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Memory Management: Contiguous

Comprehensive Course on Operating System for GATE - 2024/25

Vishvadeep Gothi • Lesson 24 • May 16, 2023

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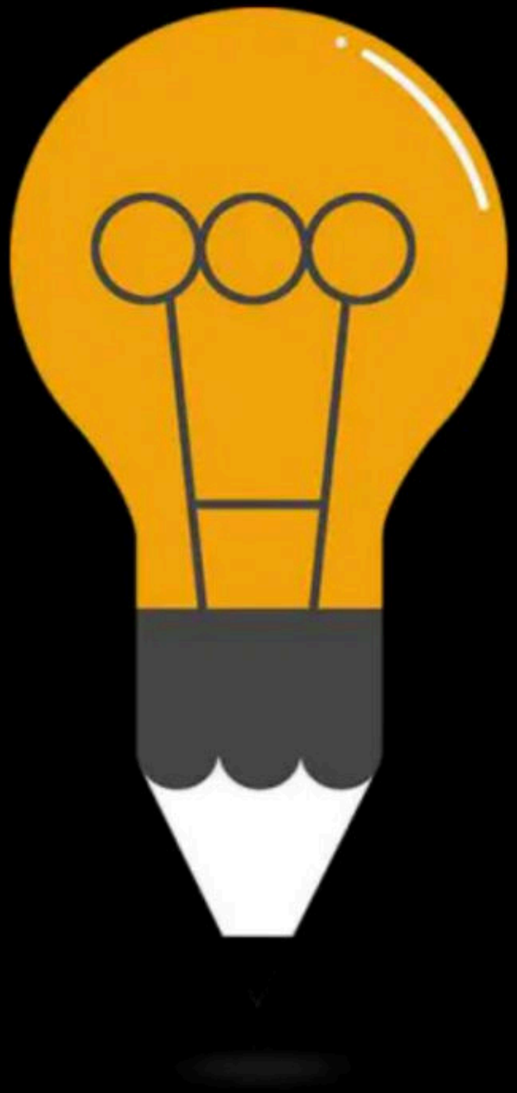


Operating System
Memory Management

By: Vishvadeep Gothi

Types of Locks

while (true);

1. Spinlock → busy waiting
2. Livelock
3. Deadlock → 2 or more processes blocked because of each other
4. Semaphores
5. Reentrant Locks

Livelock :- 2 or more processes in busy waiting for each other forever.

ex:-

binary semaphores

$S_x = 1$ 0

$S_y = 1$ 0

Processes

P_1	P_2
$P(S_x)$	$P(S_y)$
$P(S_y)$	$P(S_x)$
⋮	⋮

Processes Run

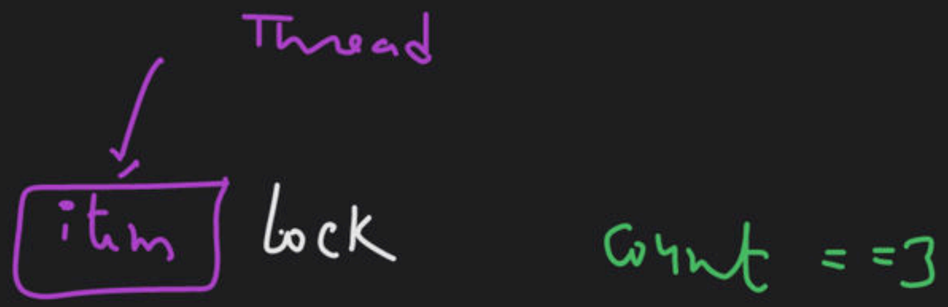
P_1	P_2
$P(S_x)$	
	$P(S_y)$

while ($S_y \leq 0$);

while ($S_x \leq 0$);

