Name:- Sumit Kumar Yadav Roll No. 18CS30042

Ans 2:-

(a) $t = 100$ n sec $= 100 \times 10^{-9} = 10^{-7}$ sec

(i) TLB, time. $= 10$ n sec $= t_t$

$0.85 = \alpha = 85\%$ found in TLB

2% Page fault $= \beta = 0.02$

$T =$ Page replacement time $= 2 \times 10^{-6}$ sec.

$\Rightarrow 1 - \alpha - \beta = 0.13$

(i) Single-level page table :-

average memory access time

$$= \alpha(t_t + t) + (1-\alpha-\beta)(t_t + 2t) + \beta(t_t + t + T + t_t + 2t)$$

$$= 0.85(10 + 100) + 0.13(10 + 100 + 100) + 0.02(10 + 100 + 2\times10^{6} + 10 + 100 + 100)$$

$$= 93.5 + 27.3 + 0.02(320 + 2\times10^{6})$$

$$= 93.5 + 27.3 + 6.4 + 4\times10^{4}$$

$$= (127.2 + 4\times10^{4})\ 10^{-9} \text{ sec.}$$

$$= 40{,}127.2 \text{ nsec}$$

$$= 40127.2 \times 10^{-9} \text{ sec.}$$

(ii) on page 5.

Ans1:-

(a) av. size 8 KB = 8×2^{10} Bytes

$\to$ 4 B

~~Optimal page size~~ $\Rightarrow$ no. of pages $= \frac{8 \times 2^{10}}{2^2}$

$= 2 \times 2^{10}$

$= 2^{11}$ pages

average $= 8 \times 2^{10} = S = 8 \times 2^{10}$ Bytes

page table entry size $= k = 4$

Page size $= P$

av. internal fragmentation per segment $= P/2$

av. no. of pages per segment $= S/P$

Thus, total overhead, $V = \frac{kS}{P} + \frac{P}{2}$

$\therefore$ value of P that minimizes overhead, $\frac{dV}{dP} = 0$

$\Rightarrow -\frac{kS}{P^2} + \frac{1}{2} = 0$

$\Rightarrow P = \sqrt{2Sk}$

$= \sqrt{2 \times 8 \times 2^{10} \times 4}$

$= 4 \cdot 2 \; 2^5$

$= 2^2 \, 2^1 \, 2^5$

$\underline{P = 2^8 \text{ Bytes}}$

(b) It improve algorithm by using reference bit and modify bit (if available) is concert.

Consider example,

take ordered pair

→ (0,0) neither recently used not modified → best page to ~~r~~ replace.

→ (0,1) not recently used but modified not quite as good must write out before replacement.

→ (1,0) recently used but clean, probably will be used again soon

→ (1,1) recently used & modified → probably will be used again soon & need to write out before replacement.

It improve performance like when we change any bit in main memory than it directly changes in Hard disk by using that another reference bit while in earlier case we have to traverse the whole page table which affect performance.

(~~c~~)

③(b) (i) allocation of page reference :-

FIFO :-

7, 3, 5, 2, 1, 0, 7, 4, 7, 1, 2, 0, 2, 6, 3, 4, 1, 5, 2, 7

4 frames

	7	3	5	2	1	0	7	4	7	1	2	0	2	6	3	4	1	5	2	7
1				2	2	2	2	4	4	4	4	4	4	4	4	4	1	1	1	1
2			5	5	5	~~5~~	7	7	7	7	7	7	7	7	3	3	3	3	3	7
3		3	3	3	3	0	0	0	0	0	0	0	0	6	6	6	6	6	2	2
4	7	7	7	7	1	1	1	1	1	1	2	2	2	2	2	2	2	5	5	5
									X	X		X	X			X				

no page fault

∴ page fault = 15 = 20 − (no page fault) = 20 − 5

= 15

(ii) LRU :-

	7	3	5	2	1	0	7	4	7	1	2	0	2	6	3	4	1	5	2	7
1				2	2	2	2	4	4	4	4	0	0	0	0	4	4	4	4	7
2			5	5	5	5	7	7	7	7	7	7	7	6	6	6	6	5	5	5
3		3	3	3	3	0	0	0	0	0	2	2	2	2	2	2	1	1	1	1
4	7	7	7	7	1	1	1	1	1	1	1	1	1	1	3	3	3	3	2	2
									X	X			X							

no page fault

∴ page fault = 20 − 3

= 17.

