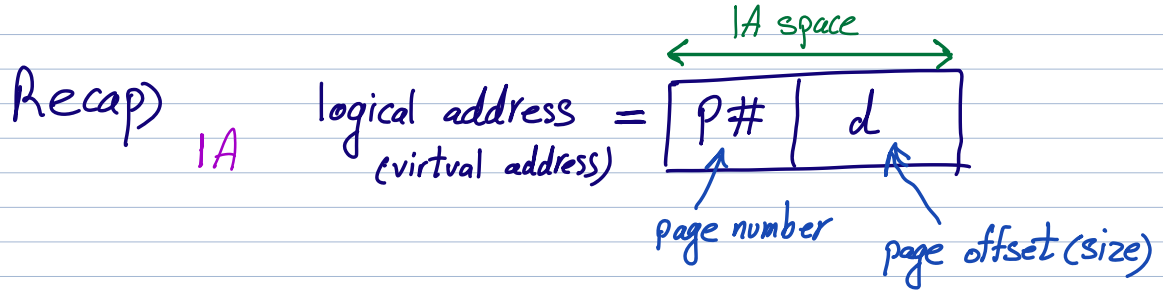
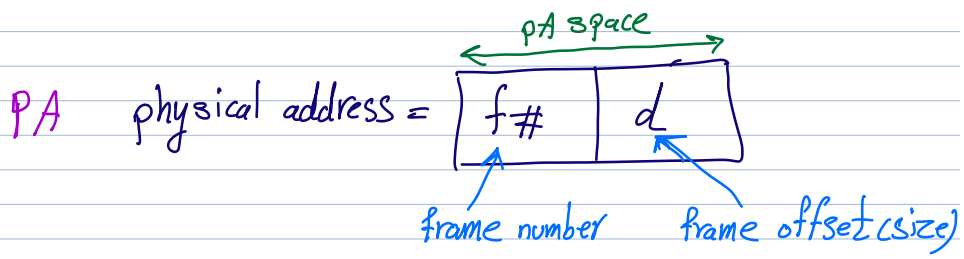
Recap)



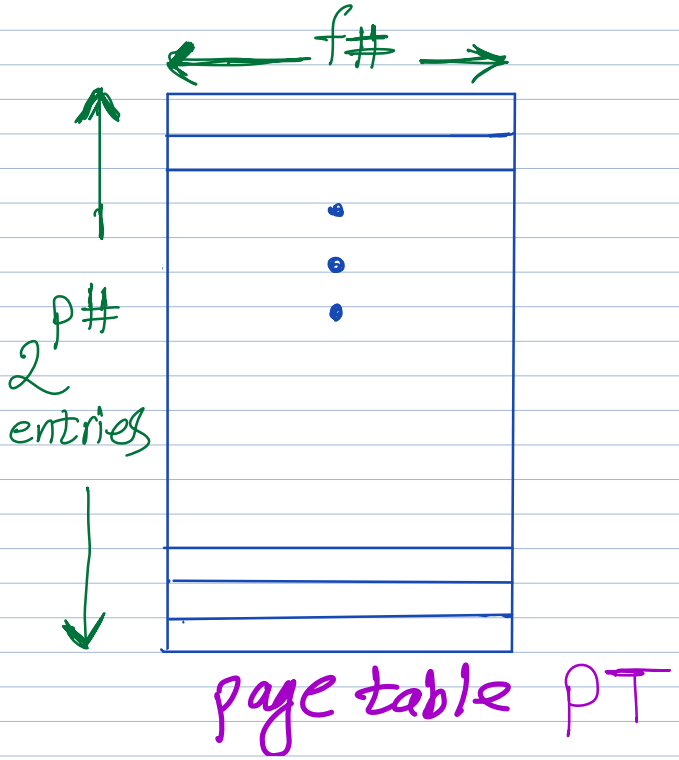


page offset = frame offset

page table size = $2^{p\#} \times (f\#)$

number of entries in page table

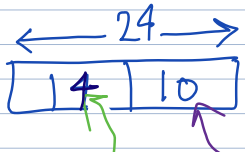
number of bits in every entry of page table (page table entry size)



Q1) In a simple paging system with 2^{24} bytes of physical memory, 256 pages of logical address space, and a page size of 2^{10} bytes, how many bits are in logical address is 18?