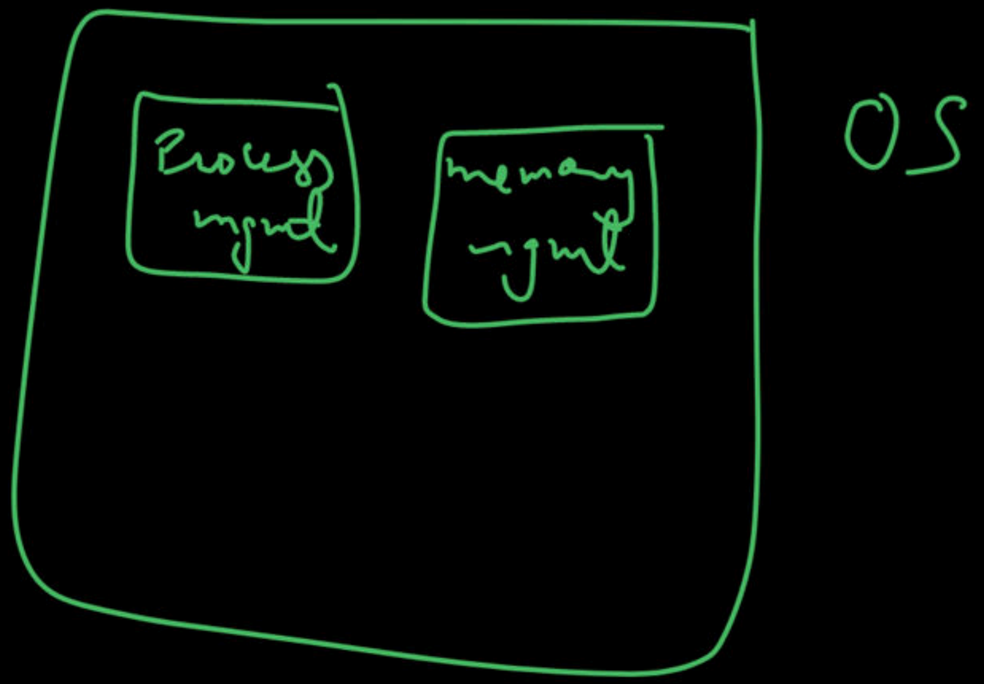
Reentrant lock :-

A thread can enter (acquire) same lock again.



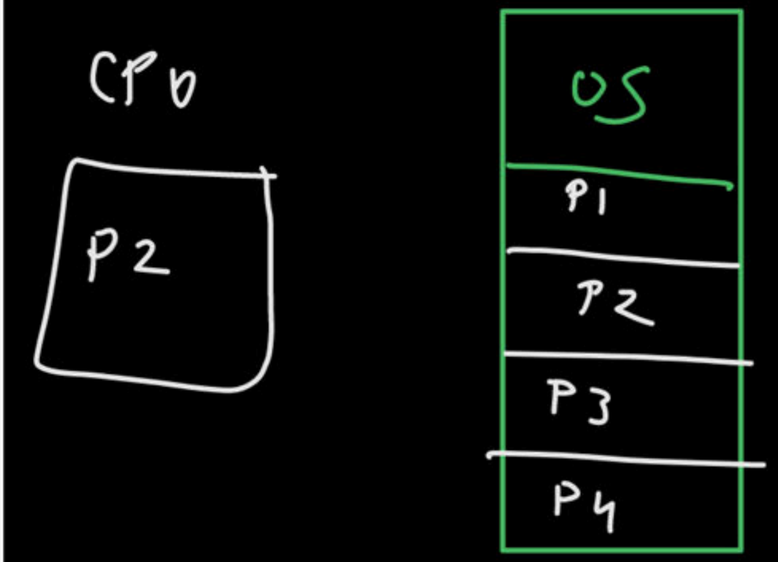
Memory Management

- Module of OS



Functions of Memory Management

1. Memory allocation :- Allocating space in mm to a newly admitted process.
2. Memory deallocation :- Deallocating space from mm for a terminated process
3. Memory protection A process can access only that part of memory which has been allocated to it by OS.



