RAM ↑
Registers ↑ } ⟹ $\dfrac{Cost}{↑}$
Cache ↑

RAM

Sec Memory

Multiprogramming ⟹ degree of Multiprogramming ↑

Ex1   RAM = 4 MB   ⟹ $\dfrac{4\,MB}{4\,MB} = 1\ processor$
      process = 4 MB

100 ⟹ 1 [70%] k' time ⟹ I/O Bound

eg   30% 1-k ⟹   CPU Bound = 30%

Ex2   RAM = 8 MB   ⟹ 2 processor
      process = 4MB

1 process ⟹ k time

70%   2 processor ⟹ k * k ⟹ k^2

70% I/O Bound , CPU Bound = ?

k^2 ⟹ I/o Bound
$(1 - k^2)$ ⟹ CPU Bounds
$(1 - (0.7)^2)$ ⟹ $\underline{0.5}$

Ex. RAM = 16 MB $\dfrac{16MB}{4MB} = 4\ Processors$
     process = 4MB

70% $(1 - k^4) = (1 - (0.7)^4)\ ?\ \%$

Contiguous allocations

Fixed /   Dynamic /

Static   Variable

Fixed Partition / static

- Partitions are fixed
- Size of partition is fixed
- Disadv
- 1) Internal fragment.
- 2) Limit for processing
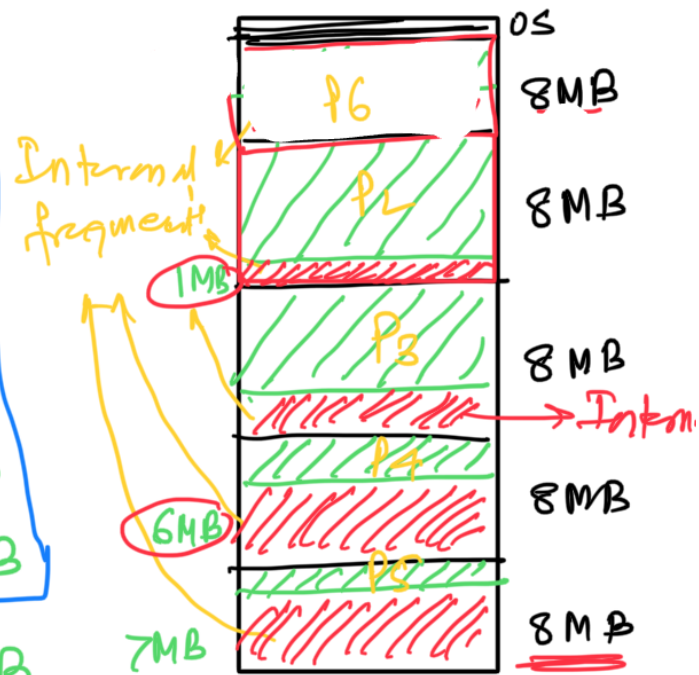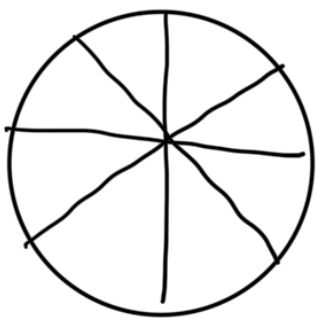- 3) Limitation for degree of multiprogramming.

$P1 = 4 MB$
$P2 = 7MB$
$P3 = 6MB$
$P4 = 2MB$
$P5 =)MB$
$P6 = 8MB$

Internal fragment

OS
P6 — 8MB
P1 — 8MB
1MB
P3 — 8MB
→ Intern
P4 — 8MB
6MB
P5
8MB
7MB

Variable partioning / Dynamic partitioning

Fixed   Variable
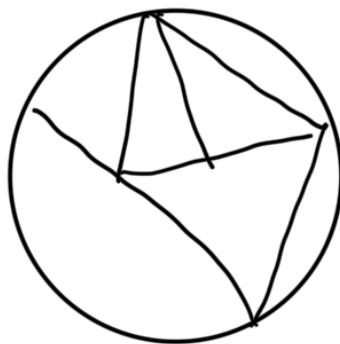
$P1 = 2MB$
$P2 = 4MB$
$P3 = 8MB$
$P4 = 8MB$

P4 Cannot allocation

Space is not Contiguous

External fragment"

