Operating System

Date ________

Name :- Ritu Rajput
Roll No. :- 2301010208

Assignment - 02

Ques 1.

Ans. logical (virtual) addresses generated by CPU are mapped to physical addresses using MMU

- Each process has its own page table.

Steps:-

① CPU generates logical address (page no + offset).

② MMU uses pages table to find corresponding frame no.

③ final physical address = frame no + offset.

- Illustration :- logical → (Page Table) → Physical

Ques 2.

Ans.
- Internal fragmentation: fixed-sized partitions waste space when process is smaller than partition.

- External fragmentation:- free blocks are scattered b/w allocated memory, too small to use

ANKUR

Spiral

Date

Mitigation techniques :-

- Use paging to avoid external fragmentation
- Use segmentation + paging hybrid.
- Dynamic allocation algorithms (best fit, worst fit, first fit)

- Beyond compaction, OS may use slab allocation or buddy system to minimize waste memory.

Ques 3.

Ans. Model :- Divide logical memory into pages and physical memory into equal-sized frames. Each process gets pages mapped to free frames.

Trade offs :-

- Overhead : Need page tables → consumes memory.

- Speed : Address translation requires extra step.

- fragmentation :- Eliminates external fragmentation but small internal fragmentation remains.

Date ______

Ques4.

Ans. Key idea :- Virtual memory allows processess to use more memory than physically available.

OS Role : Maintains page tables, handles page faults, decides replacement policy.

Hardware Role :
- MMU translates addressess.
- TLB : speeds up translation
- Disk / secondary storage : provide swap space.

Eg. :- If page not in memory, hardware triggers page fault → OS loads page from disk into RAM.

Ques 5.

Ans. (a) No. of virtual pages :—
- Virtual address space = 2^{16} = 65,536 bytes
- Page size = 2^{10} = 1024 bytes
- Page = $2^{16}/2^{10} = 2^{6} = 64$ pages.

⇒ 64 virtual pages

(b) Page table size (entry = 2 bytes) :
- Each page needs 1 entry
- Entries = 64

Date

- Page table size = 64×2 = 128 bytes

  ⇒ 128 bytes.

Ques6.

Ans: We have 1000 KB free memory, and process arrived as:

- P1 = 212 KB
- P2 = 417 KB
- P3 = 112 KB
- P4 = 426 KB

(a) First fit

- Start with 1000 KB block.

1. P1 = 212 → Allocated (1000 → 788 left)
2. P2 = 417 → Allocated (788 − 371 left)
3. P3 = 112 → Allocated (371 → 259 left)
4. P4 = 426 → Cannot fit in 259. (Not allocated).

Allocated = P1, P2, P3
Free = 259 KB.

Best Fit

- Start with 1000 KB Block
  1. P1 = 212 → Allocated (788 left)
  2. P2 = 417 → Allocated (371 left)
  3. P3 = 112 → Allocated (259 left)
  4. P4 = 426 → Cannot fit in 259

  Same as First-fit

  Free = 259 KB

ANKUR

Spiral

Date

Worst fit
- Start with 1000 KB Block

1. P1 = 212 → Allocated (788 left)
2. P2 = 417 → Allocated (371 left)
3. P3 = 112 → Allocated (259 left)
4. P4 = 426 → Cannot fit in 259

Same again
free = 259 KB.

(b) Total Unused Memory

- First fit = 259 KB unused
- Best fit = 259 KB unused
- Worst fit = 259 KB unused.

(c) Best Utilization

- In this case, all three method give the Same result.

- only P1, P2, P3 can be allocated
- P4 cannot be allocated in any metho
- Unused = 259 KB.

Date

Ques 7.

Ans: Page ref rence string

7 0 1 2 0 3 0 4 2 3 0 3 2 with 3 frames

Page-fault counts
FIFO: 10 Pages faults
optimal: 7 Pages Faults
LRU: 9 Pages Faults

Belady's anomaly

- optimal is the theoritical best (it looks ahead) so it gives the minimum faults.
- LRU performs close to optimal (9 faults) because it removes the least recently used faces).

Ques 8.

Ans. Additional time overhead from dirty pages.

Extres cost per dirty page = distribute - memory white

= 10.0000 ms - 0.0001 ms
= 9.9999 ms.

For 300 dirty pages
300 x 10 ms = 3000 ms.

Ans :- 3.0 sec.

Spiral

ANKUR

Date

(b.) Use a background page - cleaner asynochrono
write - back + clean - first replacement.
Policy : protectively flush dirty flush in the background.

Ques 9. (a) The OS can apply the working set model to track the active pages needed by each task. For mission - critical tasks it ensures this working set is allways ~~resistanc~~ resisdent in memory, preventing trashing.

(b.) A priority based dynamic memory allocation strategy is best allocate gauranteed minimum memory to real time tasks, and allow flexible allocation / sharing for non critical ones.