4. Free space management

Goals of Memory Management

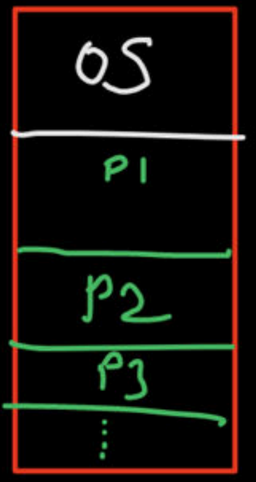
1. Maximum Utilization of space (min. space wastage)
2. Ability to run larger programs with limited space
   ↳ virtual memory

Space wastage ⇒ fragmentation
- ↳ Internal
- ↳ External

Memory Management Techniques

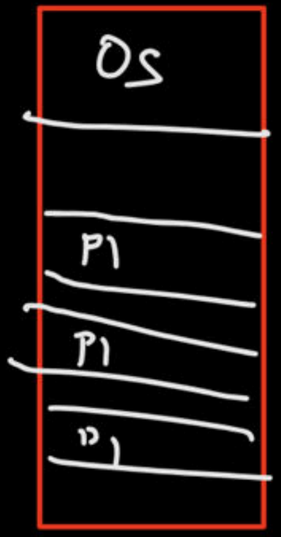
Contiguous

Entire process is stored in memory on consecutive memory locations.



Non-contiguous

Entire process is divided into partitions and each partition can be stored on memory anywhere.



Contiguous Memory Management

Entire process should be stored on consecutive memory locations

Fixed partition

Contiguous mem. mgmt Technique

⇒ Internal fragmentation

variable partition

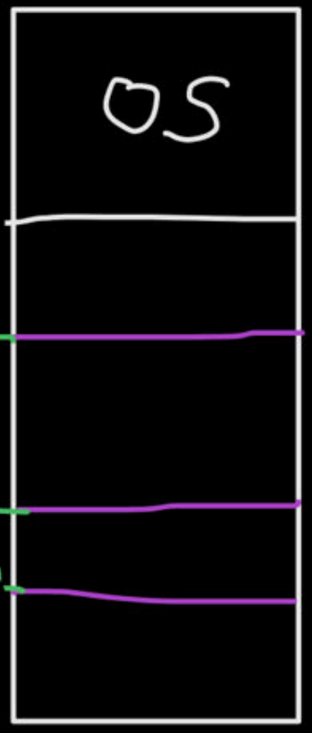
Contiguous m.m. technique

⇒ External fragmentation

Fixed Partition Contiguous MMT

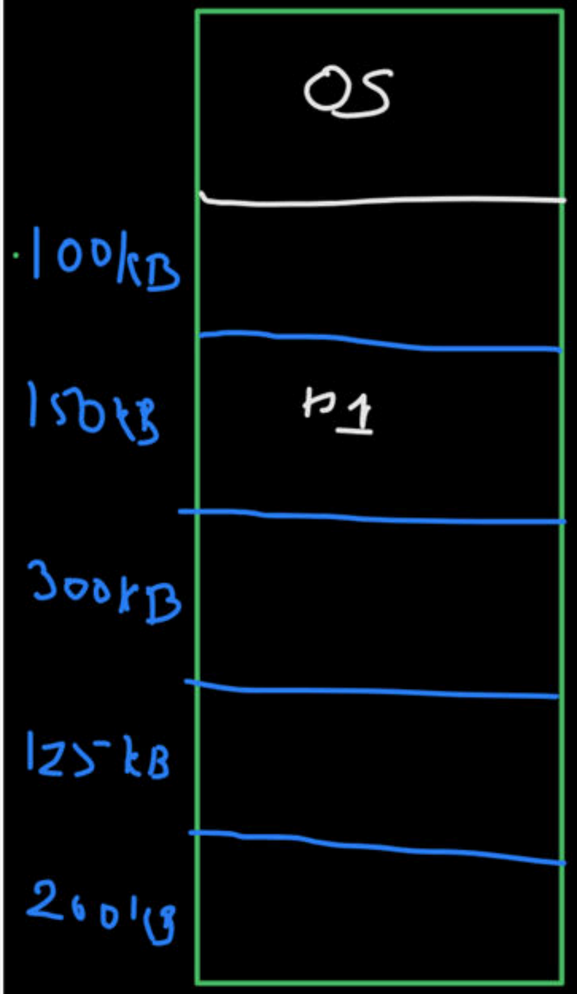
OS divides m.m. into fixed no. of partitions. Each partition can be used to accommodate only one process.

