

# Memory Management

- Allocation
- Deallocation

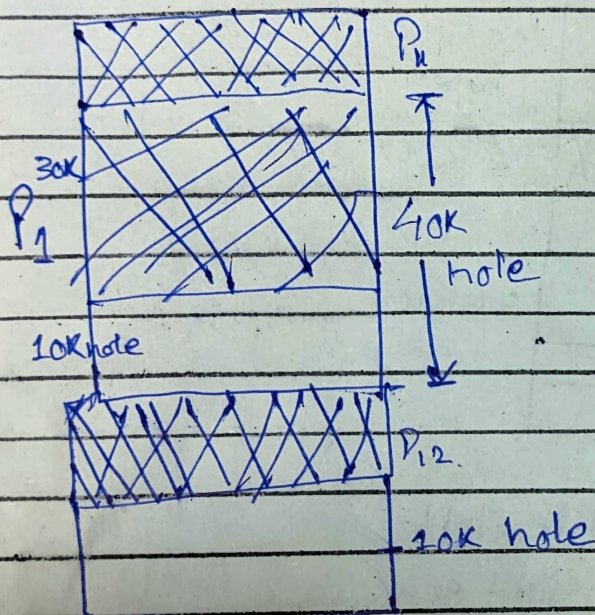
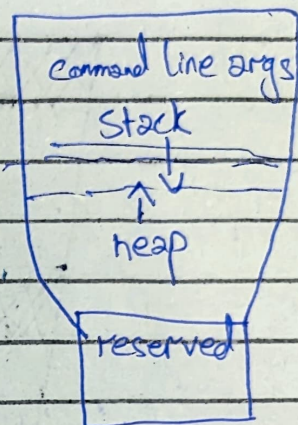
printf → High level language  
↓

010101 → Machine code

## Memory Allocation:-

- Contiguous → [Block]
- Non-Contiguous → [Divided]

