fit** :- The first partition from starting which can store the process, is allocated.

2. **Best fit** :- The smallest partition which can be used to store the process, is allocated.

Best for fixed partition mmt

3. **Worst Fit** :- The biggest partition is allocated.

4. **Next Fit** :- The first partition from previously allocated partition

example:-

2 processes

Size

$P1 \Rightarrow 110\,MB$

$P2 \Rightarrow 75\,MB$

mm

80 MB

120 MB

110 MB

200 MB

75 MB

	Partition allocated		Total internal fragmentat^n
	P1	P2	
First fit	120 MB	80 MB	10+5 = 15 MB
Best fit	110 MB	75 MB	0
worst fit	200 MB	120 MB	90+45 = 135 MB
Next fit	120 MB	110 MB	10+35 = 45 MB

Main memory does not have fixed partitions.
whenever a new process arrives then a new partition, equal to the size of process is created and is allocated to the process.

Process will always get exact size memory as much as needed. Hence there is no any internal fragmentation.
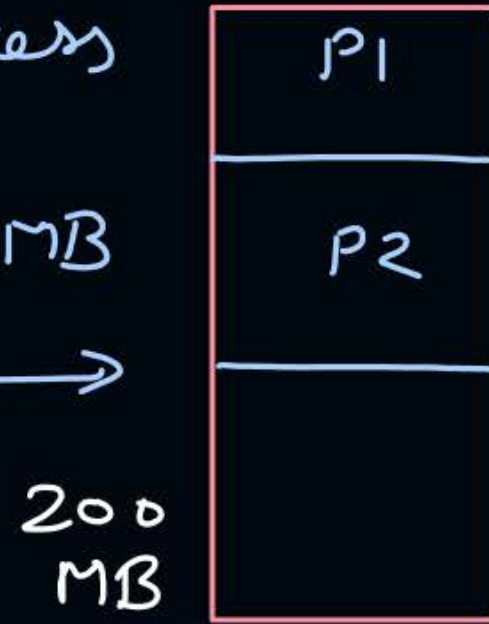
ex:-

mem

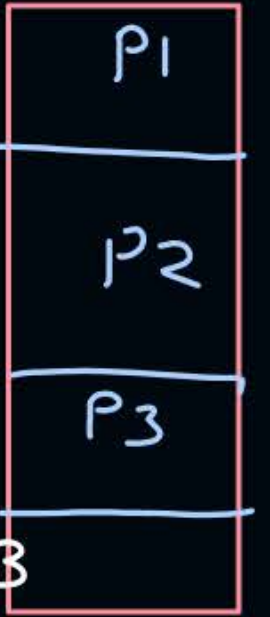New process P1, size = 250MB

New process P2, size = 150MB

New process P3 size = 100MB

600 MB

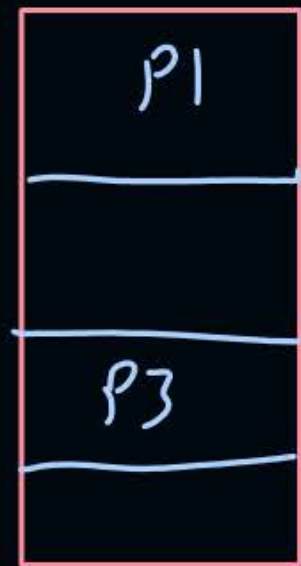350 MB

P1

200 MB

P1

P2

100MB

P1

P2

P3

↓

P2 terminates

wastage of space here is called as

External fragmentation

{ P4 cannot be allocated because 200MB space is not available in memory consecutively.

New process P4 size = 200MB
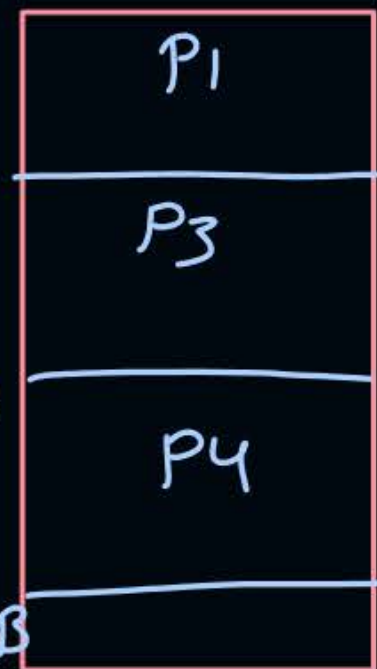
P1

P3

Holes

150 MB

100MB

After Compaction ⇒

| P1 |
| P3 |
| |

250 MB

P4 can be allocated now →

| P1 |
| P3 |
| P4 |
| |

50 MB

External fragmentation :-

If enough space available to store a process but not consecutively hence the process cannot be stored. wastage of space here is known as external fragmentation.

⇓

Solution ⇒ Compaction ⇒ Collect all allocated processes into one side of memory, so that all empty spaces will be in other side of memory collectively.

⇓

Very - very time

Consuming

H.W.

#Q.   Consider the requests from processes in given order 300K, 25K, 125K, and 50K. Let there be two blocks of memory available of size 150K followed by a block size 350K. Which of the following partition allocation schemes can satisfy the above requests? *(Variable partition MMT)*

A   Best fit but not first fit

B   First fit but not best fit

C   Both First fit & Best fit

D   neither first fit nor best fit

#Q. Consider a fixed partition MMT where there are 5 partitions of size 100MB, 250MB, 200MB, 500MB and 300MB. All Partitions are initially empty. The following process requests are made in the given order:

Process	Size	First fit	Best fit	worst fit
P1	150MB	250 MB	200 MB	500MB
P2	400MB	500 MB	500 MB	— ✓
P3	270MB	300 MB	300 MB	300 MB
P4	180MB	200 MB	250 MB	250 MB
P5	80MB	100 MB	100 MB	200 MB

Provide the following answers for First fit, Best fit and Worst Fit policies?
Maximum degree of multiprogramming? 5, 5, 4
What is the total internal fragmentation size? 270MB, 270MB, 570 MB

H.W.

Holes

#Q. Consider variable partition MMT where there are 4 ~~partitions~~ of size 250MB, 200MB, 500MB and 400MB. The following process requests are made in the given order:

Process	Size
P1	150MB
P2	400MB
P3	270MB
P4	180MB
P5	80MB
P6	50MB

Provide how the processes are stored for First fit, Best fit and Worst Fit policies?

Topic   **Memory Management**

Topic   **Memory Management Technique**

Topic   **Contiguous Memory Management Technique**