→ Each partition size can be different - diff



Whenever a new process arrives mem. mgmt. provides it a free partition

Partition Allocation Policy



	Process P1 size = 120 kB	P2 size = 80 kB
First fit	150 kB	100 kB
Best fit	125 kB	
worst fit	300 kB	
Next fit	150 kB	300 kB

Partition Allocation Policy

First fit :- Find a partitn which can accomodate the new process starting from first partitn.

Best fit :- Find smallest possible partitn which can accommodate the new process.

worst fit :- Find largest partitn

Next fit :- Find next partitn from current allocated partitn in sequence.

⇒ Fixed partition contiguous mem. mgmt technique suffers from Internal fragmentation.

↓

The space allocated to a process is more than the required space. hence the extra unused space is known as internal fragmentation.

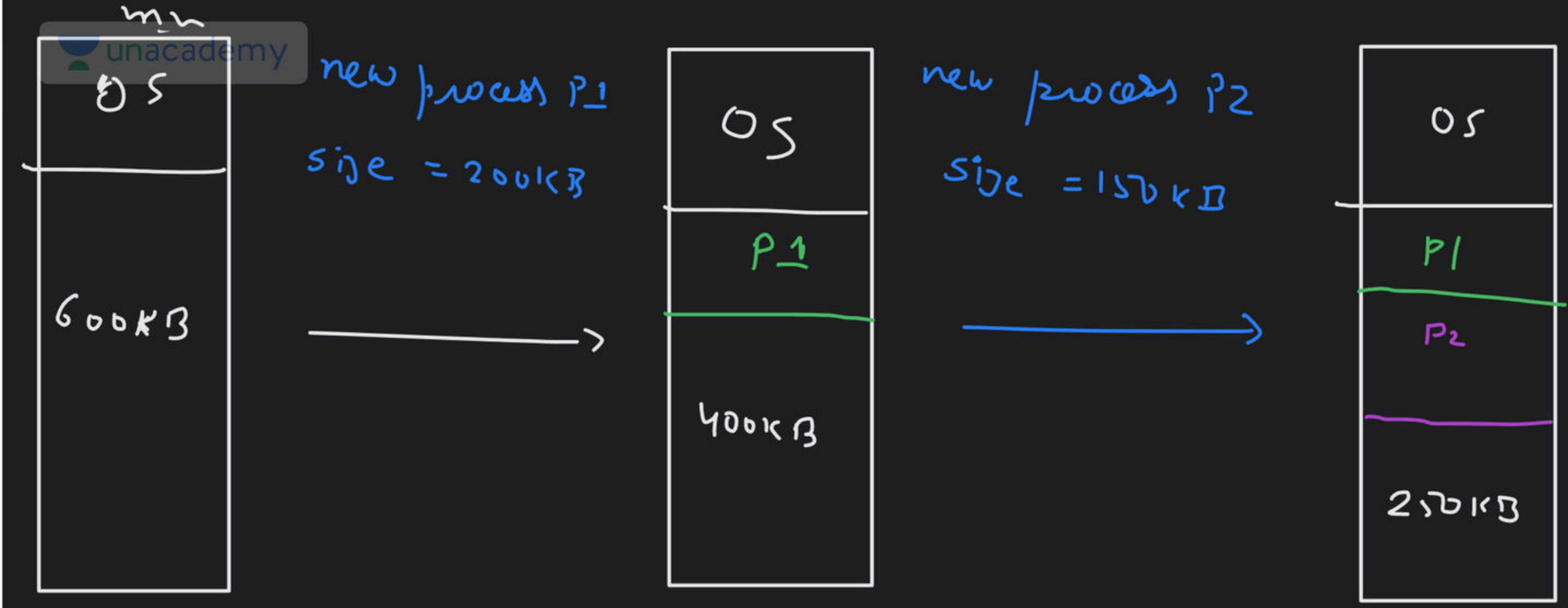
Ex:- A process of size 120 KB has been given a partition of size 130 KB. ⇒ size of internal fragmentation = 10 KB.