Process Control Block



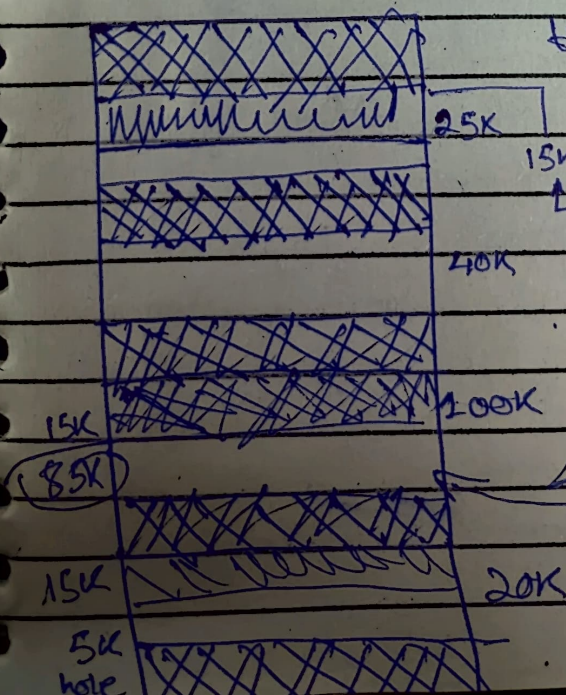
### Strategies in Contiguous Allocation

- First fit (fast)
- Next fit
- Best fit (checks leftover) (slow)
- Worst fit

tiny holes →

25K  
15K  
↳ Pander  
40K

Process = 15K



once again

Worst Case

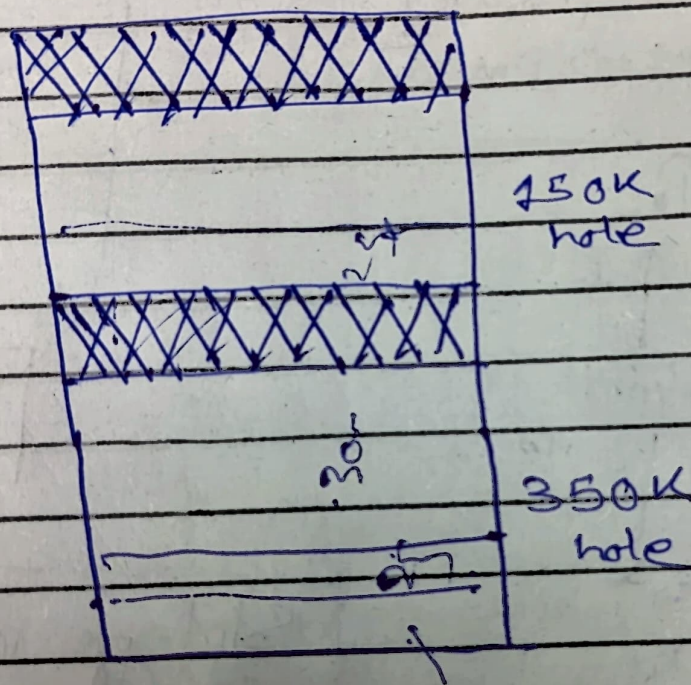


CPU  $\rightarrow$  Logical Address

$\downarrow$   
Physical Address  $\rightarrow$  MMU

Requests from Processes are:

300K, 25K, 125K, 50K



- 1) Best fit  $\rightarrow$  Not suitable
- 2) First fit  $\rightarrow$  Suitable
- 3) Both
- 4) None

Worst fit.



OS Thursday

## Memory Management:

- Continuous Allocation
- Non-Contiguous Allocation

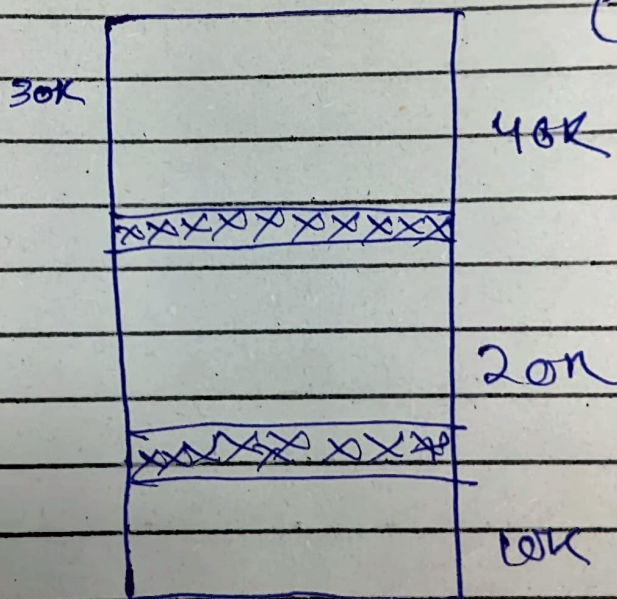
- First fit
- Next fit
- Best fit
- Worst fit

### Disadvantage:

- External fragmentation
- Internal fragmentation

(Left out holes)

(Tiny holes)



## Virtual Memory: Vs Phys Mem (RAM)

- Process is resided in VM
- Divided into fixed sized partitions called pages



- V.M
- Page  $\Rightarrow$  } Both have same size
  - frame  $\Rightarrow$  }
- ↓  
Physical memory
- 32KB process  
8 pages  
frame size = 4KB  
Page size = 4KB

## MMU (Memory Management Unit)

Page Table in Virtual Mem:

Swap out  
Swap in

Page #	frame #
2	5
1	3

CPU  $\rightarrow$  logical Address

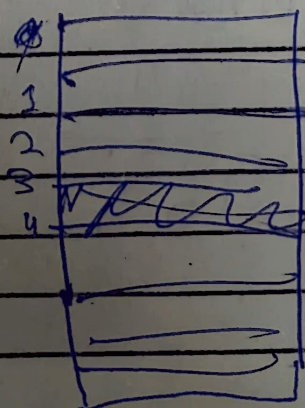
[P# | offset]

remains same  
for virtual memory  
and physical memory  
Resolves into



[f# | offset]  
4

Physical Mem





# Compaction

Merge holes at runtime to create larger block

## Decimal Virtual address

1) 200000

page size = 4KB

to find (page no, offset) for 4KB and 8KB

2) 32768 page size = ~~8KB~~ 4KB, 8KB

ii 60,000

4

4

2048

$$\frac{1}{4} \quad 200000 = \boxed{4.88}$$

4096

$$4096 \times 4 = 16384$$

$$= (4, 3616)$$

$$\begin{array}{r} 200000 \\ - 16384 \\ \hline \end{array}$$

$$\boxed{3616}$$



# 32 bit Virtual Address Space

4KB Page Size

No of Pages = ?

$$2^{10} = 1024$$

$$2^{11} = 2048$$

$$2^{12} = 4096$$

$$\frac{2^{32}}{2^{12}} = 2^{20}$$

Next up:

Virtual Address to  
Physical Address  
translation