Ans 2: (a)(ii)

in 3-level page table :- (reference from page 1 of this ansheet)

(b)

average memory access time $= \alpha(t_t + t) + (1-\alpha-\beta)(3t + t_t + t) + \beta(t_t + 3t + T + t_t + 3t + t)$

$= 0.85(10 + 100) + 0.13(3 \times 100 + 100 + 10)$
$+ 0.02(10 + 3 \times 100 + 2 \times 10^6 + 3 \times 100 + 100 + 10)$

$= 93.5 + 53.3 + (720 + 2 \times 10^6)\, 0.02$

$= 93.5 + 53.3 + 14.4 + 4 \times 10^4$

$= (161.2 + 40000)$ nsec

$= (40161.2$ nsec$)$

Ans 3:-

(a)

logical address

32	
20	12

Physical address

32	
20	12

$1024 \quad 2^{10}$

2 level page table.

Page size $= 4$ KiB $=$ ~~4096~~ Byte $= 2^2 \cdot 2^{10}$
$=$ ~~2^{30} Byte~~
$= 2^{12}$ Bytes

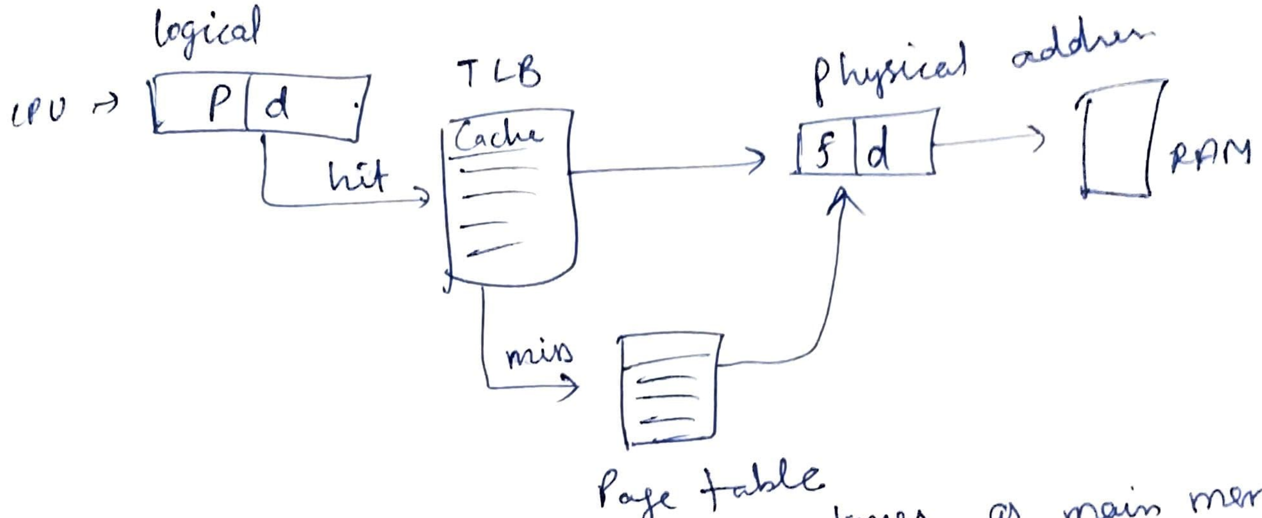
(iii) offset of page $= 12$ bit
& page size $= 2^{12}$ Bytes

0 ——— 19

(i) outer page table $= 0$

(ii) inner page table $= 10$

(c) access memory time in demand paging memory managm. system that includes TLB :-



(taken same times as main memory access)

∴ access memory time :-

t_t : time to access TLB

t : memory access the main memory

α : probability that reference found in TLB

β : prob. page fault.

∴ access memory time

Case 1 Case 2

TLB check, check in page table, access physical add.

$$= (\text{hit}) + (\text{miss})$$

$$= \alpha(t + t_t) + (1 - \alpha - \beta)(t_t + t + t)$$

$$+ \beta(t_t + t + T + t_t + t + t)$$

again check TLB

found in TLB

access the physical address

TLB check

check in page table

page replacement time