

Date.....

Name → Suyash Sam

Roll No. → 2301010249

Course → BTech CSE.

Assignment → 2.

Q1

Ans. Address translation in modern system.

- Each process generates logical (virtual) address.
- MMU (Memory management unit) translates these into physical address.

Translation steps:

- a) CPU generates logical address.
- b) MMU checks page table for corresponding frame number.
- c) Concatenation frame + offset → physical address.

Q2

Ans. Process A (100 kb of 120 kb block) / free 30 kb / Process B (200 kb).

Internal → 20 kb wasted space inside allocated blocks.

External → 30 kb free, but too small for 40 kb.

Mitigation: paging (removes external), segmentation with buddy system, slab allocators, or dynamic allocation with coalescing free space.

Q3.

Ans. → Memory is split into fixed-size frames, process into pages, page table store mapping

- * Pros: No external fragmentation, simple allocation.
- * Cons: Page tables use extra memory, TLB missed add delay, last page may waste some space.

Q4.

Ans → OS hardware interaction in virtual memory

- * Page-table in memory.
- * MMU translates virtual.
- * TLB caches recent translations.
- * Protection bits.

Q5.

Ans → 16-bit virtual address, 1KB page size

- * Address Space = $2^{16} = 65,536$ bytes.
- * Page Size = $2^{10} = 1024$ bytes.
- * Number of Pages = $\frac{65,536}{1024} = 64$.
- * Page table size = $64 \times 2 \text{ bytes} = 128 \text{ bytes}$.

Part-B

Q6.

<u>Ans</u> →	Process	Size (K.B)
	P ₁	212
	P ₂	417
	P ₃	112
APCO	P ₄	426

* First-fit

P ₁	P ₂	P ₃	P ₄
0	212	629	741

1167

Unused memory = 259 kb

* Best-fit

P ₁	P ₂	P ₃	P ₄
212	417	112	

P₄ still can't fit Unused = 259 KB.

* Worst-fit.

P₄ (426) can't fit, Unused = 259 KB.

All three methods leave 259KB unused in this case.

Q7.

Ans → Page replacement.

* FIFO = 10 faults

* Optimal = 7 faults

* LRU = 9 faults

Optimal is best, LRU is practical, FIFO may show Belady's anomaly.

Q8.

Ans → Disk write = 10ms

Memory write = 100ms

Dirty pages = 30% of 1000 = 300

a) Overhead = 300 × 10ms

= 3000 ms = 3 seconds.

- b) Optimization : Write-back caching with dirty bit tracking or pre-cleaning (background flush) reduce blocking time.

Q9.

Ans → Autonomous vehicle memory.

- * Use working set model to allocate enough frames for real-time (object detection) to prevent thrashing.
- * Replacement policy: LRU or WSLock with priority.
- * Strategy: Reserve fixed memory for real-time processes, share remaining dynamically, This ensures responsiveness and efficient utilization.