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Operating System (CSE 4509)

Assignment for CT 3

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section: G

Ans. to the Q.no:1

Given, virtual address space = 256 MB
$= 256 \times 2^{20}$ Bytes

virtual address = $\log_2(256 \times 2^{20})$ bits
= 28 bits

page size = 2 KB = 2×2^{10} Bytes

Physical memory = 4 GB = 4×2^{30} Bytes

Flag size = 7 bits

(a) Offset = $\log_2$ (page size)
$= \log_2(2 \times 2^{10}) = 11$ bits

(b) Here, virtual address = 28 bits
offsets = 11 bits
∴ VPN size = 28 − 11 = 17 bits
Number of virtual pages = 2^{17}

Again, Physical address = $\log_2(4 \times 2^{30})$ bits
= 32 bits

PFN size = 32 − 11 = 21 bits

Number of Physical frames = 2^{21}.

(c) Here, PTE size = PFN size + Flag size

$= (21 + 7)$ bits

$= 28$ bits

$= 4$ Bytes

Page table size = Number of virtual pages * PTE size

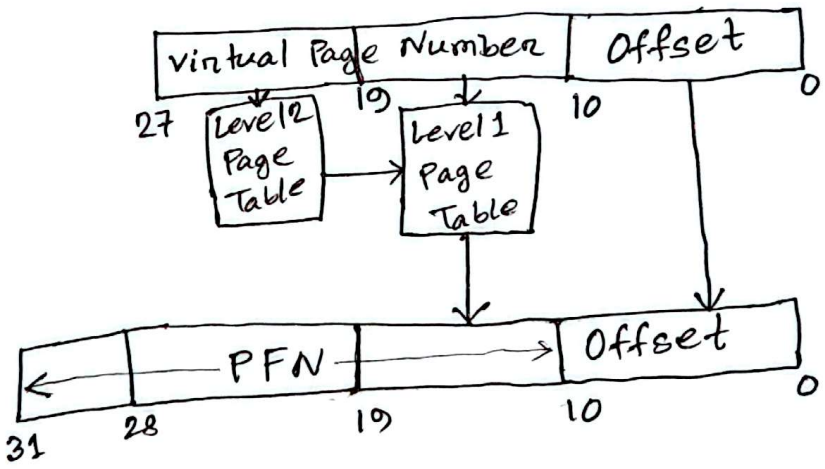
$= 2^{17} \times 4$ Bytes

$= 2^{19}$ Bytes

(d) Number of bit required at each level of table $= \log_2\left(\frac{\text{Page size}}{\text{PTE size}}\right)$

$= \log_2\left(\frac{2 \times 2^{10}}{4}\right)$ Bytes

$= 9$ bits



(e) Here, Number of PTEs per page = $\frac{\text{Page size}}{\text{PTE size}}$

$= \frac{2 \times 2^{10}}{4}$

$= 2^9$

Now,

To store Level 1 page table,

maximum space required = $\frac{\text{Number of PTEs}}{\text{Number of PTEs per page}}$

$= \frac{2^{17}}{2^9}$

$= 2^8$ pages to store 1st table

To store Level 2 page table,

maximum space required = $\left\lceil \frac{2^8}{2^9} \right\rceil = \lceil 0.5 \rceil = 1$ pages to store 2nd table

∴maximum memory to store the page tables of all processes = $(2^8 + 1) \times 256$ pages.

(f) Minimum space required to store all pages tables of one process = Number of levels × 1 page

= 2 pages

Ans. to the Q. no: 2

Given, virtual address = 16 bits

page size = 256 Bytes

Offset = $\log_2(256) = 8$ bits

$\therefore$ VPN = 16 − 8 = 8 bits (MSB)

Now,

	VPN	PFN	Physical Address
a)	0X02	Page fault	X
b)	0X06	Page fault	X
c)	0X0A	0X4	0X410