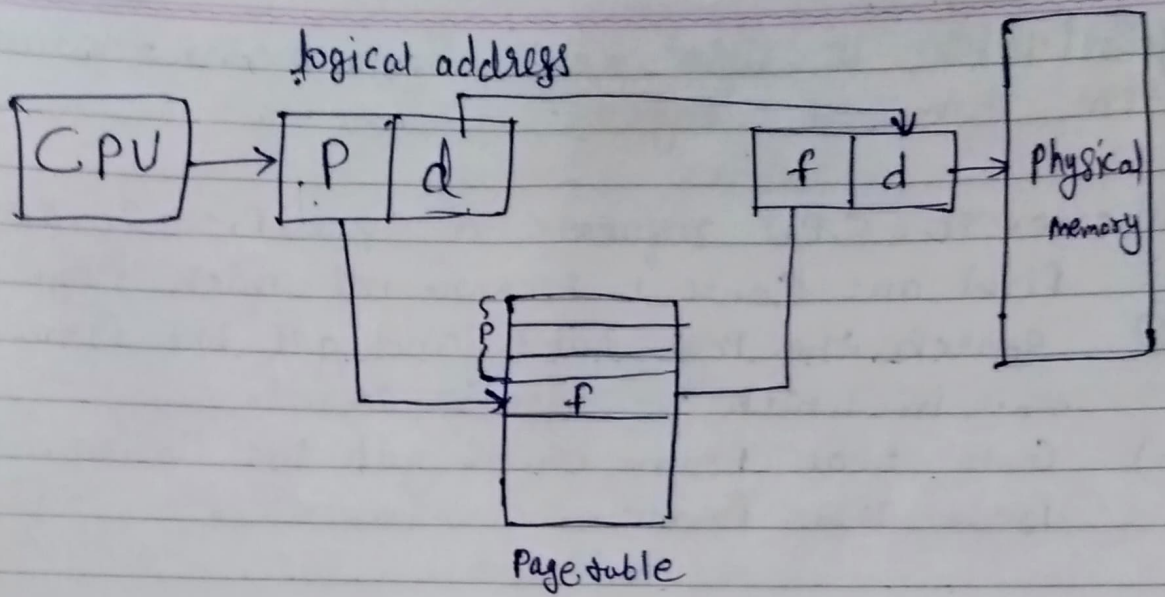


Imp

As we know Page table is stored in physical memory. so to access this Pagetable CPU needs its base address. hence There a Special purpose register in CPU which is PTBR [Page table base reg.] that contains the base address of Page table.

Example Question on Paging →

Q.1) Consider a paged memory system with logical address of 26-bits and physical address of 32 bits. The Page size is 2KB. further Consider that one page table entry size is 4 bytes.

Sol:

(1) bits in Page offset / byte offset / displacement

$= \log_2(\text{Page size}) = \log_2(2\text{ KB})$

$\log_2(2^{11}) \Rightarrow 11$ bits

(2) No. of Pages in Process → $\frac{\text{total logical Addr space}}{\text{Page size}}$

$= \frac{2^{26} \text{ byte}}{2^{Kb}} = \frac{2^{26}}{2^{11}} = 2^{15}$ Pages

(3) req. bits for Page Numbers = $\log_2$ (No. of Pages)

$= \log_2(2^{15}) = 15$ bits req.

(4) No. of frames in physical memory →

$\Rightarrow \frac{\text{total Physical Address Space}}{1 \text{ frame size}} = \frac{2^{32}}{2^{11}}$

$\Rightarrow 2^{21}$ frames

(5) req. no of bits for frame no. = $\log_2$ (total frames)

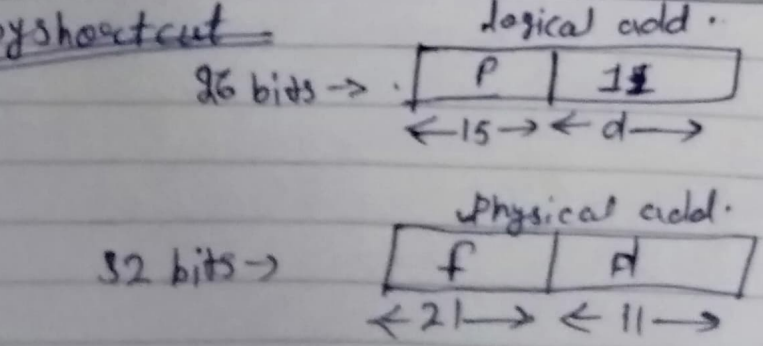
$= \log_2(2^{21}) = 21$ bits

(6) Page table size :)

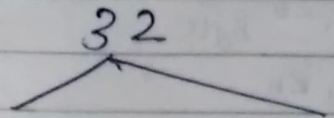
⇒ No of Pages * 1 entry size

$= 2^{15} * 4 = 2^{17}$ bytes or 128 Kb

byshortcut



1 entry size = frame No + extra bits
entry size → 4 bytes ⇒ 32 bits



Q.2] A System has 64-bit virtual addresses and 43-bit physical addresses. if the Pages are 8 KB in size, the number of bits required for VPN and PPN will be?

VPN = Virtual Page No. → logical Page No.

PPN = Physical Page No. → frame No.

