Question regarding Memory Management, simple paging, etc.

(i) An Operating System uses a 32-bit address system. Each 32-bit address is subdivided by allocating 19 bits to the page number and the remaining 13 bits to the displacement. What is the maximum number of pages available in such a system?

(ii) What is the size, in K, of each page in such a system?

(iii) If each page table entry occupies 2 Bytes of RAM, what is the maximum amount of memory that a page table could occupy (assuming all of the table is stored in RAM)?

Answer:

(i) p = 19 bits allocated. So => the number of pages = 2^19 = (2^10)*(2^9) = (1024)(2^10)/2 = 1024*1024/2 = 1048576/2 = **524288 pages**

(ii) d = 13 bits allocated => the number of displacements possible = 2^13 = (2^10)(2^3) = 1024*8
=**8192 displacements**
But, each displacement represents an address (location) for storing 1 Byte of information
=> 8192 displacements in each page allows us to store 8192 Bytes = (8192/1024) K = 8K. **So, each page is 8K in size.**

(iii) Page table entry occupies 2B of RAM (told this). The maximum number of pages is 524288. So, the maximum number of entries for a page table is also 524288. And, since we are told that each page table entry occupies 2B of RAM => the maximum amount of RAM a page table could take up is: 524288*2 Bytes = **1048576 Bytes** = (1048576/1024) K = **1024 K** = **1 MB = Answer**
Note: if the each entry were 2K in size => page table would occupy 1024MB = 1GB!!!!!!