OS   0
hole   2MB   } 6M
hole   4MB
P3   8MB
         6MB —
         8

Internal fragmentation
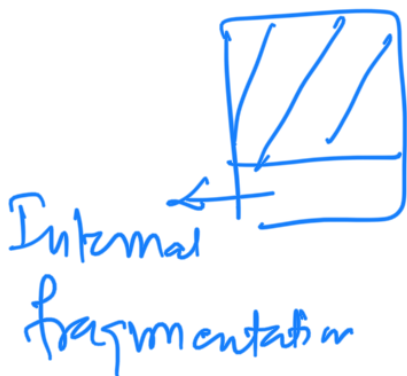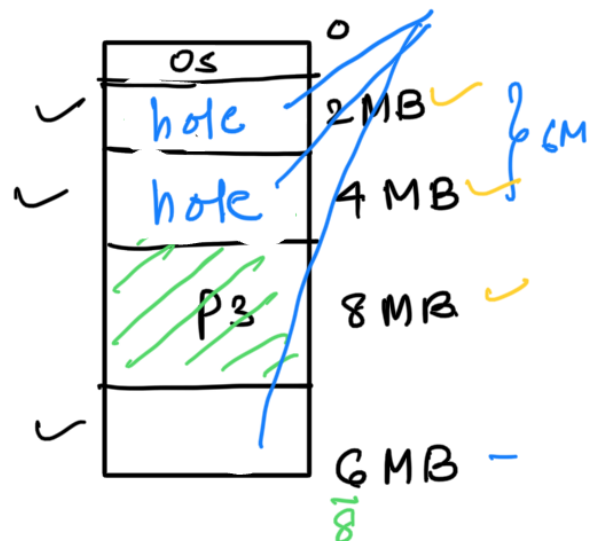
$P5 = 5MB$
P1
hole   4M
P3
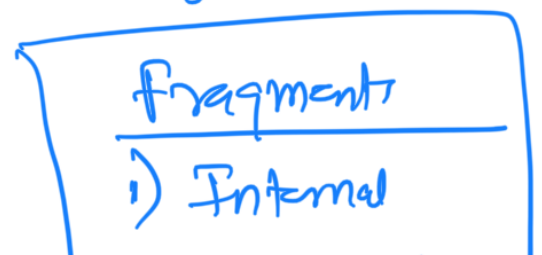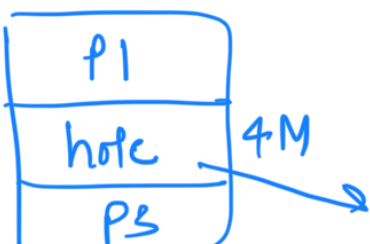
fragment
1) Internal

Advantages

— Internal fragmentati is compromised

— No limitation on no. of processes
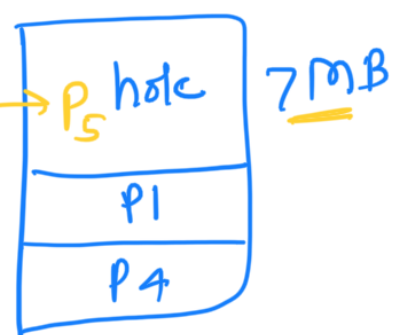
— No limitation on the process size

Disadvantages
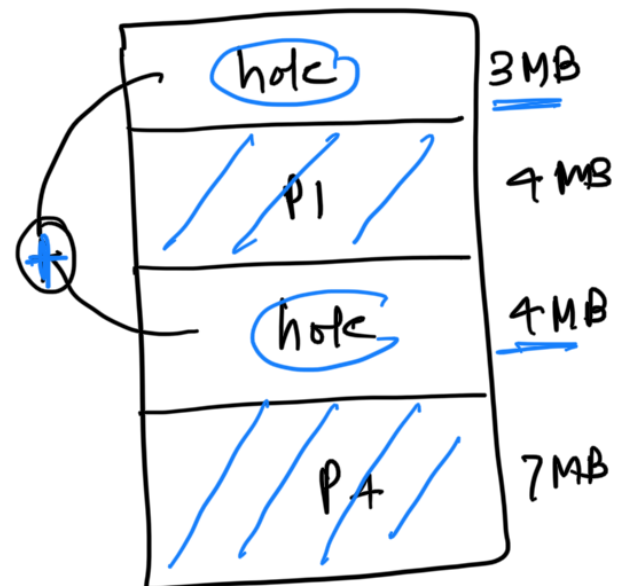
— External fragmentation

— Allocation / Deallocation becomes complex

— No. of holes are more as compared to no. of process.