Sol: ⇒ total Pages ⇒ $\frac{2^{64}}{8 \times 2^{10}}$ [virtual add. space] / [Page size]

$= \frac{2^{64}}{2^{13}} = 2^{51}$ Pages

required bits for Pages = 51

⇒ total frames = $\frac{2^{43}}{2^{13}} = 2^{30}$ frames

required 30 bits for frame No

Q:3 Consider a logical address space of 8-pages. with, page size 1024 bytes. The physical memory contains 32 frames.

(1) Bits in Logical address →

total Logical address space = No. of pages * 1 page size

⇒ $2^3 * 2^{10}$

total logical Add ⇒ 2^{13}

bits for logical Add. = 13

(2) Bits in Physical Add.

total physical address space = No. of frames * 1 Page size

⇒ $2^5 \times 2^{10}$

⇒ 2^{15}

bits required for physical add. = 15

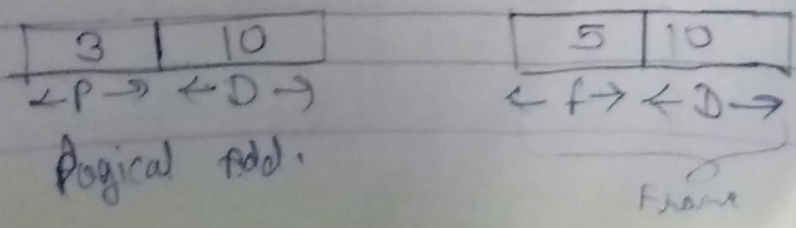
(3) Page table Size → No of Pages * page entry size

Page entry size = frame no + extra bits

→

we have 8 pages, so req. bits = 3

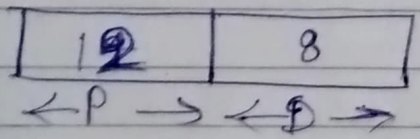
we have 32 frame, so req. bits for frame = 5



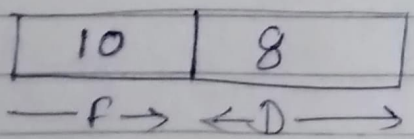
extra bits = 0
hence entry size = 5 bits
Page table size = 8 * 5
⇒ 40 bits or 5 bytes

Q.4 A System Support 4K pages in size 256 bytes, each in a demand Paging system main memory Contain 1 K frames, no of bits required for logical address and physical address are ?

Sol: total logical add. space = $2^{12} * 2^8$
$= 2^{20}$
⇒ 20 bits for logical add.



total Phy. add. space = $2^{10} * 2^8$
$= 2^{18}$



Page table Size ⇒ total Pages * entry size
$2^{12} * (10)$ bits
4K * 10 bits
40 K bits
⇒ 5 KB Kilobyte

Q.5 What is the size of the Physical add. Space & logical address Space in a paging System which has a page table containing 64 entries of 11 bits each (Including a valid bit) and page size of 512 bytes.

Sol:

Page table entry size = 11 bits

10 frames, 1 extra bit

① total logical add. space.

No of Pages = 64

each page size = 2^9 bytes

$\Rightarrow 2^9 \times 2^6 = 2^{15}$ bytes of logical add.

② total Physical add. space $\Rightarrow 2^9 * 2^{10} = 2^{19}$

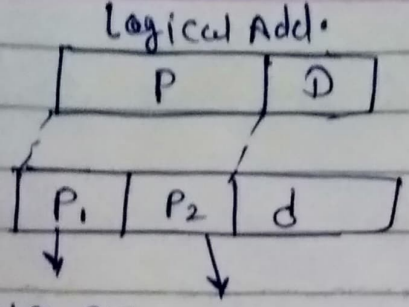
extra bit Not counted

③ Page table Size = No of Pages * entry size

$\Rightarrow 2^6 * 11$ bits

$64 * 11$ bit

704 bits. or 88 bytes



Eg: No of Pages → 2^{15}
Page size → 2Kb
Page Table entry → 4b

Sol: P.T. size = $2^{15} * 4b$
→ 2^{17} b
= 128 Kb

No of Pages ~~for~~ ~~one~~ req for Page table = $\frac{128}{2} = 64$ Page

~~total~~ ~~No of Pages req for P.T.~~ = $\frac{2^{15}}{2^6} \Rightarrow 2^9 = 512$ ~~Pages~~

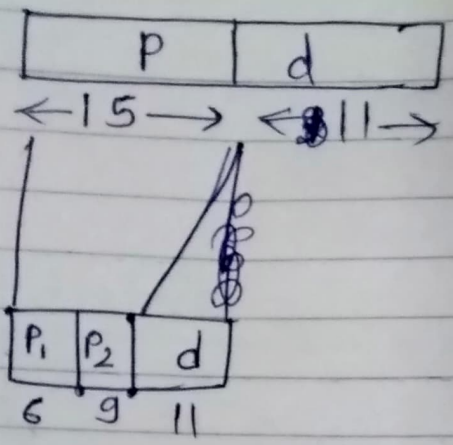
No of entry in one Page = $\frac{2^{10} b}{2^2 b} = 2^8$

$\frac{2^{11} b}{2^2 b} = 2^9$ entries

→ NO of entry in one page = $\frac{2^{11} b}{2^2 b} = 2^9$ Entries

→ No of Pages req. for P.T. = $\frac{2^{15}}{2^9} = 2^6 = 64$ Pages

~~L.A. is of 15 bit~~



Q. No of Pages = 2^{20}
Page size = 2 Kb
entry size = 4 b

No of entries in one page = $\frac{2^{11}}{2^2} = 2^9$ ents

No of Pages requi = $\frac{2^{20}}{2^9} = 2^{11}$ Pages