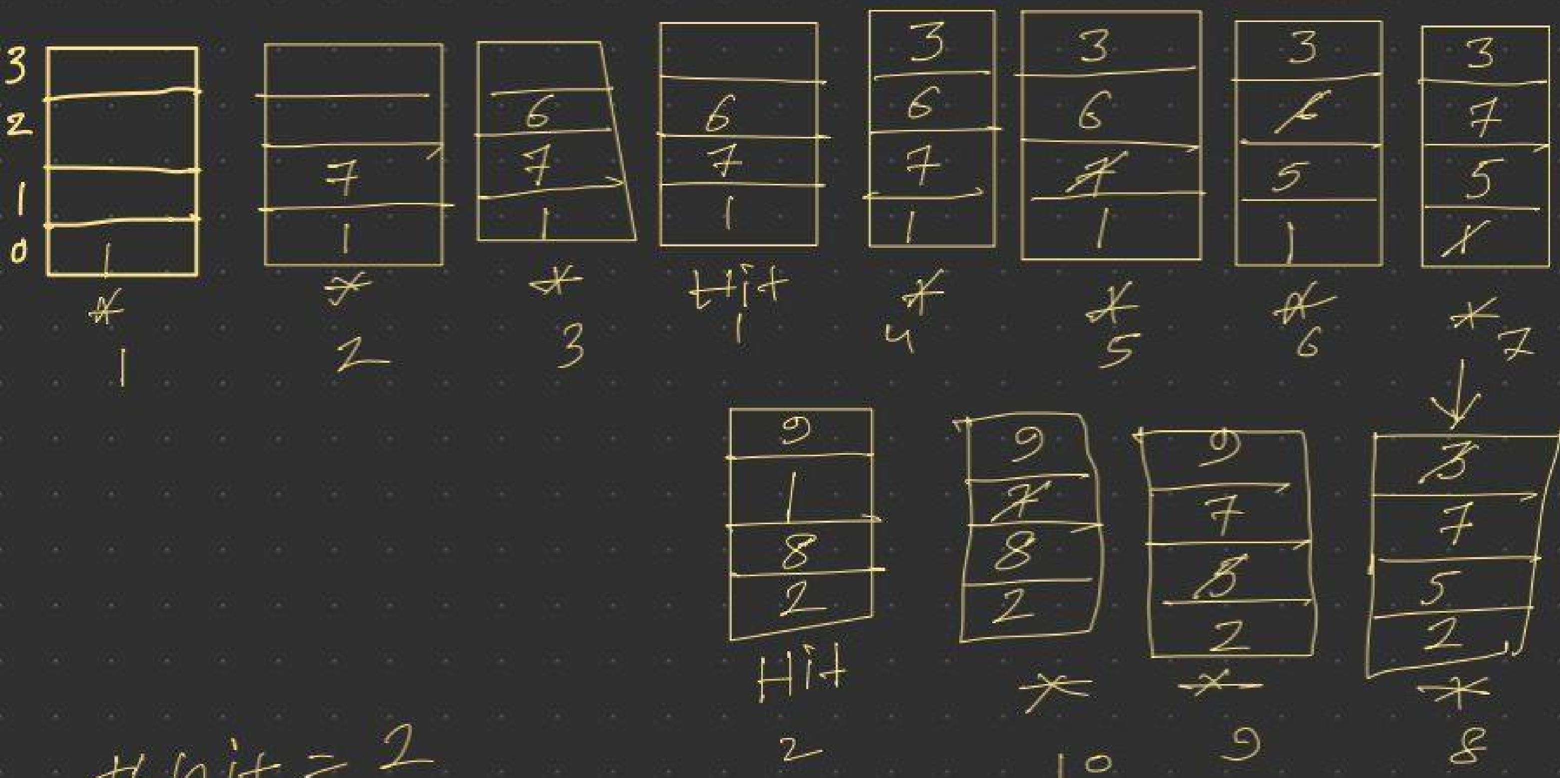
Final - A

LRU

Left

e) #Frame=4

1, 7, 6, 1, 3, 5, 7, 2, 9, 8, 1, 9



#hit = 2

#fault = 10

$$\therefore \text{Fault ratio} = \frac{\#\text{Fault} * 100}{12}$$

$$= \frac{10 * 100}{12} = 83.33\%$$

Final-B

e) #Frame = 4 Optimal

Right

7, 3, 2, 1, 2, 3, 7, 8, 3, 5, 8, 2

3				1	1	1	1	~~1~~
2			2	2	2	2	2	2
1		3	3	3	3	3	3	3
0	7	7	7	7	7	7	7	7
	*	*	*	*	Hit 1	Hit 2	Hit 3	*

8	8	8	8
2	2	2	2
3	3	3	3
5	5	~~7~~	7
Hit 6	Hit 5	*	Hit 4

#hit = 6

$$\therefore \text{hit ratio} = \frac{\#\text{hit} * 100}{12}$$

$$= \frac{6 * 100}{12} = 50\%$$

Problem 6 :-

1) Given,

LAS = 8 bits

Page size = 16 Bytes

Each Page = 4 "