Variable Partition Contiguous MMT

No any partition is created before hand.

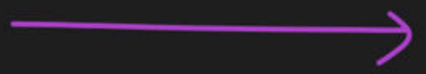
→ whenever a new process arrives then a new partition is created equal to the size of process. and the process is stored in that partition.

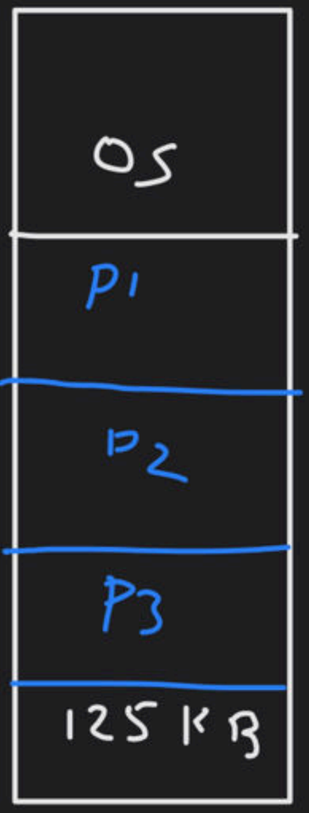
⇒ No any internal fragmentation


OS
600KB
new process P1
size = 200KB
OS
P1
400KB
new process P2
size = 150KB
OS
P1
P2
250KB

