Ans. to the qus: no: 01

(a) Page size = 4 KB = 4 × 1024 byte
= 2^{12} byte

Offset size = $\log_2$(page size) = $\log_2(4 \times 1024)$ bits
= 12 bits

(b) Virtual address size = 48 bits, page size 2^{12} byte

No. of virtual pages = $\frac{\text{Virtual memory size}}{\text{Page size}}$

= $\frac{2^{48}}{2^{12}} = 2^{36}$ bytes.

(c) Required bits for VPN = 48 - 12 = 36 bits

(d) Physical add. = $\log_2$(Physical memory size in bytes)
= $\log_2(8 \times 2^{36})$ = 33 bits

Required bits for PFN = 33 - 12 = 21 bits

(e) Page size = No. of virtual pages × PTE size
= $2^{36} \times 4$ = 2^{38} byte
= 256 GB

(c) No. of bits for VPN = 36 bits

No. of PTE in each page = $\frac{\text{Page size}}{\text{PTE size}}$

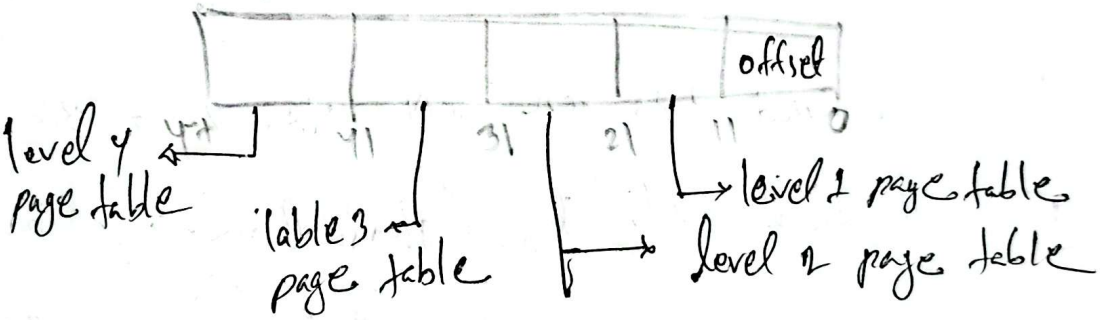
$= \frac{4 \times 1024}{4}$

$= 1024$ byte

bits required for each level of page table

$= \log_2(1024) = \log_2(2^{10})$

$= 10$ bits



Ans: to the ques: no: 02

Page size = 4 kB Ram size = 8 GB

offset = $\log_2$(Page Size) = $\log_2(4 \times 1024)$

= 12 bit.

Physical add. = $\log_2$ (Ram Size) = $\log_2$ (8 GB)

= $\log_2 (8 \times 2^{30})$.

= 33 bits

PFN = 33 − 12 = 21 bits

PTE = $\frac{21+10}{8}$ = 4 bytes

Ans: do the qus: no: 03

Virtual add space = 6 bit

page/frame size = 16 byte. (4 bits)

Virtual add 20 → $(20)_{10}$ = $(010100)_2$

⇒ VPN = $(01)_2$ = 1_{10}

Page offset = $(0100)_2$ = 4_{10}

Virtual add 40 → $(40)_{10}$ = $(101000)_2$

⇒ VPN = $(10)_2$ = $(2)_{10}$

Page offset = $(1000)_2$ = 8_{10}

Physical add = (Physical frame No. × frame size) + Page offset

(a) Virtual add: 20 →

VPN = 1, Physical frame = 3

Physical add = (3×16) + 4 = 52

(b) Virtual add: 40 →

VPN = 2, Physical frame = 11

Physical add = (11×16) + 8 = 184

Ans: to the qus: no: 04

(a) Virtual add = 64 bit = 2^{64} byte

page size = 4Kb = 4×1024 bytes

PTE size = 4 bytes

No. of required at each level of page table

$= \log_2\left(\frac{\text{Page size}}{\text{PTE size}}\right) = \log_2\left(\frac{4\times1024}{1024}\right)$

= 10 bit.

VPN = 64 − 12 = 52 bit

Max' no. of level in page table = $\lceil \frac{52}{10} \rceil$ = 6 level

(b)

Max no. of pages for:

level 1 = $\frac{2^{52}}{2^{10}} = 2^{42}$ pages

level 2 = $\frac{2^{42}}{2^{10}} = 2^{32}$ pages

level 3 = $\frac{2^{32}}{2^{10}} = 2^{22}$ pages

level 4 = $\frac{2^{22}}{2^{10}} = 2^{12}$ pages

level 5 = $\frac{2^{12}}{2^{10}} = 2^{2}$ pages

level 6 = $\left\lceil \frac{2^{2}}{2^{10}} \right\rceil$ = 1 page

Total = $(2^{42} + 2^{32} + 2^{22} + 2^{12} + 2^{2} + 1)$ Pages

Ans: to the ques: no: 05

Virtual add space = 24 bits

Physical " " = 32 bits

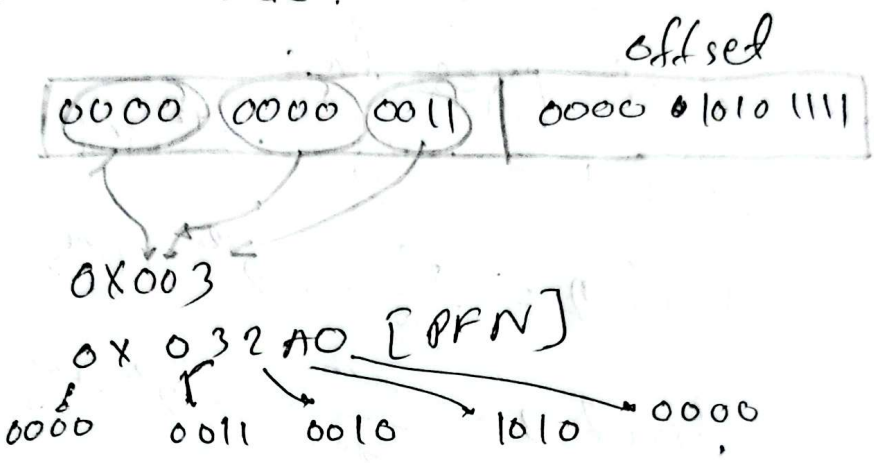
Page size = 4 kb (2^{12} byte)

size of offset = $\log_2$ (page size)

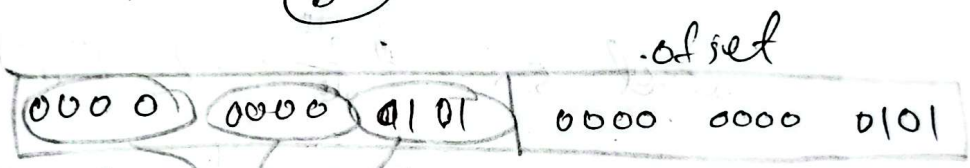
= $\log_2$ (4 × 1024)

= 12 bits

a) Virtual add:



(b)



(c)