Main memory Size = 512 Bytes

Now,

$$\#Page = \frac{\text{Page size}}{\text{Each Page}} = \frac{16}{4} = 4$$

$\therefore 2^n = 16$

$\Rightarrow 2^n = 2^4$

$\Rightarrow n = 4$

out page	inner page	offset
2	2	4

$$\underbrace{2 \quad 2}_{a} \quad \underbrace{4}_{n}$$

ii) Given, Logical Add = 179

out off = inner page

$$\underbrace{10}_{2}\,|\,\underbrace{11}_{3}\,|\,\underbrace{0011}_{3}$$

outer: page → 2, offset → 3 → f → 11, off → 3 → inner: page → 3, off → 3 → frame = 14

PA = (frame # * page size) + offset

= [(14 * 16) + 3] = 227

Now For 20

$$\underbrace{01}_{1}\,\Big|\,\underbrace{01}_{1}\,\Big|\,\underbrace{1010}_{10}$$

#Page = 1, Offset = 1 → #Frame = 6, Offset = 1 → #Frame = 20, Offset = 10

Frame 6 table 2? Page 1 [illegible],
Because offset 1.

$$\therefore P.A = (\#frame * Page\ size) + Offset$$

$$= (20 * 16) + 10$$

$$= 330$$

Problem 7:-

Given,

$LAS = 16 \text{ bits} = 2^{16} \Rightarrow m = 16$

$\text{Page size} = 16 \text{ Bytes} = 2^{4} \Rightarrow n = 4$

Entry Each Page $= 2 \text{ Bytes} = 2^{1}$

Main memory $= 1KB \approx 1024$ Bytes

(ii)

m-n	n
12	4
p	d

∴ size of inner PMT $= 2^{p} * \text{each page}$

$= 2^{12} * 2^{1}$

$= 2^{13}$

$2^{13} > 2^{9}$; so 2 level paging needed.

∴ # of pages in PMT $= \dfrac{2^{13}}{2^{4}} = 2^{9} \rightarrow n$

$\left(\dfrac{\text{size of PMT}}{\text{offset}}\right)$

n		
9	3	4
12		d

∴ size of outer PMT $= 2^{9} * 2^{1} = 2^{10}$

$2^{10} > 2^4$; so 2-level paging needed.

$\therefore$ # of pages in PMT $= \dfrac{2^{10}}{2^4} = 2^6 \rightarrow n$

$\therefore n = 6$

$$\underbrace{\overset{n}{\boxed{6}}\,\boxed{3}}_{9}\,\boxed{3}\,\overset{d}{\boxed{4}}$$

$\therefore$ size of 2^{nd} outer PMT $= 2^6 * 2^1 = 2^7$

$2^7 > 2^4$; so 2-level paging needed.

$\therefore$ # of pages in PMT $= \dfrac{2^7}{2^4} = 2^3 \rightarrow n$

$\therefore n = 3$

$$\underbrace{\overset{n}{\boxed{3}}\,\boxed{3}}_{6}\,\boxed{3}\,\boxed{3}\,\overset{d}{\boxed{4}}$$

$\therefore$ size of 3^{rd} outer PMT $= 2^3 * 2^1 = 2^4$

$2^4 == 2^4$; paging completed :)

#

Question 2 (CO1 - 6 points): A process runs in a system with multi level paging and it has a logical address space of 8 bits. In the system page size is 16 Bytes, size of each entry of the page table is 4 Bytes and size of the main memory is 512 Bytes. In order to fit the pages of the process in the main memory the OS applies a two-level paging technique in outer page number bits of the logical address space until the outer most page table can be allocated in a frame of the main memory.

I. Illustrate the logical address space of the process including the necessary outer page bits, inner page bits and offset bits of every step with proper mathematical calculations during the paging mechanism of the system described above.

II. In this system, if the CPU generates logical addresses 130 and 104 then map the corresponding physical addresses of these logical addresses.

Necessary page table information is given below:

Outer page table		
Page #	Frame #	valid/invalid bit
0		i
1	6	v
2	11	v
3		i

Inner page tables					
PMT at frame 6			PMT at frame 11		
Page #	Frame #	valid/invalid bit	Page #	Frame #	valid/invalid bit
0	3	v	0	25	v
1	20	v	1		i
2	—	i	2	12	v
3	7	v	3	14	v

Given, LAS = 8 bits $= 2^8$ $m=8$

Page size = 16 Bytes $= 2^4$ $n=4$

Each Page Entry = 4 Bytes $= 2^2$

Main memory = 512 Bytes

Now,

4	4
P (m-n)	d = offset

# of inner Page PMT $= 2^P *$ Each Page

$= 2^4 * 2^2$

$= 2^6$

$2^6 > 2^4 \rightarrow$ Need Two Level

#of Size in PMT = $\frac{2^6}{2^4} = 2^2$

$\therefore n = 2$

p		d
2	2	4

#of Outer Page in PMT = 2^P * Each Page

$= 2^2 * 2^2$

$= 2^4$

$2^4 == 2^4$

So, Completed

ii) Need = 8 bit binary.

130 = 1000 0010

104 = 0110 1000

For, $\underbrace{10}_{2} | \underbrace{00}_{0} | \underbrace{0010}_{2}$

F = 11   F = 25   offset

$\therefore$ # Frame = 25

$\therefore$ offset = 2

$\therefore$ P.A = $(25 * 16) + 2 = 43$

For,

$$\underset{1}{\underline{01}}\,|\,\underset{2}{\underline{10}}\;|\;\underset{2}{\underline{0010}}$$

$F = 6$ $\quad$ $F =$ invalid

Logical Address Invalid