A1) LA

PA



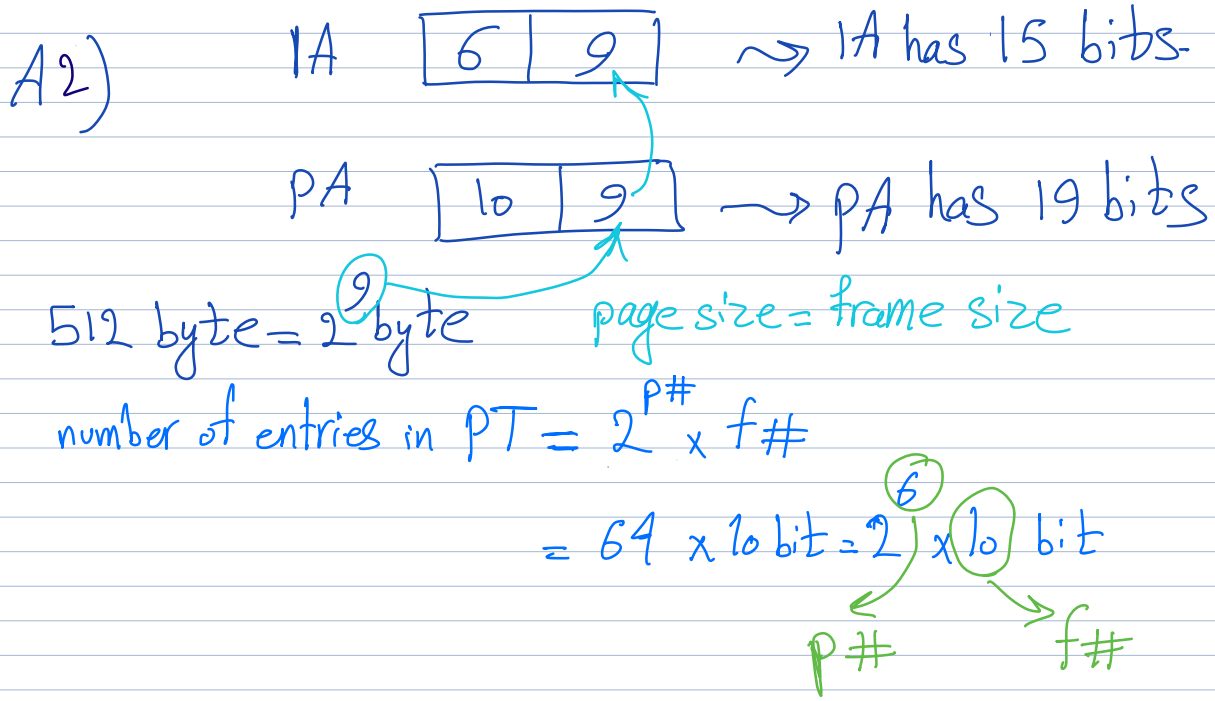
# of pages = 256 = 2^8

24 - 10

page size = frame size = 2^{10} byte

Q1) A computer system uses memory paging. The paging table has 64 entries of 10 bits, and page size is 512 byte. How many bits are in logical address and physical address?

A2)



Q3) A page size is made to be 1024 byte long. A process needs 3100 bytes. The amount of memory lost to internal fragmentation is? 996 B

A3)

1024 x 3 = 3072 B] with three pages

3100 - 3072 = 28 B] for the last page

1024 - 28 = 996 B] is wasted in the last page. In total this process has four pages.

(1024: size of last page; 28: the memory used in the last page)

Q4) The page table of a process is in memory. The memory-access time is 60 ns and TLB-access time is 5 ns. The hit ratio of finding pages in TLB is 75%. Compare the address mapping performance when we use TLB and when TLB is not used?

A4)

without TLB = 2 x (memory-access time)

with TLB = h (TLB + (memory-access time)) + 1-h (TLB + 2 (memory-access time))
= Effective Access Time

without TLB = 2 x 60 ns = 120 ns

with TLB = 0,75 (5+60) + 0,25 (5+(2x60))
= 80 = EAT $\Rightarrow \frac{120}{80} = 1.5$ improvement

Q5) in a computer system, logical address space is 4GB and physical address space is 64 MB. The page size is 4kB. what are the number of pages, frames, entries in page table. what is the size of page table?

A5)

LAS = 4GB $= 2^2 \times 2^{30} = 2^{32}$ → 32 → LA length

PAS = 64MB $= 2^6 \times 2^{20} = 2^{26}$ → 26 → PA length

page size = 4kB $= 2^2 \times 2^{10} = 2^{12}$ → 12 → frame size

page offset(size) = frame offset(size)

No of pages = ? 2^{20}

No of frames = ? 2^{14}

No of entries in page table = ? 2^{20}

size of page table = ? $\underbrace{2^{20}}_{1MB} \times 14 = 14\,MB$