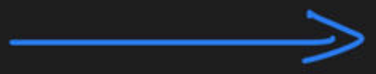
new process P_3

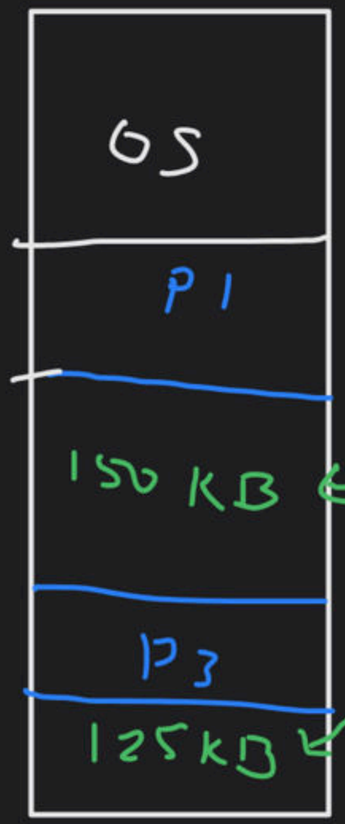
size = 125 KB





Process P_2 Terminated





empty holes

new process P4

size = 170 KB

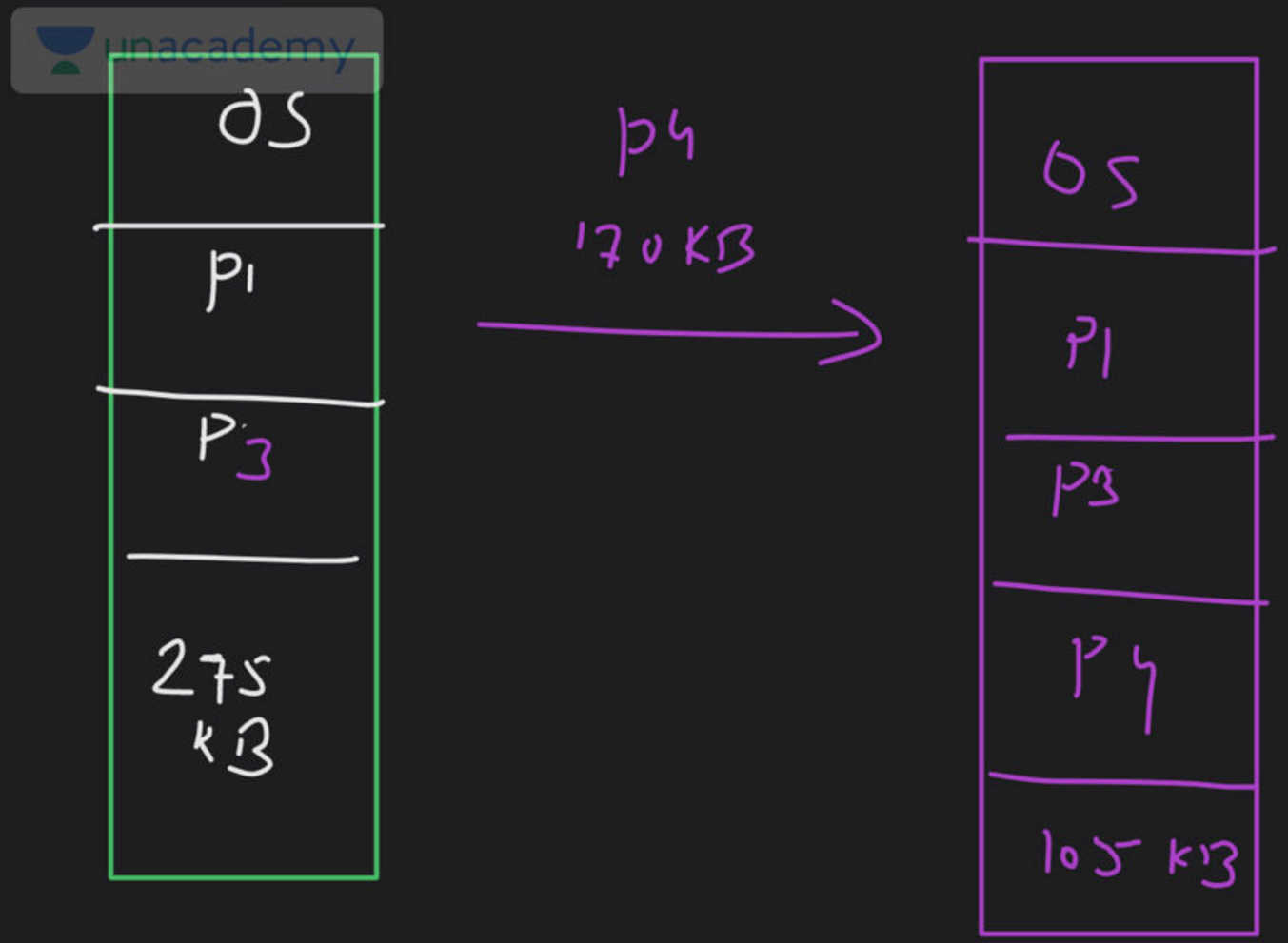
⟶ External fragmentation (Enough space is available in memory but not contiguous to store a process)

⇓

Soln = Compaction

⇓

Gather all allocated spaces into one side of memory so that other side can have all empty spaces together.


