P_1

0	a b c d	
1	e f g h	
2	i j k l	
3	m n o p	16B
4	q r s t	20B

P_1 size = 20B, each B here can be considered as an different entity that can be addressed.

Page size = main memory frame size = 4B

So, 2^m = number of entries / Bytes of a process = 20B

$m = 5$

logical address of 5 bits : $- - - \underbrace{- -}_{n}$ offset.

★ offset value/bits number depends on the number of individual entities that we can identify in a page. So,

4B
a b c d

4B, each byte is addressable / individual entity, $2^n = 4$, $n = 2$

{ PT2 is also called outer page table. }

PT1

0	5	0
1	6	
2	4	1
3	1	
4	2	2
5	[illegible]	
6	[illegible]	3
7	[illegible]	

(1) page table of the process

PT2

0	9
1	12
2	14
3	0

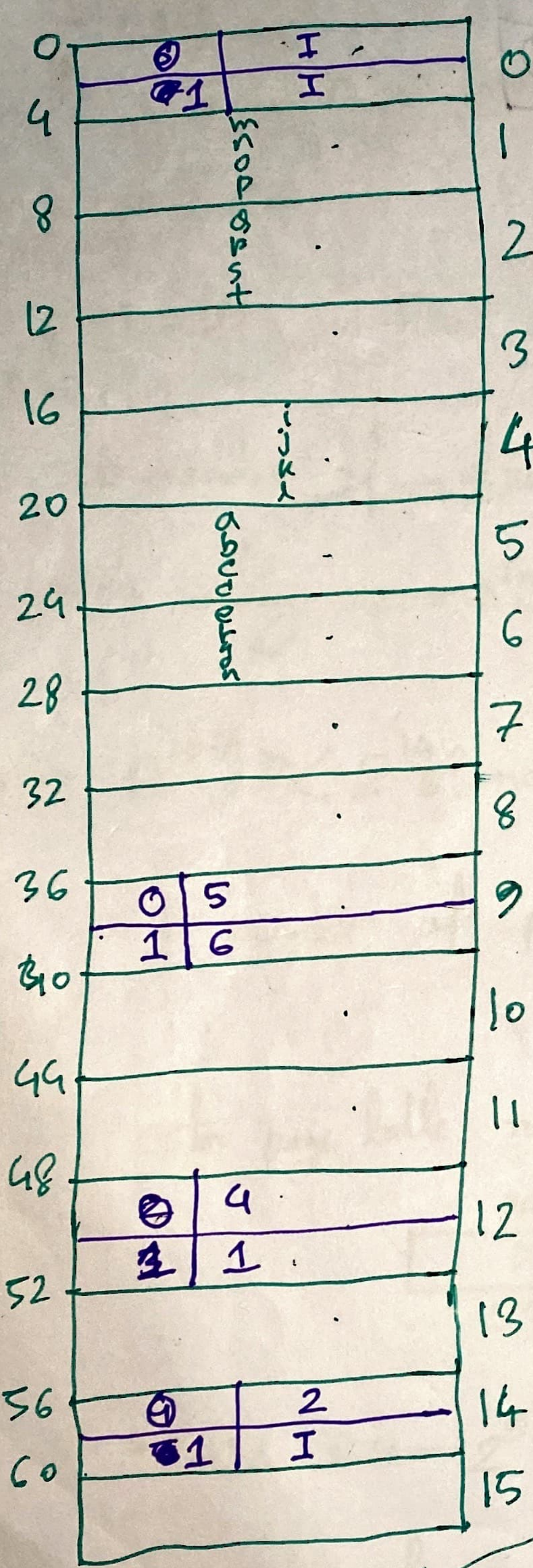
(2)

page table of the page table (1) PT1

1| out of the 5 bits we had 3 bits left, now 2 of them goes for the page table of the page table.

$\underbrace{- \; -}_{P_2} \; \underbrace{-}_{P_1} \; \underbrace{- \; -}_{n}$

forame no.



★ we use the offset/n bits to identify each items of the foramer that contains the info of the process itself.

Now, what if the page table (initial one) is too big to fit inside one forame.

★ we need to see the size of the page table. lets say each entry of the page table takes 2B space.

→ there are 8 entries in our page table thus, the total size of the page table

$= 8 \times 2 = \underbrace{16B}_{\text{the size of page table}}$.

we can not fit this into one forame.

★ We need to page the page table / divide the page table into pages.

number of pages the page table can be divided into $= \frac{16B}{4B} = 4$ pages.

$= 2^2 \rightarrow$ 2bits to represent 4 pages of page table.

(1)

Q#4) total number of addresses $= 2^{118}$, the page size.

the $= 16KB = 2^4 KB = 2^4 \times 2^{10} = 2^{14} B$

$2^n = 2^{14}$

$n = 14$

P1	offset
104 bits	14 bit

#pages $= \frac{2^{118}}{2^{14}} = 2^{104}$

number of entries in PMT $= 2^{104}$

each entry size $= 8B = 2^3 B$. So total page table size $= 2^{104} \times 2^3 = 2^{107}$.

So, $2^{107} B < 2^{14} B$? no, thus page the page table,

number of pages in page table 2 $= \frac{2^{107}}{2^{14}} = 2^{93}$

outer page table requires 93 bits.

PMT2	PMT1	
P_2	P_1	offset
93	11	14

PMT2 size $= 2^{93} \times 2^3 = 2^{96} < 2^{14}$? no,

number of pages in page table 3 $= \frac{2^{96}}{2^{14}} = 2^{82}$

PT3 requires 82 bits.

PT_3	PT_2	PT_1	
P_3	P_2	P_1	offset
82	11	11	14

6

_ _ _ _ _ _ _ _ $\underbrace{\_\ \_\ \_\ \_}_{\text{offset}/n}$

$2^n = 16$
$2^n = 2^4$ | $n = 4$.

#page table entry $= 2^4$ size $= 2^4 \times 2^2 = 2^6$ | $\leq 2^4$? no.

So, page the page table, # of pages in the PMT2 $= \frac{2^6}{2^4}$

$= \boxed{2^2}$ bit for PMT2

size of PMT2 $= 2^2 * 2^2 = 2^4 \leq 2^4$? Yes.

$\underbrace{\_\ \_}_{P_2}\ \underbrace{\_\ \_\ \_}_{P_1}\ \underbrace{\_\ \_\ \_}_{\text{offset } n}$

179 in 8 bits $= \underbrace{10}_{2}\underbrace{110}_{3}\underbrace{011}_{3}$

$2 \rightarrow 11$ $3 \rightarrow 14$

$14 * \cancel{16} + 3 = 227$.