Operating System 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 (100kb of 120 kb block) / free 30 kb /
      Process B (200 kb)

Internal → 20 kb wasted space inside allocated block.

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

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 misses
   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.
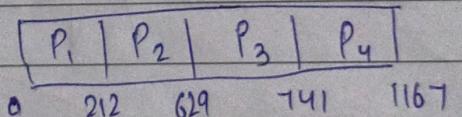
Ans 16-bit virtual address, 1kb page size.
- Address space = 2^{16} = 65536 bytes
- Page size = 2^{10} = 1024 bytes
- Number of Pages = $\frac{65536}{1024}$ = 64

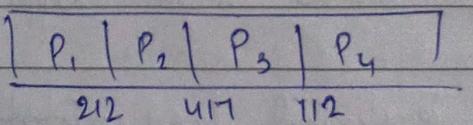- Page table size = 64×2 bytes = 128 bytes

Part B

Q6.

Ans

Process	Size (kb)
P_1	212
P_2	417
P_3	112
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

P_4 still can't fit   Unused = 259 kb

- Worst-fit

  P_4 (426) can't fit, unused = 259 kb

All three methods leave 259 kb unused in this process.

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 = 10 ms

Memory write = 100 ms
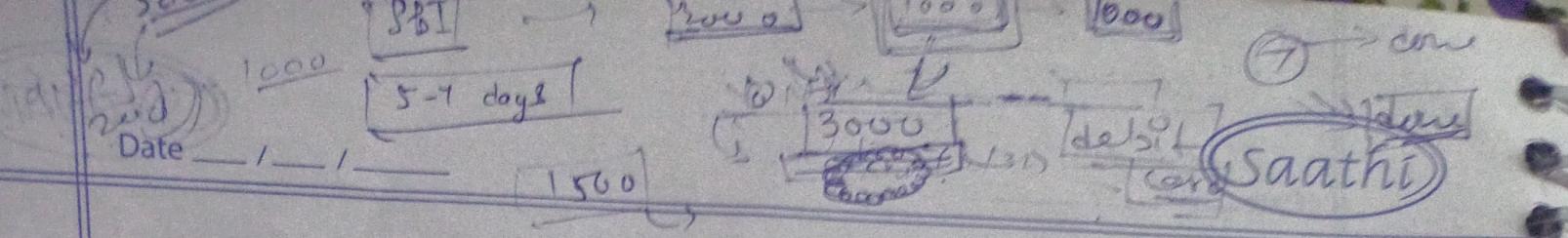
Dirty pages = 30% of 1000 = 300

(a) Overhead = 300 × 10
   = 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

SBI → ₹200 → 1000 · 1000
5-4 days
1000
Date ___ / ___ / ___
3000 · debit
1560 Saathi
⑦ → com

- Replacement policy : LRU or WSlock with priority.
- Strategy : Reserve fixed memory for real-time processes, share remaining dynamically. This ensures responsiveness and efficient utilization.

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2/4/25