OS
P1
P3
275 KB
P4
170 KB
OS
P1
P3
P4
105 KB

Question

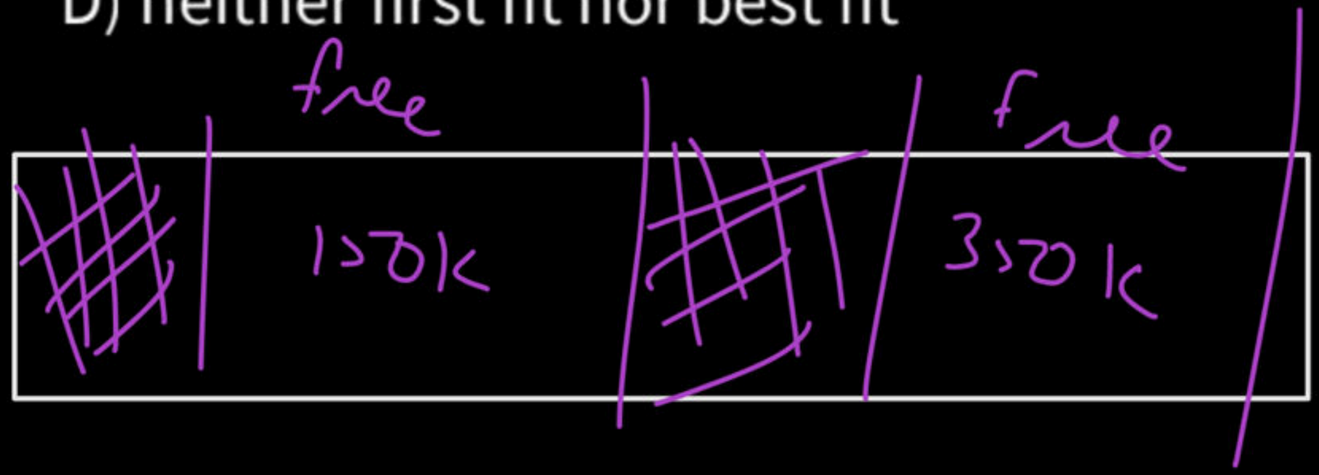
Consider the requests from processes in given order 300K, 25K, 125K, and 50K. Let there be two blocks of memory available of size 150K followed by a block size 350K. Which of the following partition allocation schemes can satisfy the above requests? (variable partition contiguous mmt)