$\Downarrow$

Compaction → free space (holes)

P1 - 4MB

P4 - 7MB

P5 - 6MB

Apply Compaction

Collect the free space available in the memory

Strategies to allocate the process

1. First fit

2. Next fit

P1 = 4M

3. Best fit
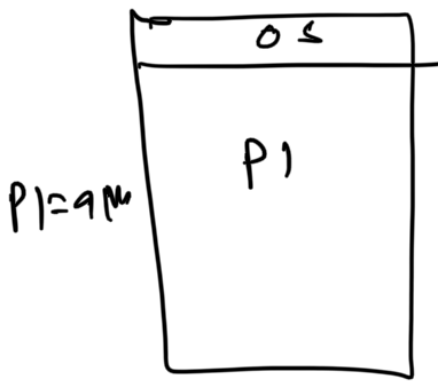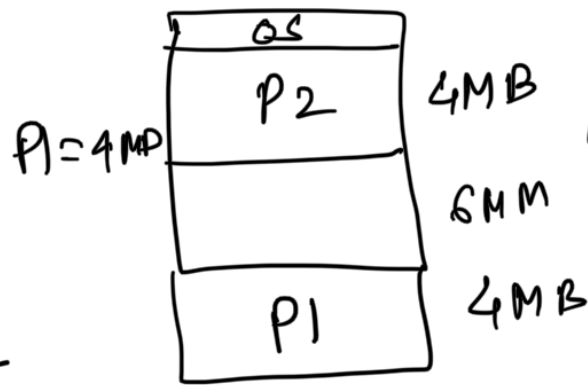
4. Worst fit

4MB

OS

P1=4MB

P2   4MB

6MM

P1   4MB

Next fit

4MB   P1   4MB

6MB

Best fit

OS

P1

P1=9M

12MB

8MB ⇒ Waste

Worst fit

Example

P1 = 3MB ✓

P2 = 7MB

P3 = 7MB

P4 = 1MB

fixed → Variable

OS

2MB

P3 3MM   4MB — 1MB
Best fit

P1   7MB —4MB
First-fit

P2 8MB

13MB — 10MB
Worst fit

P1   5MB
Next fit

Ex:

P5 = 2MB

?

P5

P5
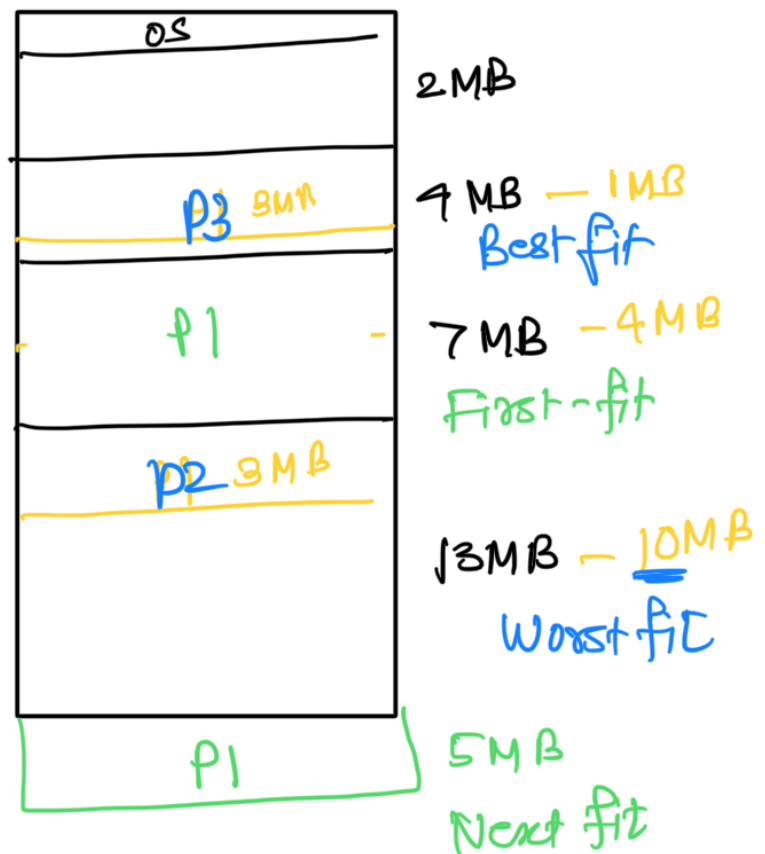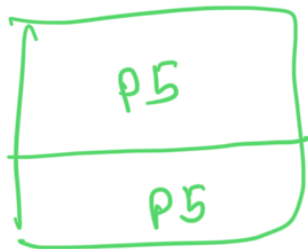
4MB → First fit (fragmentation)

2MB → Best fit —