

# Paging

Important Points / Formulae for Solving Paging

# Considering Memory only

- In general, if the given address consists of 'n' bits, then using 'n' bits,  $2^n$  locations are possible.
- Then, size of memory =  $2^n \times \text{Size of one location}$ .
- If the memory is byte-addressable, then size of one location = 1 byte.
- Thus, size of memory =  $2^n$  bytes.
- If the memory is word-addressable where 1 word = m bytes, then size of one location = m bytes.
- Thus, size of memory =  $2^n \times m$  bytes.

- Calculate the size of memory if its address consists of 22 bits and the memory is 2-byte addressable.
- Calculate the number of bits required in the address for memory having size of 16 GB. Assume the memory is 4-byte addressable.

# Considering Paging

- For Main Memory-
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- Physical Address Space = Size of main memory
- Size of main memory = Total number of frames x Page size
- Frame size = Page size
- If number of frames in main memory =  $2^X$ , then number of bits in frame number = X bits
- If Page size =  $2^X$  Bytes, then number of bits in page offset = X bits
- If size of main memory =  $2^X$  Bytes, then number of bits in physical address = X bits

- For Process-
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- Virtual Address Space = Size of process
- Number of pages the process is divided = Process size / Page size
- If process size =  $2^X$  bytes, then number of bits in virtual address space = X bits

- For Page Table-
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- $\text{Size of page table} = \text{Number of entries in page table} \times \text{Page table entry size}$
- $\text{Number of entries in pages table} = \text{Number of pages the process is divided}$
- $\text{Page table entry size} = \text{Number of bits in frame number} + \text{Number of bits used for optional fields if any}$

# Numerical Problems

Q. Consider a system with byte-addressable memory, 32 bit logical addresses, 4 kilobyte page size and page table entries of 4 bytes each. The size of the page table in the system in megabytes is \_\_\_\_\_.

Q. Consider a machine with 64 MB physical memory and a 32 bit virtual address space. If the page size is 4 KB, what is the approximate size of the page table?

Q. In a virtual memory system, size of virtual address is 32-bit, size of physical address is 30-bit, page size is 4 Kbyte and size of each page table entry is 32-bit. The main memory is byte addressable. Which one of the following is the maximum number of bits that can be used for storing protection and other information in each page table entry?