A) Best fit but not first fit

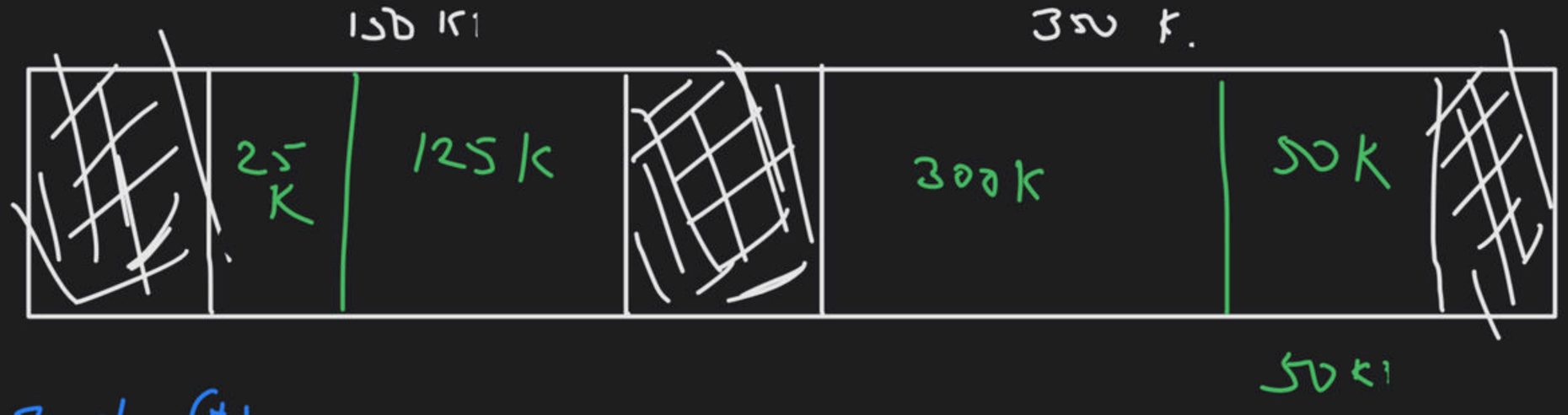
B) First fit but not best fit

C) Both First fit & Best fit

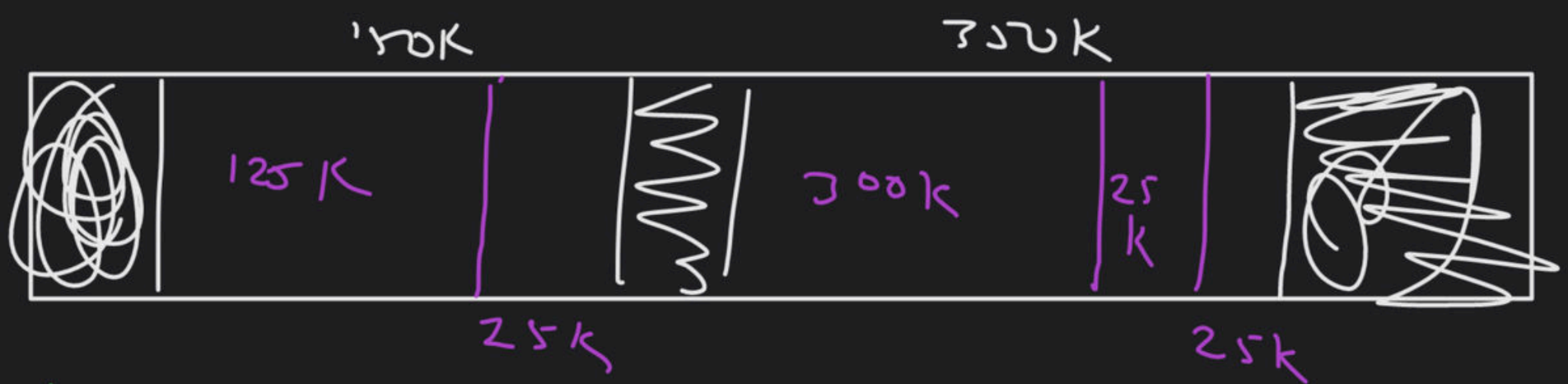
D) neither first fit nor best fit



First fit:-



Best fit:-



last process not stored

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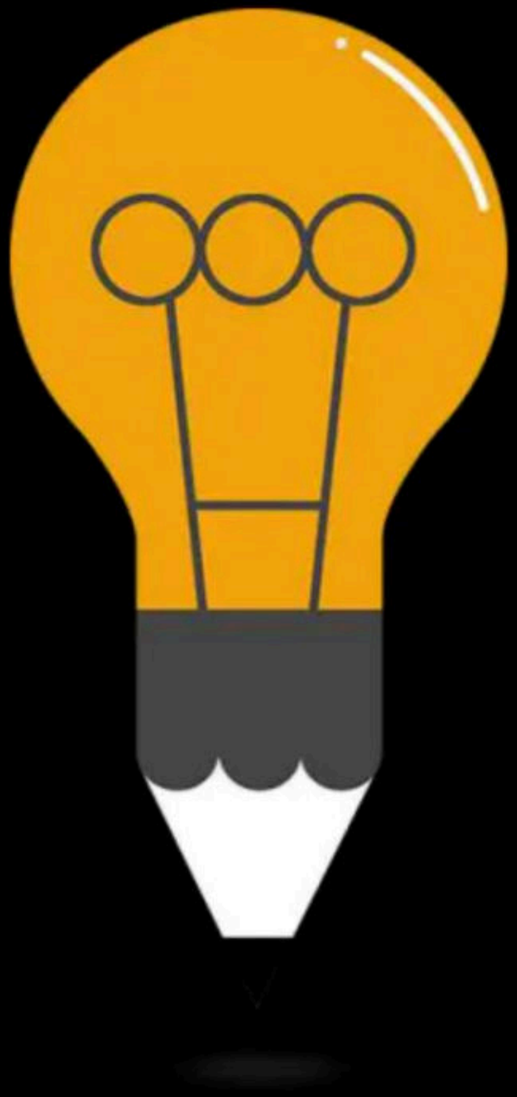

DPP

By: Vishvadeep Gothi

Question 1

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
P1	150MB
P2	400MB
P3	270MB
P4	180MB
P5	80MB

Provide the following answers for First fit, Best fit and Worst Fit policies?

1. Maximum degree of multiprogramming?
2. What is the total internal fragmentation size?

Question 2

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

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Happy Learning.!